the town of knightdale

2027 Comprehensive Plan

Town Council Adopted July 7, 2003

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RESOLUTION FOR THE ADOPTION OF THE 2027 KNIGHTDALE COMPREHENSIVE PLAN R-03-07-07-001

WHEREAS, the Town of Knightdale seeks to balance the relationship between the rural areas and urban areas within Knightdale by maintaining and enhancing the community character of Knightdale; and

WHEREAS, the Town of Knightdale seeks to promote economic development opportunities to provide a vibrant and varied local economy, which will attract and support a wide diversity of business opportunities and community services; and

WHEREAS, the Town of Knightdale seeks to ensure safe, dynamic and sustainable neighborhoods, which offer employment opportunities, quality education, adequate and affordable shelter, health care and recreational amenities; and

WHEREAS, the Town of Knightdale seeks to ensure a land development pattern that promotes balanced and responsible urban design by directing and guiding development to achieve optimum utilization of public infrastructure and to encourage quality planning of the Town's built form; and

WHEREAS, the Town of Knightdale seeks to ensure the identification, conservation and preservation of the cultural and historic resources of Knightdale; and

WHEREAS, the Town of Knightdale seeks to ensure the provision of parks, recreation facilities, open space and greenways to all residents of Knightdale; and

WHEREAS, the Town of Knightdale seeks to maintain diversity in type and character of development, and promote opportunities for varied residential environments and variety in type and cost of housing; and

WHEREAS, the Town of Knightdale seeks to establish a safe and efficient circulation system that provides for both motorized and non-motorized transportation that protects the natural and built environment, and that provides incentives for quality economic development; and

WHEREAS, the Town of Knightdale seeks to provide equal opportunity to all Knightdale residents, including equal access to facilities and opportunities of the Town and region; and

WHEREAS, the Town of Knightdale seeks to ensure that the Knightdale community participates in the creation of and updates to the 2027 Comprehensive Plan; and

NOW, THEREFORE, Be it Resolved by the Town Council for the Town of Knightdale that the 2027 Comprehensive Plan be adopted to serve as the official statement of the Town's goals and objectives regarding future physical growth.

Adopted this 7th day of July, 2003

_____ _____

Mayor Jeanne M. Bonds Attest, Town Clerk

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ACKNOWLEDGEMENTS - Project Team

The 2027 Comprehensive Plan is the product of the participation of many people involved in the update process. Those persons include the residents of Knightdale, elected officials, advisory board members, town staff and the development community. The plan specifically acknowledges those below who have served to update the plan.

Knightdale Town Council

Mayor Jeanne Bonds
Mayor Pro Tem Michael Chalk
Mr. Jeffrey Eddins
Mr. Steven Meadows
Mr. Timothy Poirier
Mr. William Wilder
Former Mayor Joseph Bryan
Mr. Brett Zick
Mr. Y.A. Taylor
Mr. Stan Whitt
Mr. Glenn Doyle

Knightdale Comprehensive Plan Update Committee

Mr. Michael Chalk, Chair
Mr. Jeffrey Eddins
Mr. Brian Mize
Ms. Becky Barbee
Mr. David Corum
Mr. Terrence Gleason
Mr. Daniel Devin
Mr. David Stark
Mr. Gary Norris
Ms. Ruth Murphy
Ms. Jennifer Bryan
Ms. Jill Harper
Mr. Robert Cameron

Knightdale Planning and Appearance Board

Ms. Jill Harper
Mr. Terrence Gleason, Chair
Ms. Lois Burch
Mr. Stephen R. Morgan
Mr. Nathan Ray
Mr. Doug Taylor
Mr. Donald S. Keener

Knightdale Town Staff

Mr. Gary McConkey
Town Manager
Ms. Rebecca Agner
Town Clerk/Personnel Director
Mr. Reed Alexander
Public Works Director
Mr. Skip Blaylock
Public Safety Director
Ms. Tina Cheek
Parks and Recreation Director
Mr. Micheal Ciriello
Comprehensive Plan Staff Manager
Ms. Vivian Coleman
Planning Director
Ms. Pamela Hinson
Finance Director
Mr. Clyde Holt
Town Attorney

ACKNOWLEDGEMENTS - Design Team Members

ColeJenest & Stone, P.A.
Mr. Brian C. Jenest, RLA
Ms. Jane S. Alexander, RLA
Mr. William G. Siler, RLA
Mr. Ryan M. Mosser
Ms. Tracy L. Sagehorn

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The Team also included the following:

CH2MHILL
Mr. Peter J. Elkan, PE

Greenways Incorporated
Mr. Jonathan Parsons
Ms. Haley Blakeman

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Mr. Michael Williams
Mr. Brian Reese

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Mr. N. R. Standerfer, AICP

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Mr. Mark Freeman, PE

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CHAPTER 1

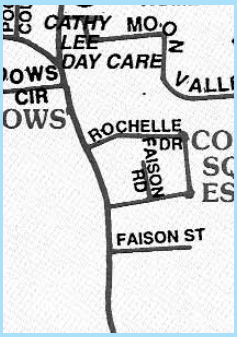
COMPREHENSIVE PLAN

I. INTRODUCTION

In April of 1999, the Town of Knightdale began an update of the Town's Comprehensive Plan. The original Comprehensive Plan, adopted in 1993, had become 'outdated' and an update became necessary. For all who have been involved in realizing the completion of this task, it has become much more than just a simple update. The creation of the new 2027 Comprehensive Plan was and is a public, citizen-driven, process, and as the Town was diligent in its efforts to include the broadest spectrum of stakeholders in the update process. The resulting product is a direct response to the growth concerns and issues facing the Town of Knightdale and offers building blocks for Knightdale's future.

The process began as an evaluation of the place from which the Town comes to develop an understanding of its resources and potential, then organized these lessons and finally set a course for the future. It is fair to say that much of what is known about Knightdale is pleasing, but it is underscored by the realization that the Town has much to lose without a vision for the future, and even more to gain if it approaches the future that beckons at its door in a proactive manner.

Although the new Comprehensive Plan is a multi-faceted document encompassing elements such as parks, transportation, utilities, and public safety, it is an opportunity to review in a comprehensive way how these elements work together. When these elements are understood holistically, they lead to the kind of future that will benefit the greatest number and in turn leave a rich legacy for future generations. The participants who are the architects of this plan envision more housing choices, a broader economic base, improved accessibility and mobility for all citizens, enhancement of the town's rural edges, and improved fiscal efficiency.



At the core of the update process was the concern that the future was quickly getting ahead of the Town. This is borne in fact by a 216% increase in population of the Town from 1990 to 2000. Rapid growth can compromise a community's ability to respond to the needs of residents and businesses. In reaction to rapid growth, the public typically expressed two primary concerns: (1) overcrowded roads and (2) the disappearance of community character and open space.

