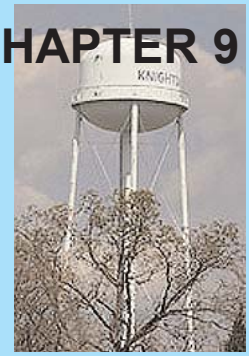
CHAPTER 9



PUBLIC UTILITES
MASTER PLAN

I. INTRODUCTION

The Public Utilities chapter is a plan for the orderly and efficient expansion of Knightdale's public infrastructure. It is not an engineering study, but a strategic plan that coordinates public infrastructure and services with growth. The Town of Knightdale must ensure that it will have adequate water and sewer to serve the growing population.

The Public Utilities chapter contains four primary sections:

1. Background, Merger and Service Areas
2. Wastewater Collection and Conveyance
3. Water System
4. Objectives and Action Items

II. BACKGROUND, MERGER AND SERVICE AREAS

A. FACILITIES PLAN

Since 1991, the Town of Knightdale has commissioned several utility plans and studies. Information cited in this chapter comes from those plans and studies. The two most important documents referenced are the:

1. *Water and Wastewater Facilities Plan: 1990-2010*, 1991, Tate Lanning and Associates;
2. *Knightdale Water and Sewer Utility Merger Feasibility Study Final Report*, 2003, CH2MHILL.

Until recently, the 1991 Facilities Plan served as the master plan for water and sewer extension and analysis.

The 2003 Knightdale Water and Sewer Utility Merger Feasibility Study Final Report is replacing the 1991 plan and will serve as the Town's Facilities Plan.

Merger Study

In an effort to promote regional planning, Wake County adopted the Wake County Water and Sewer Master Plan (Prepared by CH2M HILL in 1998) which evaluated county-wide options for water supply planning.

Envisioning Raleigh and Cary as the central utility systems with the eventual merger of the county's water and sewer providers into a single countywide water/sewer utility,

one recommendation was to develop regional water and sewer authorities for eastern and western Wake County.

Following up to this goal for a countywide plan, Wake County has assisted several municipalities to individually assess long-term water and sewer planning options. So far, the Towns of Rolesville and Garner have signed agreements to merge their utility systems with the City of Raleigh's system.

The Town of Knightdale is considering its options to plan for additional water and sewer allocations and system expansion needed to accommodate its growth during the next few years. One option is merging Knightdale's system with the City of Raleigh. If the systems merge, the City of Raleigh will be charged with maintaining and installing the water and sewer systems within the Town of Knightdale's planning area. In return, Knightdale will receive additional capacity to accommodate growth.

The Town serves approximately 2,800 customers (water accounts). Most of the Town's water and sewer accounts are comprised of residential accounts with few commercial and industrial users. There are approximately 30 miles of water lines and sanitary sewer lines in the service area.

Since 1981, The Town has maintained a service agreement with the City of Raleigh to provide finished water to and accept wastewater from the Town. In accordance with a supplemental agreement in 1987, the Town may send up to 0.73-million gallons per day (MGD) sanitary sewer flow to the City of Raleigh. In 1996, Amendment No. 6 agreed to furnished up to 2.75 million gallons per day (MGD) to Knightdale, Wendell and Zebulon, with Knightdale's portion being 1.0 MGD (on a maximum daily basis).

Paralleling efforts to complete the 2027 Comprehensive Plan, CH2M HILL was contracted to evaluate Knightdale's water and wastewater needs. CH2M HILL was tasked to update recommendations and costs of water and sewer improvements necessary for the Town to adequately serve its customers. CH2M HILL identified water and sewer improvements in line with the Town's planned development and projected water demands and sewer flows. It was assumed that Knightdale's growth in water demand would be aligned with the City of Raleigh requirements after 2010.

This chapter contains the research, findings and recommendations of the CH2M HILL Final Report.

B. SERVICE AREA

Knightdale services four areas:

- The current Corporate Limits
- The Extra-Territorial Jurisdiction (ETJ)
- The Short Range Urban Service Area (SRUSA)
- The Long Range Urban Service Area (LRUSA)

The Town's planning jurisdiction includes the land within its Corporate Limits plus its ETJ. The SRUSA and LRUSA are future growth areas as defined by the Wake County Land Use Plan, adopted by Knightdale.

The total Knightdale service area, existing and future, spans approximately 30 square miles (19,468 acres).