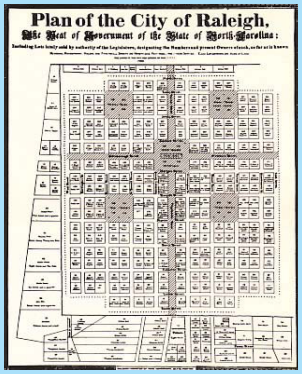
This document addresses these concerns and other growth issues by examining the way in which a town is built, why it grows, and how it develops. Once one can understand, appreciate, and accept the fundamental of town building, one will be well along the way toward facing growth concerns and be able to harness the potential of the community. Town building, and specifically, urban design, is not a trend. The

essence of town building is its timelessness. One does not look at the Roman Coliseum and merely see a stadium; most people do not look at the Empire State Building and see just a commercial office building in the form of a skyscraper.

Similarly, it is the hope of town leaders that when future Knightdale is envisioned it is more than a disconnected collection of buildings and left over bits of "open space", and instead is a town of rich architectural diversity, vibrant public spaces, and peaceful neighborhoods. The lessons of history can serve as a guide. Throughout the sorted course of human history great cities and towns have grown, prospered, decayed, and been reborn. Certain features survived because they reflected the community's spirit, values, culture and aspirations.

A town is essentially a compilation of buildings and open spaces. What sets great towns apart from the mass of mediocre places is that the form and arrangement of those buildings, the open space and the public and private spaces that are the residual byproducts of them. They encapsulate the spirit, values, culture, and aspirations of the community. The creation of great towns was often, and still is, the work of a few whom possessed a unique vision and the trust they engendered from the people through their leadership to make that vision a reality. In Knightdale, location is the town's greatest asset and the key to its growth, which can be directly attributed to its proximity to the economic engine of Raleigh, Research Triangle Park, and other Triangle assets like North Carolina State University, Duke University and the University of North Carolina. The participants involved in the Comprehensive Plan process have expressed that the town's location in the region is important to achieving its vision.

The most memorable and impressionable places grew-up from a framework that was conceived to respond to the needs of, and to then reflect the aspirations, of the Town's citizens. These places were not developed in a vacuum; they did not ignore the historic context or try to merely mimic a past period of human history. Visionary leaders recognized that certain truths exist and that lessons have been learned about town building that they incorporated into their visions. They merged these truths with contemporary technological improvements and created timeless places that have evolved, avoided decay, and are so loved by residents and visitors to this day. It is the aspiration of Knightdale's leaders that Knightdale be one of these places that grows in a quality way and continues to be admired by its residents and visitors.



From City of Raleigh Planning Department

II. ORGANIZATION OF THE 2027 COMPREHENSIVE PLAN

The 2027 Comprehensive Plan is divided into eleven chapters dealing with the Town's past, present, and future. The chapters cover all elements of town planning, including statistics and history and master plans for transportation, parks and recreation, open space and greenways, utilities, design districts and community services. The plan also includes a chapter for focus area plans.

Chapter 1 includes an outline of the Introduction, Organization of the Comprehensive Plan, reflections on the purpose and process of creating comprehensive plans, a timeline of the activities and milestones associated with the development of this document, and a brief description of Knightdale which acquaints the reader with Town's history. Chapter 2, Vision 2027, articulates and illustrates the Town's future aspirations. Chapter 3, Town Resource Analysis, provides an inventory and analysis of Knightdale's existing population, demographics and zoning assessment. Chapter 4, Community Services, provide information regarding health care, public safety and education and includes a series of objectives and tasks to be undertaken to attain those objectives.

The next chapters outline the building blocks Knightdale will use to realize its future. Chapters 5-9 are the Town's "Master Plans". Chapter 5, Design District Master Plan, provides a new land use plan and a series of design guidelines for various areas of the planning area. Chapters 6-10 outline the Master Plans for the Town's Parks and Recreation System, Open Space and Greenway System, Transportation, and Utility systems. A series of objectives and actions items are found in each of the master plans which address central issues facing the Town of Knightdale.

Chapter 10 is devoted to Implementation Strategies, which will help to identify the mechanisms the Town can use to implement the overall scope of the plan. This chapter includes growth management recommendations.

Chapter 11 includes existing Focus Area Plans, which the Town will develop and use to guide the design, development, and decision-making processes of specific areas within the Town that warrant special attention. Future focus area plans will be added as each plan is completed.

The 2027 Comprehensive Plan will become effective upon adoption by the Knightdale Town Council. In order to carry out the Plan, land use regulations will need to be amended. The eighteen months following the adoption of the Plan will be known as the Implementation Period. During this time, amendments will be made to the Town's

We shape our cities, thereafter they shape us"

—ANONYMOUS

Unified Development Ordinance. Existing regulations, as amended, will remain in effect throughout this Implementation Period.

III. PURPOSE OF THE COMPREHENSIVE PLAN

Communities around the world have used comprehensive plans for many hundreds of years. Often these visions were the dictates of leaders who imaged grandiose capital cities for their nations like Paris, St. Petersburg, Berlin, and ancient Rome. In this country, early settlements adopted comprehensive plans to guide development decisions including placement of civic buildings, utilities, and mobility. Among these were General Oglethorpe's 1733 "Plan of Savannah (Georgia)", and William Christmas' 1792 "Plan of the City of Raleigh".

The primary objectives of comprehensive plans are to:

1. Coordinate public and private investment,
2. Minimize conflict between land uses,
3. Influence and manage the development of the community,
4. Increase both the benefits and cost effectiveness of public investment,
5. Predict infrastructure and service needs in advance of demand,
6. Ensure that community facilities are located to best serve the community.

The Knightdale Comprehensive Plan provides the basis for rational decision-making, *but does not* replace the decision-making process. The enactment of the *Knightdale Comprehensive Master Plan* does not constitute a substantive change in existing ordinances of the Town of Knightdale, nor does it supersede or replace the *Unified Development Code* or any regulatory ordinances adopted prior to the adoption of the *Comprehensive Plan*.

In applying such ordinances, consideration should be given to the *Objectives and Action Items* of the Plan in an attempt to harmonize the two provisions.
The Comprehensive Plan is intended to provide guidance in the evaluation of future decisions on land use, infrastructure improvements, transportation, and other plans.

Community planning is a continuous and dynamic process that helps the community achieve goals that are important to its citizens and to the community at large. Over time, these goals will likely change. Then, the community must again review where they have been, how they got there, what has changed since their last planning effort, and where they want to go next. This is a normal planning process, and it happens in all communities.