The current Corporate Limits encompass approximately 1700 acres including:

- The Old Town Center
- Relatively new residential sub-divisions and commercial developments
- Non-contiguous individual properties that were annexed into the Town for water service.

The SRUSA classification is defined as the land expected and intended to be urbanized and served by municipal services within the next ten-years and is not located within a water supply watershed, as designated by the State.

LRUSA is defined as the land that is expected and intended for urbanization and municipal services, but not within the next 10 years, and is not located within a water supply watershed, as designated by the State. The Knightdale LRUSA extends to the south along Poole Road to Mark's Creek to the east.

The service area is in the Neuse River drainage basin and is divided into nine sub-basins. Drainage basins provide the context for planning and designing sewer systems. The sub-basins are identified in the Table below.

SUB-BASIN TABLE

Sub-Basin Number	Sub-Basin Name	Sub-Basin Area (Acres)	Average Day Flow (MGD)
1	Beaver Dam Creek	2936	1.23
2	Marks Creek	4407	1.81
3	Marks Creek (LRUSA)	868	0.36
4	Poplar Creek	3622	1.48
5	Clifton Road	1694	0.63
6	Poole Road at Hodge Road	658	0.27
7	Mingo Creek	2825	1.13
8	Green Pines/Barclay Downs	1483	0.62
9	Milburnie	975	0.38
Total		**19,468**	**7.91**

C. POPULATION PROJECTIONS

Between 1990 and 2000, Knightdale's population increased from 1,884 to 5,958, an average annual population growth rate of 12.2%.

Transportation improvements expecting to spur additional commercial and residential development are:

- The US 64 Bypass, scheduled to open in 2005.
- The Raleigh Outer Loop (I-540), scheduled to reach Knightdale by 2008.

The Town anticipates continued growth through 2009 at an annual rate of approximately 12%. If water and sewer service were available, the Town would expect to continue growing at a rate of about 8% from 2010 to 2015, declining to 7% from 2015 to 2020. However, if the Town conforms to the standards developed by Raleigh, Knightdale would need to slow growth from 2010 to 2015 to a rate of 4%, declining to 3% beyond 2015, and matching Raleigh's growth rate of approximately 2% after 2025.

Population projects established in the 2003 Facilities Plan are for the purpose of planning future demand. The figures were derived from discussions with Planning Staff and CH2M HILL regarding current growth patterns and future development patterns.

Key assumptions for the forecast are:

- Annual growth in water and sewer demand is assumed at 12% through December 31, 2009.
- In accordance with City of Raleigh requirements, the water and sewer demand growth will be capped at 4% from January 2010 through December 31, 2015;

and 3% growth beyond 2015.

- The residential growth from 2000 to 2010 includes all permitted and planned developments.
- Water demand is based on per capita consumption of 88.6 gpd/capita for the period from 2002 to 2005. From 2005 to 2015, the per capita consumption is expected to increase to 110 gpd/capita. This is due to a goal to increase the commercial/industrial development from 20% to 30% of the tax base.
- Wastewater flow is projected as a ratio of water demand forecasts. Average Daily 1.)Wastewater Flow (ADF)/Average Daily Water Demand (ADD) is an estimate based on average monthly ratios from July 2001 to February 2002 and is 0.86.

The Table below summarizes projected growth in water and sewer demands during the next 25 years.

POPULATION FORECAST AND DEMAND FOR SEWER AND WATER

Year	*Knightdale Population Forecast*	*Average Daily Demand (MGD)*	*Day Water*	*Peak Day Water Demand (MGD)*	*Average Sewer (MGD)*	*Day Flow*
2001 (year end)	6,242	0.55		0.88	0.46	
2005	10,500	0.93		1.49	0.78	
2010	15,331	1.52		2.43	1.27	
2015	16,839	1.85		2.96	1.54	
2020	19,520	2.15		3.44	1.79	
2025	22,630	2.49		3.98	2.07	

D. WATER AND SEWER EXPANSION CRITERIA

Knightdale's water and sewer facility expansion is based on the philosophy that new development should pay for itself.

Water and sewer facilities can be extended in three ways:

1. By a developer
2. By the Town
3. A combination of both

As properties develop in the Knightdale planning area and Short Range Urban Service Area, the builder/developer is required to extend water and sewer facilities to their property. When constructed, these facilities are required to be built to the Town's standards and specifications.