Charleston, SC

IV. 2027 COMPREHENSIVE PLAN DEVELOPMENT PROCESS

Public Meetings

The Town of Knightdale has grown tremendously over the past ten years. This growth is expected to continue, and perhaps escalate, for a number of reasons both within and outside of the Town's control. Foremost among these reasons, Knightdale has been an appealing place to live and work. The community possesses rich human resources, including a responsive town staff, and an astute and visionary political culture. The community is geographically well positioned and located in central North Carolina. Knightdale is closely associated with state government headquarters in adjacent Raleigh, and the Research Triangle Park less than 30 miles away. Major medical facilities and universities in Raleigh, Durham, and Chapel Hill are integral parts of Knightdale's world. The natural environment and landscape is attractive and includes a countryside that remains dotted with family farms, pastures, and forests. For now, much of Knightdale's natural system remains in tact. These qualities remain within Knightdale's ability to enhance, manage and sustain.

Timeless Neighborhoods

However, there are other forces that are outside of the community's control which seem detrimental, but actually bode well for the town. For example, increasing air and stormwater quality regulations will affect funding for infrastructure. Diminishing state and federal funding resources for an automobile-only transportation network will impact our ability to approve development that affords no other way for people to access a site except by automobile. Economic changes affected by globalization, new technology, and other forces, including heightened competition for jobs and skilled residents, could include the rejuvenation of at least some of the local agricultural economy. If these are viewed as opportunities rather than impediments Knightdale can move to the head of the pack.

In order to retain appealing qualities, and enhance the success of the community, the Town must plan for the future forever mindful its past. The Town must make decisions today about what kind of community it wants to be tomorrow. The alternative is grim and there are forces on the horizon that raise the specter of growth that can irreparably damage the community's physical qualities, constrain personal choice, conduce fiscal inefficiency, and negate a generation's ability to leave behind a community with strengths which are not only bigger, but better.

Preserve Farmland

Knightdale's Comprehensive Plan is a statement of the Town's goals, objectives and policies regarding future physical growth; it is an official public document adopted by the Town Council. The Plan reflects the concerns and preferences of Knightdale, as well as eastern Wake County and the Triangle Region. The Plan reflects what the community is feeling about how and where the Town should grow.

At a minimum, the Comprehensive Plan communicates the Town's intentions regarding land use, policy formulation, and capital improvement programming, thus enabling coordination of public and private development activities. It will be utilized as a guide for the future and serve as a consistent reminder to learn from the best and worst of the Town's past. In 25 years, Knightdale may come to look and function very much as this Plan imagines today. If so, then the Plan and the people, who have contributed so selflessly to its creation, will have realized success.

A. History of Knightdale's Comprehensive Plan

The Town of Knightdale adopted its first Comprehensive Plan on November 1,1993 and at that time the document fulfilled the town's needs to coordinate growth. (Per the 1993 Plan, an update is required every five years.) However, Knightdale has seen dramatic change since the adoption of the 1993 plan. With the construction of the Knightdale Bypass and the Eastern Wake Expressway proving to be the most significant developments which will impact the physical development of Knightdale more than at any point in the Town's history, it became more evident that a major update to the comprehensive plan was necessary.

Discussion of an update began in 1999 and on April 3, 2000, a joint meeting of the Town Council, Planning Board, Appearance and Architectural Review Board, Board of Adjustment and Parks and Recreation Advisory Board was held to discuss the update process. It was also at that meeting that the Town Council appointed an Ad Hoc Comprehensive Plan Update Committee to update the Town's existing Comprehensive Plan for the Town of Knightdale. The Committee was made up of 2 members of the Town Council, a representative from the Planning Board, Appearance and Architectural Review Board, Parks and Recreation Advisory Board, Board of Adjustment and Chamber of Commerce; and 5 at-large members from the community. This group represented the many and varied interests in the Town and acted as a filter and sounding board for Knightdale's planning staff and consultants as data was collected and analyzed. During the development of the Plan, the Committee was engaged in learning about the intricacies of planning and urban design and the relationship of these to the function of the Town. The Committee was introduced to professionals from other communities and attended a tour of several peer communities in the vicinity of Charlotte. The update process itself has taken various forms and a longer time period to complete than anticipated primarily due to turnover of planning staff managers and due to the ever increasing responsibilities of the Planning Department which made it difficult to update the Plan in-house. In February of 2002, the Town hired consultants to complete the update.

B. The Public Participation Process, Meetings and Timeline

Knightdale has a tradition of participatory government. When larger issues arise, the response of the Town has been in many cases to appoint citizens to a committee charged with studying the issues and recommending solutions. Citizen involvement is important in Knightdale. The decision making process is more effective and stronger if the Town's residents, business people and development community continue to be invited to participate. The appointment of an Ad Hoc Comprehensive Plan Update Committee to update the Town's existing Comprehensive Plan continues Knightdale's commitment to public involvement. As stated, the update process took approximately three years to complete, due to difficulties in completing the update in-house. However, once the consultants were hired, the Planning Staff and Update Committee were able to move forward towards completion.

The public participation process involved a series of meetings, public hearings and citizen surveys. In the initial stages the Town sought to perform a simple update; however, as the Update Committee continued to meet a series of recommendations emerged which required dramatic changes in the concepts of the Plan. This required complex involvement from the consultants, Update Committee, Town Staff and the public. The following provides highlights and general timeline of the update process:

1999	Discussion of a Comprehensive Plan Update
April 3, 2000	Joint meeting of Town Boards and Appointment of the Ad Hoc Comprehensive Plan Update Committee
April 27, 2000	Public Hearing to Initiate Update Process
May 25, 2000	Comprehensive Plan Update Committee Meetings Began to Review Elements (These meetings continued on a semi-regular basis until Plan completion.)
April 4, 2002	Farm Owners Meeting (Sponsored by Wake County)
April 23, 2002	Stakeholders Meeting (Citizens, and business, civic, religious and other community leaders)
June 12, 2002	Landowner's Meeting (Landowners of parcels >10 acres)
August 7, 2002	First Public Workshop on Design Districts
September 4, 2002	Second Public Workshop on Design Districts
October 15, 2002	Third Public Workshop on Design Districts
October 23, 2002	Fourth Public Workshop on Design Districts
December 4, 2002	First Comprehensive Plan Open House Forum
December 18, 2002	Second Comprehensive Plan Open House Forum
January 6, 2003	Town Council initial Public Hearing for Final Draft
January 15, 2003	Third Comprehensive Plan Open House Forum
January 27, 2003	Planning Board review and approval of Draft Document
April 3, 2003	Public Meeting to Review Draft Plan
July 2003	Approval of Final Document

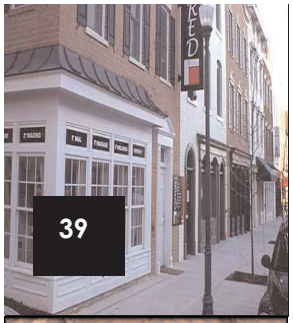
Visual Preference Survey

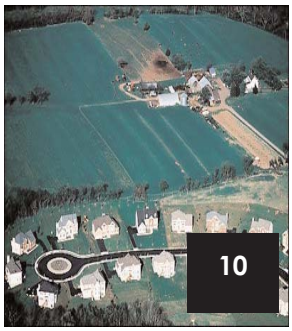
In early 2002, a visual preference survey was distributed to citizens via public meetings, inclusion in Town and Chamber of Commerce mailings and through the Planning Department. The survey was used to generate discussion and interest in the Comprehensive Plan and to have citizens think about the future of Knightdale.

The town received a number of responses. The responses varied, but overall the public was in favor of a mixture of housing types and densities; alternate transportation options such as mass transit, sidewalks, and greenways, instead of just automobile usage; a mixture of shopping opportunities that included quaint small scale shopping areas; and a variety of industry types, including biotechnology and farming industries. The preference survey along with the many comments received by the public revealed that citizens had a strong interest in preserving Knightdale's small town charm and its open space and farmland.

The visual preference survey results are shown on the next page. The four columns on the survey asked certain questions of the public to understand thier viewpoint on what choices they would make regarding shopping, housing, working and mobility. The numbers in each box reflect the number of responses. The survey and discussion raised from the survey continued to indicate that Knightdale's citizens wanted to maintain small town character and have varied housing, shopping and transportation choices.

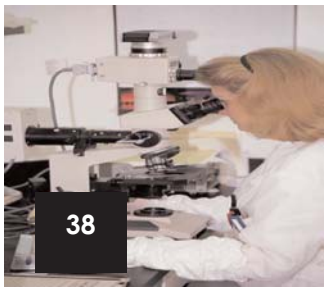
Where Would You Most enjoy shopping?

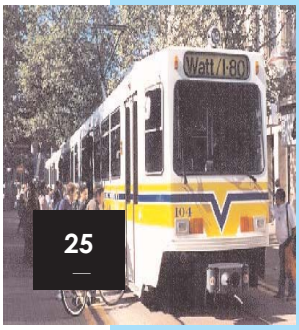




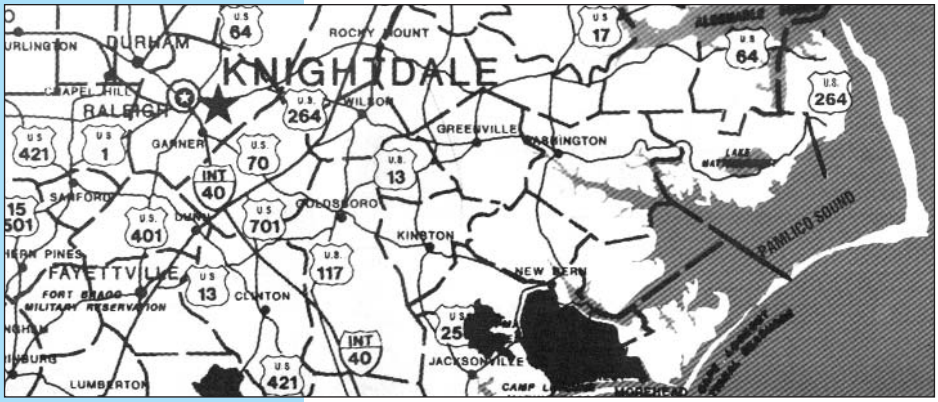
Where Would You Most Enjoy Having a Home?

What Types(s) of Industry Should We Have in Town?





How Would You Prefer to Get Around?



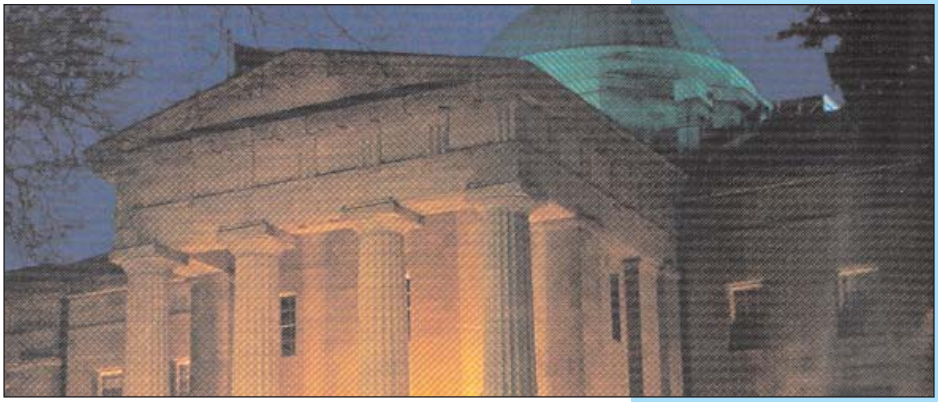
V. KNIGHTDALE LOCATION AND HISTORY

In order to appreciate fully where the Town of Knightdale is today it is helpful to review its past. By looking in the mirror one can ask, "do I like what I see?" If one doesn't like the view, one can take steps to improve it; or using modern technology, even dramatically alter it. Fortunately, the face staring back in Knightdale is in very good shape.

The story of Knightdale begins with exploration and discovery. As an incorporated town, Knightdale is a relative newcomer to Wake County and North Carolina history. The Knightdale community, which is an area that extends beyond the present day extraterritorial jurisdiction or ETJ, has a recorded heritage that dates back to the colonial era in American history. In the year 1700, the Lords Proprietor of the Colony, wishing to know what lay in the interior of the land that was called Carolina, hired a young man named John Lawson to explore this vast unknown land. Starting in an area near present day Charleston, South Carolina, Lawson began a trek that covered roughly 1,000 miles through the heart of the Carolina Colony. According to his diary, which was published in England in 1709, Lawson passed through this area sometime in February of 1701. His diary records a meeting with fierce Tuscarora Indians on the banks of the Neuse River. With the help of an Indian interpreter, Lawson made peace with the Tuscarora. Whether or not this event occurred, Lawson is thought to be the first European to explore this part of North Carolina.