Often, to allow for expansion beyond a particular development and to comply with the Facilities Plan, water and sewer facilities within a particular development are required

to be upsized. Upsizing requires installation of water and sewer facilities larger than the size normally required to supply the development. The Town has an adopted reimbursement policy for upsizing.

The Town can finance the extension of water and sewer facilities by two methods:
· Assessing property that benefits directly from the extension.
· Sell general revenue bonds. General revenue bonds require voter approval.

III. WASTEWATER COLLECTION AND CONVEYANCE

A sanitary sewer system includes a collection network, interceptor lines, and pumping stations. The Town of Knightdale owns and operates it's own sanitary sewer system, but the Town does not treat wastewater effluent. The Town's own treatment facility was taken off-line in 1988. Since then, Knightdale contracts with the City of Raleigh for this service.

A. COLLECTION AND INTERCEPTOR LINES

Knightdale's collection network consists of 8-inch sewers. Originally, vitrified clay, asbestos cement, and cast iron pipe were used. Today, PVC, truss, and ductile iron pipe are the norm. The collection network is gravity fed from the house or business to either an interceptor or pump station.

Interceptor lines are generally large sewers, 12-inches or larger. These lines collect wastewater from the smaller collector sewers and convey it to the treatment facility. Interceptor lines often follow creeks and rivers to maximize the gravity flow of wastewater. Knightdale's two interceptor lines are:

1. **Mingo Creek:** Brought into service in 1986, this interceptor generally follows Mingo Creek from just south of Smithfield Road to the Neuse River at the Hodge Road pumping station. The Mingo Creek interceptor is sized to handle the discharge from both existing and future developments in the Mingo Creek Basin. All of Knightdale's wastewater is sent to Raleigh's treatment facility via the Mingo Creek interceptor.

2. **Beaverdam Creek:** The Beaverdam Creek interceptor is in the northwest quadrant of the U.S. 64 and Smithfield Road intersection. Wake County Public Schools participated in developing the project so Lockhart School could discharge into the interceptor.

The Beaver Creek interceptor was sized to handle the discharge from Maplewood and Pebblebrook subdivisions, Knightdale Industrial Park, Lockhart School and several

large, undeveloped parcels. The interceptor will need extending as the Beaverdam Creek basin develops.

B. PUMPING STATIONS

Knightdale's sanitary sewer system includes eight (8) pumping stations. Pumping stations are required to raise wastewater from a lower to a higher elevation or location where it can then be gravity fed. Pumping stations are costly to build and maintain.

Knightdale's service area includes eight (8) drainage sub-basins which are tributary to Mingo Creek and Beaverdam Creek. Properties within the sub-basins can flow by gravity. But, gravity flow is not necessarily possible between sub-basins. These are the points that pumping stations are required in Knightdale. As Knightdale's service areas develop, some the pumping stations can be taken off-line.

A brief description of each of Knightdale's eight pumping stations is presented below:

1. **Hodge Road Pumping Station:** This station, at the terminus of the Mingo Creek interceptor line, conveys all of the wastewater in Knightdale across the Neuse River to the City of Raleigh system.
2. **Lockhart School Pumping Station:** This station is on the west side of Smithfield Road near Lockhart School. This station was constructed as part of the Beaverdam Creek interceptor.
3. **Pebblebrook Pumping Station:** This station is at the end of Breckenridge Drive and serves Pebblebrook Subdivision and Knightdale Industrial Park.
4. **Square D Pumping Station:** This station is at the southwest corner of the Square D property and serves the Square D facility.
5. **Kelly's Wil-Ros Pumping Station:** This station is in the Kelly Wil-Ros Subdivision. This station serves the northern part of this subdivision and has available capacity.
6. **Flowers Street Pumping Station:** This station is on Flowers Street, across from the baseball field and serves the southern end of Sallinger Street, Kelly Wil-Ros Subdivision, and Knightdale Manor East Apartments.
7. **Faison Drive Pumping Station:** This station is at the western end of Faison Drive and Park Avenue and serves those same areas.
8. **Harper Street Pumping Station:** This station is on the north side of Harper Street between Smithfield Road and Fayetteville Street and serves the portion of the town south and east of the Norfolk and Southern railroad right-of-way.

The Flowers Street and Harper Street Pumping stations were built in 1968 and are the

oldest on-line facilities in the Knightdale system.

C. INFILTRATION AND INFLOW

Infiltration is when outside water seeps into underground sewer lines. Inflow is when unwanted water flows directly into the system. Neither infiltration nor Inflow are significant problems in Knightdale. Significant infiltration or inflow, or combination, can adversely impact the sewer capacity. At this time, the cost to mitigate infiltration and inflow would likely exceed the benefit. The Town should monitor the system to ensure that infiltration and inflow does not become a problem. Monitoring the system becomes more important as the system ages.

D. SEPTIC TANKS

Septic tanks are individual wastewater treatment systems usually serving a single dwelling unit or small business. Soil suitability is the primary factor in determining the feasibility, location, and design of a septic tank. Soils must be capable of filtering waste with a percolation rate that is neither too fast nor too slow. Poorly maintained and/or poorly located septic tanks and poorly designed often lead to groundwater quality problems. In Knightdale's planning jurisdiction, the Wake County Department of Public Health issues permits for septic tanks. Regulations to detect and correct septic tank failure are currently on a complaint basis. Current Town policy discourages septic tank use for new construction.

E. PROJECTED DEMAND

Wastewater flow discharges are based upon water consumption. Wastewater discharge can be estimated by applying a 10 - 20% reduction for consumptive loss--drinking, washing the car or watering the garden. This figure was further refined by the water that enters the system through infiltration and inflow.

Wastewater planning assumes land use trends will remain constant. Collection systems and interceptors are designed according to predicted land uses that will be built-out during a long period of time.

Included with the Facilities Plan is a map titled, Wastewater Collection System Facilities Map. This map illustrates the required network of sanitary sewer facilities to serve the twenty-five year predicted development horizon. The Wastewater Collection System Facilities Map is adopted as part of the Comprehensive Plan.

Developers are required to construct permanent facilities consistent with the Facilities Plan. In some cases, it may not be cost effective or practical for a developer to construct the permanent system. In these cases, the developer may construct a

temporary pumping station that would be abandoned when development occurs downstream and the interceptors are extended. The Town Council approves temporary facilities. When temporary pumping stations or other facilities are built, the Town should not be a participant in the cost.

The Wastewater Collection System Facilities Plan should be re-evaluated every five-years to ensure the adequacy of the system.

F. SEWER SYSTEM UPGRADES AND PROJECTS

CH2M HILL evaluated improvements to Knightdale's wastewater collection system and conveyance facilities. The design parameters used to select and size the improvements are contained in Knightdale Water and Sewer Utility Merger Feasibility Study Final Report. New facilities will largely service planned development.

Based on the design criteria, improvements are recommended to meet specific level of service goals for the Town's sewer system. These goals are to:

1. Extend sewer lines to allow for future development while at the same time directing/encouraging areas of development to reduce sprawl.
2. Provide sewer lines that will spur development to continue the extension of sewer lines.
3. Reduce the number of pump stations.
4. Preserve the capacity of existing lines to delay paralleling lines.

CH2M HILL identified alternate routes for conveying wastewater flow from the southern portion of the Knightdale service area to the Raleigh wastewater collection system including:

1. Cross the Neuse River at Poole Road
2. Parallel Wendell's wastewater line along Auburn-Knightdale Rd
3. Run an interceptor line south along Bethlehem Road directly to the Neuse River WWTP.

Based on the information readily available, the route along Poole Rd was estimated to have the lowest capital cost and is the alternative chosen for this analysis. Further review of all the alternate routes are recommended to more accurately assess the full project cost and trade-offs of the alternatives.

The following are proposed for construction by the Town of Knightdale under the Knightdale Water and Sewer Merger Feasibility Study Final Report. These improvements and are only a portion of the recommended upgrades to the sewer

system. The overall Wastewater Facilities Map shows all lines proposed for the Knightdale wastewater system.

2002-2004

- **Neuse River Crossing at Hodge Road** - Install 36" River Crossing and abandon Hodge Road Pump Station. Approximately 900 LF of 36" pipe.
- **Beaver Dam Interceptor** - Extend sewer from existing City of Raleigh 54" crossing near Beaver Dam Lake to the existing Lockhart Pump Station and abandon the Lockhart Pump Station. This location is also a possible future discharge point for the Marks Creek Pump Station.
- **Beachwood Interceptor to cross future I-540** - Coordinate with Raleigh to abandon Heater package plant and connect Beachwood Subdivision into the City of Raleigh's double-18" siphon Neuse River crossing. Extend the Beachwood Interceptor to cross under future I-540; approximately 9300 LF of wastewater lines.
- **Upgrade Wastewater Pump Stations with Telemetry** - Upgrade wastewater pump stations to Raleigh standards by installing a SCADA. An allowance is provided for materials and time to change out based on City of Raleigh estimates of cost for 6 pump stations.