During the eighteenth century, people began to be interested in acquiring land in this new frontier. After receiving the report from Lawson, the King of England decided that the time had come to apportion these lands to willing settlers. Around 1730, John Hinton left his home and headed west, finally settling in what would one day be called Knightdale. This hardy woodsman erected the first dwelling built by a settler of European descent in the Knightdale area. Although the land that was granted to Hinton extended to what is now Clayton, North Carolina, and beyond, Hinton settled in an area near the Neuse River, not far from where Hodge Road and Old Faison Road now intersect.

In time more settlers became attracted to this area. As more people moved here, the need for some sort of local government arose. The colonial government appointed Hinton to be the Justice of the Peace for Craven County— a portion of Hinton's land at this time was in Craven County. After forming Johnston County out of Craven County in the 1750's, the colonial government looked to Hinton to organize a militia. Given the rank of colonel, Hinton formed a small band of militiamen to serve at the wishes of the royal governor in New Bern, North Carolina. Aside from serving as the local police, this militia saw no action until after the County had been divided again. In 1771, Wake



N.C. Division of Tourism, Film, and Sports

County was carved out of Johnston County.

At the beginning of the American Revolution, Hinton abandoned his allegiance to the Crown and was called on again to serve as a military leader. Hinton played a key role in the first battle of the American Revolution fought on North Carolina soil, the February 1776 Battle of Moore's Creek Bridge. Not long after the battle, Hinton was chosen as a delegate to the Fourth Provincial Congress, which passed a resolution known as the Halifax Resolve, later used by Thomas Jefferson as a model for the Declaration of Independence. In this way, the area that we plan for today played a role in the formation of our nation. Three of the seven Hinton plantations in the Knightdale area are still intact, "The Oaks", "Midway", and "Beaver Dam".

After Independence, the people of this area went about making a living on the land. Local farmers successfully grew tobacco and cotton. Although not as prominent in this area as the Deep South, slavery nonetheless was a component of the community's economy. Although many slaves were buried in long-lost unmarked gravesites throughout the Knightdale area, documentation of some gravesites is helping the Town identify and protect these as an important part of our cultural and historic heritage.

Following the Civil War, Raleigh and Wake County saw a tremendous population boom resulting in the need to divide the County into smaller administrative units, "townships", that could respond more effectively to the needs of residents. The area that became Knightdale is located in St. Matthew's Township, but in name only as the Township no longer functions as an independent administrative unit.

For many years the area that is now downtown Knightdale was a crossroads served only by a post office. Most of the people in the area were farmers who grew a variety of crops, although tobacco was the area's main cash crop. Near the end of the nineteenth century, many citizens of the area saw the need to establish a town at this crossroads with a post office. One, Mr. Henry Haywood Knight donated some of his vast land holdings in the area to the Norfolk and Southern Railroad Company in the hopes that a railroad would come to the area. The railroad would provide freight and passenger service, and would facilitate the incorporation of the community, but Mr. Knight did not live to see the railroad in Knightdale. Not long after his death in 1904, the railroad finally came to the community that would bear his name.

The coming of the railroad and station caused the life and commerce of the area to move at a faster pace. The railroad moved timber and farm products to the market and moved people to Raleigh and Wake County. As the need for more railroad workers increased, Norfolk and Southern moved many families into the community to take care

of the railroad. Many of the older homes in Knightdale were built specifically for the use of railroad workers and their families. Along the tracks on Railroad Street there remains the original railroad stationmaster's house.

With the railroad generating commerce and traffic, so did the demand for services. To fill this need, a bank, shops, and other businesses were established on First Avenue. The increased economic activity and growing local identity that stemmed from the railroad led to Knightdale receiving its articles of official incorporation from the North Carolina Legislature on March 9, 1927. After incorporation, many more businesses moved into town, including a farmer's cooperative, a barbershop, and several small grills.

Despite the growth and prosperity, Knightdale's future was dimmed by the absence of municipal services, including most notably, a municipal water system. Relying only on well water to serve its needs, the Town was subject to the unpredictable nature of the weather and the threat of fire. This shortfall came to a head in 1940 when, in the early morning hours of February 7, a fire began in the storehouse of Robertson's Hardware Store and rapidly threatened to engulf the entire business district and adjacent homes. In a virtuous act of community spirit, town residents turned out to fight the flames. Desperate to bring the fire under control, neighbors joined together to draw water from the wells, forming bucket brigades to try and halt the fire. The heroic effort was futile. Arriving too late to save most of the original commercial and residential core of the community, the fire was not brought under control until trained firefighters arrived from Raleigh with an adequate water supply.

In 1952 a municipal water system was finally completed; the Knightdale Volunteer Fire Department was established in 1953. Nevertheless, soon after the fire, the people of Knightdale went about rebuilding their once proud downtown business district. Helped along by the baby boom following World War II, the population of Knightdale grew at a steady pace, but Knightdale retained its small town atmosphere. The corner drugstore, the bank, and the barbershop on First Avenue not only served as places of business, but places for social gatherings. Movies were often shown on the wall of the old bank building, which is located at the intersection of First Avenue and Main Street.

As competition from the automobile increased, the railroad's role as a determining factor in the urban form of the town disappeared. In the 1960's, with acres of land needed to accommodate the automobile, new businesses in Knightdale began to locate along US 64 and onto land once farms and forests. The widening of US64 to four lanes in 1970's, coupled with the explosive growth of the Research Triangle region of central North Carolina, accelerated Knightdale's population growth while

farms and forests continued to evaporate. The downtown business district, once fought for so valiantly, is a quiet shadow of its former glory.

I. INTRODUCTION

The Official Seal of the Town of Knightdale embodies a train, cotton, a tobacco leaf, and a pine tree; symbols of Knightdale's historic beginnings and economic origins say much about her citizens' desires for Knightdale's future. It is known that the physical, built form of a town reflects the vision ~ or lack of vision ~ that influences the decision making processes. For example, every community would like to see its local economy enhanced by development, but those communities do not have to rely upon the dictates of others unfamiliar with that community's aspirations and whose actions can compromise those aspirations as the community pursues a more prosperous future.

Knightdale is in an enviable location that few communities share and the question becomes not "will" Knightdale grow; the question is "how". The Town of Knightdale is confident that it will grow because of the following reasons:

- Proximity to major employment centers, major universities and colleges;
- Ease of access (Two major freeways will run through the town by 2006);
- Potential to utilize the existing rail corridor for enhanced freight and / or passenger service;
- Availability of large parcels of undeveloped land adjacent to transportation corridors;
- Availability of public utilities; and,
- Rapid residential growth (Knightdale's resident population grew an astounding 216% between 1990 and 2000, one of the fastest rates in the state.)

1963 Raleigh-Durham Airport

1963 Beltway Construction

1963 Planning RTP

Visions from the 1960's from NC Department of Commerce

In November, 1996 the Town of Huntersville discarded its old zoning ordinance and replaced it with a new ordinance modeled upon the principles of traditional town planning. Of great concern to the individuals who drafted Huntersville's new growth policies was the fact that suburban sprawl oftentimes eradicates a town's uniqueness by establishing conventional building patterns that disrespect the existing fabric of the community. Huntersville has, until very recently, been a small rural town with a modest central business district, numerous working farms, and extensive woodlands. Certainly no one expects Huntersville to remain this way forever---but there are steps that can be taken to accommodate new development that respects the values and characteristics that are unique to Huntersville.

The irony of most suburban development is that it often promises "life in the country" but typically delivers a finished product that, when combined with other suburban development, eliminates the "country" characteristics that drew new residents and businesses in the first place.

Town of Huntersville (NC)
Town Planning Philosophy

II. OVERALL GOALS OF THE COMPREHENSIVE PLAN

The Comprehensive Plan of the Town of Knightdale provides a functional framework to guide in the development and implementation of a vision that promotes the following goals:

1. Maintain a respect for the existing relationship between rural and urban Knightdale; the old English concept of town building based upon "town and country" is the foundation of this Plan;

2. Provide equal opportunity to all Knightdale citizens, including equal access to facilities and opportunities of the Town and region;

3. Provide safe, dynamic and sustainable neighborhoods, which offer employment opportunities, high quality education, adequate and affordable shelter, health care, and recreational amenities;

4. Provide a vibrant and varied local economy, which will attract and support a wide diversity of business opportunities and community services;

5. Provide balanced and responsible urban design, planning and development, and protection of the Town's historical, cultural, and natural resources;

6. Provide an open, accessible, responsive, and fiscally responsible government whose structure creates the functional framework to meet the goals of the Plan.

The goals as outlined are the result of several years of learning, listening, and communicating with citizens, town officials, the development community, and plan consultants. Knightdale's Comprehensive Plan Update Committee and the Town's Planning Staff agreed that because the Town possesses a unique, and enviable, geographic position within a nationally-recognized economic center and because of improving accessibility and regional growth, Knightdale can afford to imagine a proactive future, guided by the expressed desires of her citizens.

While demonstrating a desire for growth and development, the Town should seek to minimize the negative impacts of growth, and always, expect that new development will contribute to the overall health and function of the Town. In the final analysis, the

Comprehensive Plan Update Committee hopes that the decisions made by the Town in the coming years will contribute to the building of a legacy that benefits the generations that follow us.

Realizing the overall vision for Knightdale requires clear, attainable objectives that address central issues facing the Town. Action items, or tasks to be completed, to achieve these objectives are provided to guide the Town's planning and implementation strategies. The objectives and actions items throughout the document are tasks by which the Town can measure its progress in fulfilling the vision for Knightdale's future. The objectives and action items are formed by local desires, current conditions, future trends and opportunities.

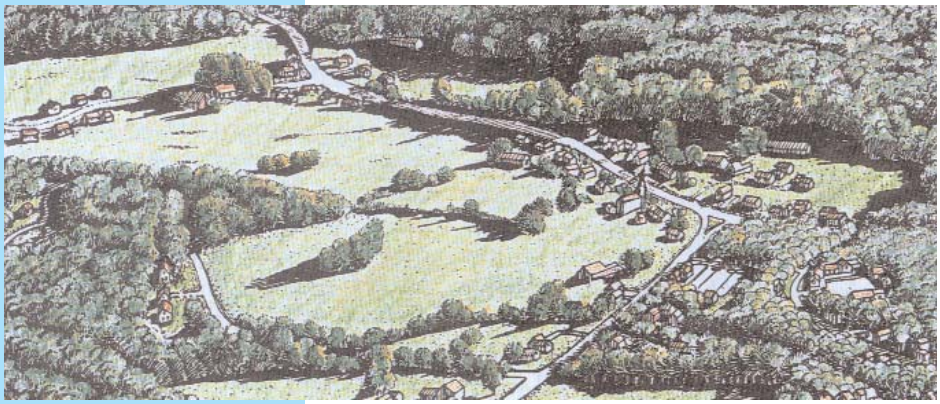
In crafting a vision for Knightdale, public participation played a key role in understanding what it was the public envisioned for the future of the Town. Feedback in the form of phone calls and email, discussion at meetings and written comments from a visual preference survey provided a common theme that prevailed from the people of Knightdale. The following summarizes the most common concerns and issues as stated by the people. These specific statements were made at the June 2002 Landowner's Workshop **(The full summary of the June 12, 2002 Public Planning Workshop is at the end of Chapter 2 as Figure 2.1)**:

- Preserve some of the rural character…farms, and natural areas.
- Retain the small-town atmosphere.
- Expand economic opportunities, broaden our local economy.
- Expand housing choice.
- Improve transportation choices. Make it easier to walk, get to Raleigh
- Preserve and enhance our unique character
- Preserve our history
- Continue to make Knightdale more attractive
- Knightdale has so much potential it does not have to settle for less.

Creating the vision of what Knightdale can be in 2027 meant mixing what the public said with what the staff, committee and consultants learned about the town's resources, constraints, and future trends. A number of questions were posed throughout the visioning process by the Update Committee and included the following:

What are the precedents that should be followed?

The project team looked to Raleigh's Cameron Park neighborhood; the Towns of Cornelius, Davidson and Huntersville, NC, and English town building concepts as citizens expressed a strong desire to maintain a small town



atmosphere and preserve rural areas.

What could be learned from other places?

After studying a number of scenarios from existing towns, it was identified that transportation corridors determine where and how development occurs, that existing infrastructure can be maximized, and that the Town can be require a high standard of development.

Could the Town imitate successes from other places?

The project team understands that many 'new places' have components which may be duplicated from 'old places.' New towns and developments take many design features from old towns, such as Charleston, South Carolina or Savannah, Georgia. These towns have become major tourist attractions for a reason…and the question is, does Knightdale want to become 'Everywhere, USA' or does Knightdale want to have a unique small town character which is memorable to its citizens and visitors?

What tools do we need?

Strong leadership is one of the most important 'tools' available as the Town's leaders make important decisions about land use and town creation. Vision is another important tool. The vision outlined in this Plan is the result of active public participation which dictates how the town will grow over the next 25 years. Sound planning principles are also critical and require implementation of a well written zoning and subdivision ordinance and sound town policies on issues such as annexation and extension of water and sewer.

What can be the Town's future?

It's not unrealistic to imagine that Knightdale can continue to be a regional leader in town building and that Knightdale can continue to grow in a quality fashion. Growth pressures due to the Town's location are ever increasing and with the right tools in place, Knightdale can have a prosperous future.