2005-2010

- **Marks Creek Pump Station and Reroute** - Add odor control to Mark's Creek Pump Station, upgrade pumps and re-route force main to new Beaver Dam Interceptor at Lockhart Pumping Station. Includes boring under US 64 and approximately 4700 LF of 6" force main. Rerouting the force main preserves capacity in the existing 18" interceptor.
- **Clifton Road/Poole Road Pump Station and Clifton Road Interceptor** - Construct a new pump station south of future US 64 Bypass/I-540 Interchange and 21" Force Main along Poole Road to Raleigh Neuse River Interceptor. The Clifton Road Interceptor would extend north of NC64 Bypass. The pump station would be designed to handle future flow from the US 64 Bypass/ Knightdale Eagle Rock Road Pump Station and the Baywood Forest Pump Station. Pump Station design flow would be for a flow of 2,200 gpm.
- **Baywood Forest Pump Station and Poplar Creek Interceptor -** Construct a new pump station south of Smithfield Road/US 64 Bypass with a discharge point at the new Clifton Road/Poole Road Pump Station. The Poplar Creek Interceptor would extend north to the Wil-Ros and Flowers Pump Stations and allow for the abandonment of these pump stations. The pump station could initially be designed to handle flow from the US 64 Bypass/Knightdale Eagle Rock Road Pump Station

and serve 1,700 gpm.

- **Knightdale Eagle Rock Road Pump Station and Mark's Creek Interceptor** - Construct a new pump station south of the US 64 Bypass/Knightdale-Eagle Rock Road interchange with a discharge point at the Baywood Forest Pump Station, and extend gravity sewer lines to promote growth around the interchange. The pump station would be designed initially for development around the interchange area, and ultimately for the entire drainage basin as Marks Creek Interceptor is extended up stream and the existing Marks Creek Pump Station is ultimately abandoned. Pump station would initially be designed for initial flow of 1,100 gpm.

IV. WATER SYSTEM

A. EXISTING CONDITIONS

The Town of Knightdale owns and operates a potable water system. Knightdale's system consists of supply and treatment, storage and transmission facilities. The Town of Wendell also purchases water from Knightdale via the US 64 transmission line. In 2003, the per capita consumption of water was estimated at 120 gallons per capita day (gpcd). This figure was calculated by dividing the average daily consumption by the equivalent population served in that same year.

The Town receives finished water from the City of Raleigh through the existing 16" water main and booster pump station at US 64. The Town distributes finished water to its retail customers and wholesale customers through the water distribution system.

Knightdale currently maintains two water tanks and operates at two pressure zones. The 500,000 gallon tank on US 64 operates at an overflow elevation of 497 Mean Sea Level (MSL) and the smaller 75,000 gallon Hester Street Water Tank operates at an overflow elevation of 438 MSL. The new 1,000,000 water tank constructed at Hodge Road has an overflow elevation of 497 MSL and will soon be in service. The Hester Street Water Tank will be abandoned once the Hodge Road Water Tank comes on line and the US 64 Water Tank is retrofitted with a new altitude valve. When this occurs, the entire system will operate at 497 feet MLS.

The City of Raleigh maintains a meter at the US 64 water distribution interconnection with Knightdale; the meter reading serves as the basis for billing of finished water sales to the Town. The Town maintains a second meter on US 64 at the interconnection between the Town and Wendell's water system; this meter serves as the basis for wholesale billing to Wendell and Zebulon.