The people's vision for Knightdale in 2027 can be summarized by the term, "Town and Country" and the specifics of this vision can be found throughout this document, from the Design District Master Plan to the Focus Area Plans, where one can find summaries of projects for Knightdale's future that will contribute to the creation of a community for which future generations will be grateful.

FIGURE 2.1
Summary of June 12, 2002 Public Planning Workshop

After an introduction about the importance of the comprehensive planning process to the aesthetic, economic, environmental, fiscal, and functional future of the Town of Knightdale, Councilman Chalk welcomed the opportunity to participate in a short conversation with workshop participants. Following a brief discourse, the participants then split up into three groups of 4 - 5 people. The groups were comprised of the same general cross-section of residents as the larger whole.

They were asked to discussed the action plan issues as proposed by Cole Jenest & Stone, one of our consultants on the Comprehensive Plan update team. To guarantee impartiality, Councilman Chalk conceived of a spatial arrangement of tables in the Council Chambers to ensure that each group would function independently of the other groups outside of the auditable range of each other. His layout worked remarkably well ~ as each group focused in its own members ~ no "sharing" of thoughts was witnessed between groups during process.

Nevertheless, there was surprising consensus among the groups on most of the issues. In particular, the groups desired to retain the "small-town character" of Knightdale while recognizing that preventing growth to preserve that character was not desirable. The group optimistically suggested tactics, policies, and plans the Town should pursue that would maintain the qualities of a small-town while accommodating growth and enhancing the benefits of our proximity to a major U.S. city. Everyone agreed that our greatest potential in the future would lay in the enhancement and preservation of a unique character for Knightdale and that we should avoid losing our qualities even as we continued to be integrated into the larger regional engine.

A specific recounting of group responses to the action plan issues:

WHAT ELEMENTS WOULD MAKE KNIGHTDALE A DISTINCT AND MEMORABLE TOWN?

Group 1:
- "Small town atmosphere"
- "Country life with city perks"
- "Safety"
- "Distinctive / upscale shopping (quaint downtown)"

Group 2:
- "Small town atmosphere"

"Different street standards - small scale"
"No more cul-de-sac(s)"

Group 3:

"A strong comprehensive plan implented (sic) by zoning, ordinances etc. - community vision"
"Uniform design standards"
"Differentiate ourselves from our surrounding communities - East Raleigh - etc."

LAND USE AND GROWTH

Group 1:

"Why do comprehensive plan if someone can randomly change it - need to change zoning to implement the Comp. Plan."

Group 2:

"Create a plan to put high density where we want it."
"New zoning districts"
"Neighborhood streets"
"No landfill!"
"Place a section away from (existing) residential for high density & commercial"

Group 3:

"Need future land use map"
"Implement new zoning and ordinances to encourage growth in accordance with new plan"

HISTORIC PRESERVATION

Group 1:

"Revitalize downtown - commuter rail"

Group 2:

"Protect our downtown"
"Protect existing quality of life"
"More open space"
"Connectivity"
"Link from past to future of Knightdale"
"Diversity"

Group 3:

"Old downtown, plantations"

TRANSPORTATION

Group 1:

"Link North Knightdale with South K-Dale (sic)"
"Rail"

Group 2:

"Zone existing s/d (sic) property to protect from haphazard dev."
"Noads (sic) of development to connect back from edges of highways"
"Expand our roads and ease congestion (sic)"
"Train stop in K'dale properly zoned"
"Plan corridor along rail system"

Group 3:

"Develop regional political strength to influence transportation issues on a regional basis"
"As a municipality become local road builders. (Bonds paid for by impact fees)"

BYPASS 64

Group 1:

"Speed up link /connection from 540 to 64 bypass"

Group 2:

"Need to take control of interchanges in our ETJ and expand ETJ. Run water sewer."

BUSINESS 64:

Group 1:

"Less stoplights
"Synchronized lights"

Group 2:

"Prevent Bus. 64 from looking like hwy 70 in Clayton or Capital Blvd"
"Buffers and streetscapes"

Group 3:

"How do we retain existing large businesses. How do we promote quality long-term businesses. We need to be user friendly"

SMITHFIELD ROAD

Group 1:

"Pedestrian friendly aesthetically pleasing (landscaping)"
"Streetscaping - old fashioned lights. Meandering / winding, walkways, benches"
"Greenway connectivity"

Group 2:

"Important future connector from 64 bypass to Knightdale need to look at

future land use on this corridor - future 4 lane with median"

Group 3:

"Park and ride for train to RTP and downtown"

OPEN SPACE, PARKS AND RECREATION

Group 1:

"Usable open space - a variety not specific to team sports"
"Connectivity localize parks - amphitheater - pool"

Group 2:

"More green space in each new s/d"
"Greenway system to connect K'dale"

Group 3:

"Preserve what little older growth that we have."
"Force developers to do lower impact development"
"Require natural areas"
"Need tax base growth for Parks and Recreation"

HOUSING

Group 1:

"Better quality"
"Larger lots"
"Higher density"
"More varieties of builders"
"No more cookie-cutter garage doors on the street"

Group 2:

"Don't want to see manufactured housing as infill in existing s/d"
"Larger homes"
"A place for all homes"

Group 3:

"More upscale single-family homes."
"Balance with commercial, industrial."

RETAIL

Group 1:

"More upscale / distinctive shops"
"Revitalize downtown buildings for shops, restaurants, cafes, etc"
"More variety"
"Less fast food, car wash, Quick Lubes"

Group 2:

"Keep in noads (sic) from the edges of main highways"
"New ways to encourage employment based growth"

Group 3:

"More mixed-use - community integrated small store shopping"

CATALYST PROJECTS

Group 1:

"Industrial park"
"Wake Tech (Community College) extensions"
"Medical center"

Group 2:

"Good planning"
"Medicine"
"Have a large corporation / industry come to K'dale area like Bayer plant, Glaxo…"
"Hi-light / promote amphitheater at Park"
"Encourage the arts - music, drama, dance"

Group 3:

"Important to attract now before large land tracts are gone. Incentives? romotion? Chamber?"

CHAPTER 3

town resource analysis

I. INTRODUCTION

This chapter of the 2027 Comprehensive Plan is intended to present background information and statistics on the Town of Knightdale and how the Town has changed over the last several years. This data is provided to give some context to the community goals, objectives, and policies that follow in subsequent chapters. The Town Resource Analysis chapter contains data and analysis regarding seven primary areas:

- Geography
- Land Use and Land Values
- Population and Demographics
- Housing and Commercial Real Estate Data
- Historic Resources
- Economic Character
- Environment and Natural Resources

II. GEOGRAPHY

Knightdale is one of twelve municipalities located within Wake County, North Carolina. The Town is situated approximately six miles east of the City of Raleigh across the Neuse River. Knightdale is predominately an agrarian town with over 44% of the overall planning area used for agricultural production. 18.9% of the planning area is currently developed for residential usage with an emphasis on detached single-family home development. Less than 0.1 % of the total residential development is used for apartments and high-density development. Currently, 15.9% of the area is vacant and in transition awaiting a new classification. The remaining 21.1% is classified as commercial, industrial or exempt land uses that include utility company property, churches, and schools.