B. ELEVATED STORAGE

Elevated water storage is an extremely important component of Knightdale's water system. Elevated water storage capacity is one of the criteria used to determine fire

rating for insurance purposes. Elevated water storage capacity is also an important factor in the location of industry and economic development opportunities. Elevated water storage facilities serve four functions: maintains operational pressure; equalizes demand; supplements supply capabilities for fire protection; and provides emergency reserves in case of an accident or natural disaster.
This is significant to the town for the following reasons:

- **Operational Pressure:** Operational pressure is required to provide for adequate water pressure. To ensure that adequate operational pressure is maintained in the system, it is recommended that all new elevated storage tanks be constructed with overflow elevations that exceed 497 feet. The Town currently meets state standards for water pressure.
- **Equalize Demand:** Demand equalization is required to make sure there is enough water to satisfy the difference between the maximum hour demand and the supply rate. To ensure adequate demand equalization, the Facilities Plan recommends elevated water storage equal fifteen percent (15%) of the maximum day demand.
- **Fire Protection:** Required water storage for fire protection ensures sufficient fire flows are available to fight a fire at the largest building in the Knightdale fire district. To ensure adequate fire flows, the Facilities Plan recommends the following standard:
  3,500 gallons per minute (gpm) for three hours, equaling 630,000 gallons.
- **Emergency Reserves:** Water storage for emergency reserves is required so that the Town can continue to distribute water if there is a major failure in the system. The Division of Environmental Health of the North Carolina Department of Environment, Health, and Natural Resources recommends total elevated storage equaling a one-day supply of water as the standard to ensure adequate emergency reserves. Knightdale currently meets this standard. Since the Knightdale system can "float" on the Raleigh system, which operates under a higher pressure zone, the Facilities Plan does not recommend using this "floating" standard. Water storage for demand equalization and adequate fire flows should also provide for adequate emergency reserves.

Locating elevated storage facilities on relatively high ground minimizes construction costs. Elevated storage facilities should also be located where transmission and distribution mains can be sized for the most efficient operation. Careful distribution of these facilities throughout Knightdale's service area both minimizes the impact on the system for fire flows and allows for isolation of segments of the system to facilitate repairs without disrupting service.

Under the current Knightdale/Raleigh water agreement, Knightdale must maintain

elevated storage for an average day's supply of water. After the utility merger, it is assumed that Raleigh would apply the NCDENR recommendations for elevated storage, or ½ average day supply, to the Knightdale area. Knightdale will have 1.5 mg of elevated storage once the Hodge Road Water Tank comes on-line and the Hester Street Tank is abandoned.

Knightdale's average day demand is estimated to exceed 3 mgd in 2018-2019. This will require an additional elevated storage tank in approximately 2015-2020. The proposed location for a future elevated storage tank is along Horton Road, south of the Horton Road/Old Knight Road Intersection.

C. FUTURE DEMAND

The purpose for projecting water demand is so a water system expansion can be logically planned and efficiently designed. In 2003, the average day per capita consumption of water was 120 gpcd. In estimating water demand, the maximum day demand and the maximum hour demand must also be considered. Annual growth in water and sewer demand is assumed to be 12% through December 31, 2009. In accordance with City of Raleigh requirements, the water and sewer demand growth will be capped at 4% from January 2010 through December 31, 2015; and 3% growth beyond 2015.

Water demand is based on per capita consumption of 88.6 gpd/capita for the period from 2002 to 2005. From 2005 to 2015, the per capita consumption is expected to increase to 110 gpd/capita due to a goal to increase the commercial/industrial development from 20% to 30% of the tax base. Wastewater flow is projected as a ratio of water demand forecasts. Average Daily Wastewater Flow (ADF)/Average Daily Water Demand (ADD) estimates, based on average monthly ratios from July 2001 to February 2002, is 0.86.

These rates are used in projecting future demand because:

- Water distribution systems are designed to supply the maximum daily demand from supply with the storage held in reserve for peak hourly rates and fire flows.
- Supply and treatment facilities are sized for the maximum daily rates.
- Tanks and pipes are sized for the maximum hourly rate.

Distribution systems are designed to supply fire flows at a minimum residual pressure of 20 pounds per square inch (psi), and to supply normal consumption at service pressures between 40 psi and 100 psi.
Included as part of the Facilities Plan is a map titled the Water System Facilities Map.

This map illustrates the required network of water mains to serve the twenty-five year demand horizon. Because of this projection, the Water Facilities Plan is adopted as part of the 2027 Comprehensive Plan. Developers are required to construct permanent facilities consistent with the Water System Facilities Plan. The Water Facilities Plan should be re-evaluated every five-years to ensure the adequacy of the system.

Water conservation is an important component of Knightdale's effort to plan for future water demands. Conservation could reduce residential water consumption by 15 to 50%. Knightdale should adopt water conservation strategies that address:

- Emergencies.
- Dry weather conditions.
- Amending the building code to require low volume plumbing fixtures for new development.
- Institute a progressive graduated price scale for water consumption.

Education must play a central role in Knightdale's water conservation program.

D. WATER SYSTEM UPGRADES AND PROJECTS

CH2M HILL and Town Staff identified the system improvements that will be needed to meet level of service requirements for planned development through the year 2020. The design parameters used to select and size the water distribution facilities are presented below.

E. WATER DISTRIBUTION EVALUATION

The Knightdale water system was modeled using Haestad WaterCAD, and was incorporated into the City of Raleigh water model by Pitometer Water Services of Greensboro utilizing WaterMax software.

F. WATER LINE SIZES

Based on City of Raleigh Utility Standards, the maximum length for 8-inch mains before they must connect to a larger water main is 2000 linear feet in residential areas and 1200 linear feet in other areas. The proposed Knightdale water distribution layout shows some 12-inch lines that help satisfy this requirement. However, additional lines will be required as the Town develops. The 12-inch lines shown help satisfy this grid requirement as well as improve the hydraulics of the system.

Water lines are sized for fire flow requirements in accordance with Department of Insurance requirements (3500 gpm in Industrial/Commercial areas), with a system residual pressure of at least 20 psi. For the purposes of this study, 3500 gpm was

used for each node in the model. The fire flow model runs were based on the average use on the maximum day.

Velocity in the pipes is limited to 3 to 6 feet per second under normal operating conditions to limit scouring of the lining of the pipes. Water demands are based on the Technical Memorandum entitled Knightdale Water and Sewer Demands for the Town of Knightdale (CH2M HILL, July 2002). Water demands were distributed based on existing, on-going, and planned development. Sources of development information included the US 64 Knightdale Bypass Interchange Study prepared by Stantec and dated July 2001, and information provided by Knightdale Town Staff.

The future water line locations are based on the current Capital Area Metropolitan Planning Organization Transportation Plan and are staged based on meetings with Town staff regarding areas of future development.

G. PRESSURE ZONES

Knightdale currently operates under two pressure zones: the predominant 497 feet MSL zone and the smaller 438 feet MSL zone based on the Hester Road Water Tank. The Hester Road Water Tank is scheduled to be abandoned once the Hodge Road Water Tank is completed and the US 64 water tank is retrofitted with a new altitude valve; therefore only the 497 feet MSL zone is used in this study.

As the Knightdale service area expands, areas below the 311 contour will be subjected to static pressures above 80 psi, which will require water service customers to install and maintain pressure reducing valves.

H. KNIGHTDALE WATER IMPROVEMENTS

The following improvements are proposed to be constructed by the Town of Knightdale under the *Knightdale Water and Sewer Merger Feasibility Study Final Report* and are only a portion of the recommended upgrades to the water system. The overall Water Facilities Map shows all water lines proposed for the Knightdale water system.

2003 Water System Improvements

- **Forestville Road Booster Pump Station and 16-inch Waterline** - Construct a booster pump station at the intersection of the Forestville Road/Old Milburnie Road to provide a second connection to the Raleigh water system. The second connection will be needed for emergency water flow in the short term and, as development continues, to meet everyday water demands. The booster pump station would connect to the existing Knightdale system via a 12,000 linear foot 16-inch water main from the booster pump station to the existing water main at the

Forestville Road/Horton Road intersection. The booster station will have two pumps with each pump having an operating point of 2100 gpm at a TDH of 132'.

2004 - 2006 Water System Improvements

- **Faison Road Water Main** - Extend approximately 10,400 LF of 16-inch water main and 2,200 LF of 12-inch water main from Hodge Road to the existing Knightdale system north of the Faison Road/Bethlehem intersection.
- **Allowance for Meter Change Out to Automated Meters** - A meter change out program will be initiated. An allowance is provided to change out existing meters with new automated meters upon development of merger agreement (total of 2,800 meters).

2006 - 2007 Water System Improvements

- **Faison Road Water Main** - Extend approximately 9,200 LF of 16" waterline from Bethlehem Road to Knightdale Eagle Rock Road.
- **Fayetteville Street Water Main** - Extend a 12-inch water main approximately 2400 LF from the existing 12-inch line on First Avenue to the proposed Fayetteville Street/Faison Road Intersection.

2010- 2015 Water System Improvements

- **Faison Road Water Main** - Extend a 16-inch waterline approximately 4500 LF from Knightdale Eagle Rock Road to NC 64. This extension assumes that Faison Road extension would be constructed during the same time period.
- **Forestville Road Water Main** - Extend approximately 1,400 LF of 12" waterline from Old Knight Road to US 64 highway.

V. POLICY AND LEGISLATIVE ACTIONS

The Town of Knightdale should adopt a proactive and progressive leadership position on matters of policy and legislative initiatives affecting the Town of Knightdale and the region's long-term capacity to support and manage the effects and impacts of growth and development. These actions involve the analysis, development and enactment of administrative and policy directives relating to expectations of the following stakeholders for implementation of activities and actions to cooperatively plan, program, finance and manage future growth and development:

- The Town Council
- Town Manager
- Departmental managers
- Development interests
- Public

Priority initiatives include:

1. Update and Adoption of Short, Mid and Long Range Policy Plan for future annexations and related Water/Wastewater provision tied to annexation.
2. Update and Adoption of Administrative Plan for Water and Wastewater Infrastructure extensions, over-sizing and cost participation.
3. Update and Adopt an Annual, 5-Year and 10-Year Capital Improvements Program (CIP) reflecting the goals and policies of this Plan.
4. Adopt a position supporting State of North Carolina "Smart Growth" legislation and grant of authority to local government.
5. Revise, Update, Modernize and Extend the out-of-date methodology of the existing impact fee powers granted to the Town of Knightdale relating to the provision of infrastructure.

VI. PUBLIC UTILITIES OBJECTIVES AND ACTION ITEMS

A. OBJECTIVES

The Town of Knightdale seeks to:
(1) Direct and guide development to achieve optimum utilization of the public infrastructure; and
(2) Ensure that public utilities maximize fiscal efficiency and contribute to the overall economic, social, and physical health of the community.

B. ACTION ITEMS

9.1 The Public Utilities Master Plan of the 2027 Comprehensive Plan will be formally updated every five (5) years by the Town Engineer to ensure optimum utilization of the water and sewer systems. The update will be in the form of amendments. These amendments must be approved by the Town Council. At a minimum, the update must revise data and projections, review plan effectiveness, and identify future needs.

9.2 The Town shall abide by the following general criteria in the extension of water and sewer facilities outside the corporate limits:

1. The extension must be in the best interest of the residents and businesses in Knightdale.
2. The extension must be in accordance with the Public Utilities Master Plan;
3. Sufficient capacity shall exist to serve the need created by the extension;

4. The extension shall be approved by the Town Council on a case-by-case basis.
5. The submittal of an annexation petition shall be required.

9.3 The Town shall adopt a policy and standards for the extension of water and water and sewer into the Town's Extraterritorial Jurisdiction, and Urban Service Areas;

9.4 The Town shall continue to replace substandard water lines, sewer lines and supporting facilities.

9.5 The Town shall maintain elevated water storage to provide operational pressure; equalize demand; supplement supply capabilities for fire protection; and provide emergency reserves in case of an accident or natural disaster.

9.6 The Town shall plan and install utility lines in a manner and location that does not interfere with aesthetic considerations related to the Town's streetscape plans.

9.7 The Town shall continue to annually update a Capital Improvement Program to guide the provision of public utilities. Capital improvement projects shall be evaluated using the following criteria:

1. Is the project needed to:
   - protect public health and safety?
   - fulfill the Town's legal obligation to provide facilities and services?
2. Does the project increase the efficiency of existing facilities?
3. Is the project in conformance with Public Utilities Master Plan?

9.8 The Town shall provide training for operational and field personnel on water conservation.

9.9 The Town shall sponsor educational programs on the benefits of water conservation.

9.10 The Town shall monitor sewer system efficiency to ensure that infiltration and inflow does not become a significant problem.

9.11 The Town shall work with the City of Raleigh to ensure waste water

treatment capacity.

9.12 The Town shall cooperate with Wake County to develop a comprehensive septic tank and private well monitoring and maintenance program.

9.13 The Town shall prepare utility related ordinances during the 2003-04 UDO Update to include utility design standards, vegetated buffers, grease control, backflow prevention, water conservation, drought management and landscape irrigation systems which are as strict as Raleigh's ordinances.

SEE FIGURE 9.1: WASTEWATER COLLECTION FACILITIES MAP

SEE FIGURE 9.2: WATER SYSTEM FACILITIES MAP