The planning area for the Town of Knightdale is composed of four geographic units or subareas:

- The Corporate Limits
- The Extra-territorial Jurisdiction
- The Short Range Urban Service Area
- The Long Range Urban Service Area.

These boundaries have been established through enabling legislation from the State of North Carolina, as well as by mutual cooperation with Wake County and surrounding municipalities.

The Corporate Limits is the area that is incorporated, or within the defined city limits of Knightdale. Knightdale collects taxes from citizens and properties within this area, while providing the full range of municipal services, like police and fire protection.

The Extra-territorial Jurisdiction (or ETJ) is an area surrounding the city limits which projects outward for approximately one mile from the city limits. The Town of Knightdale has the authority to complete land use planning for this area, though taxes in this area are not collected by the Town. As new development occurs within the ETJ, the Town requires that new development submit a voluntary annexation petition. This allows Knightdale's city limits to grow.

The Short Range Urban Service Area (or SRUSA) is a band around the Town's ETJ on the northern, eastern and southern sides. This is an area which will eventually come under the land use planning jurisdiction of, and ultimately be, annexed by the Town of Knightdale. Typically, land use planning control is extended as Knightdale pushes its ETJ boundary outwards from the corporate limits as new development locates proximate to the city limits. When the SRUSA was originally developed in 1997, it was envisioned by Knightdale and Wake County that Knightdale would extend urban infrastructure (such as roads and sewer lines) throughout the Short Range Urban Service Area within ten years, or by 2007.

The Long Range Urban Service Area (or LRUSA) represents the ultimate extent of Knightdale's City Limits and planning jurisdiction at some point in the future. The LRUSA is bounded on the north and south by the City of Raleigh's LRUSA, and on the east by the Town of Wendell's LRUSA. Knightdale currently has no control over land use planning within its LRUSA. Figure 3.1 shows each of the four geographic subareas which compose Knightdale planning area.

Figure 3.1 Knightdale Planning Area Boundaries
Previous land use planning efforts in Knightdale have not included the area beyond the ETJ boundaries, but changing conditions now warrant that the 2027 Comprehensive Plan consider all of the ultimate planning area.

See Figure 3.1 Knightdale Planning Area Boundaries Map

Table 3.1 shows the number of individual parcels and the various boundary sizes of the parts composing the Knightdale planning area. The Knightdale planning area is composed of over 6,000 parcels, occupying over 31 square miles. Approximately 40% (12.7 square miles) of this area is composed of the Corporate Limits and the ETJ. Knightdale has a somewhat small planning area, and will have to grow in a compact fashion to make the best possible use of the available land.

TABLE 3.1:
Number of Parcels and Physical Size for Knightdale Boundaries, June 2001

	Corporate Limits	*Extra-Territorial Jurisdiction*	*Short Range Urban Service Area*	*Long Range Urban Service Area*	*TOTALS*
Number of Parcels	2,437	1,268	1,165	1,446	6,316
Gross Acres	1,757.0	6,369.5	8,986.5	3,043.1	20,156
Square Miles	2.75	9.95	14.04	4.75	31.49
Percent of Total Square Miles	8.7%	31.6%	44.6%	15.1%	100.0%

Source: Wake County GIS (Property Appraiser's Office Data) as of 6/1/01

FIGURE 3.2:
Planning Area Sizes (percent of total)

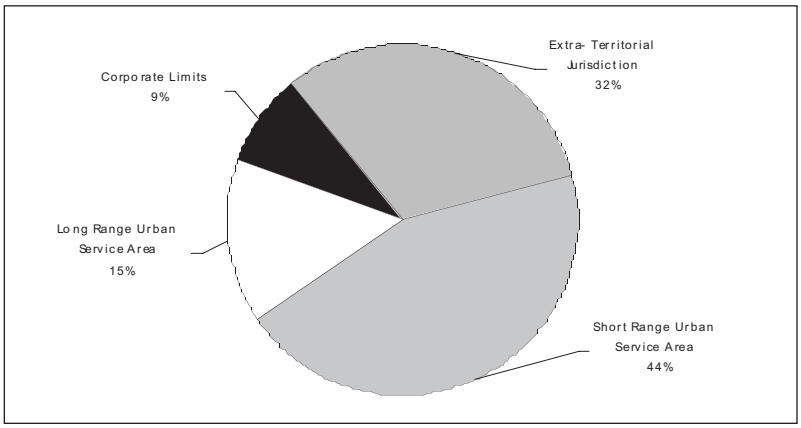


Table 3.2 charts the population growth and annexation statistics for the Town of Knightdale during the 1990s. According to the North Carolina Office of State Planning, the population within the Knightdale Corporate Limits increased by over 3,000 people from 1990 to 1999. The vast majority of this population growth is a result of annexations.

The Corporate Limits almost doubled in size from 1.38 square miles to 2.65 square miles over the 1990s, picking up over 812 acres. One of the reasons for this increase is that Knightdale requires new development occurring outside the Corporate Limits to submit a petition for annexation as a part of the development approval process. If past development trends can be used to predict the future, it is likely that the rate of Knightdale's geographic expansion will increase in the coming years.

TABLE 3.2:
Population Growth and Annexation in the Town of Knightdale, 1990-1999

4/1/90 Population *	1,884
7/1/99 Population	5,242
Population Increase from 1990-1999	3,358
Amount of 7/1/99 Population within Area Annexed from 1990-1999**	2,841
"Core" Population Growth ***	517
Corporate Limits Land Area on 4/1/90 (in sq. mi.)	1.38
Corporate Limits Land Area on 7/1/99 (in sq. mi.)	2.65
Amount of Land Anexed Between 4/1/90 and 7/1/99 (in sq. mi.)	1.27
Amount of Land Anexed Between 4/1/90 and 7/1/99 (in acres)	812.80

Source: NC Office of Statewide Planning
** Source: US Census of Population & Housing*
*** This is the population (as of 7/1/99) contained within all the areas annexed from 4/1/90 to 7/1/99*
**** This is the amount of population increase which occurred within the Corporate Limits Land Area (as it existed on 4/1/90) from 4/1/90 to 7/1/99*

III. POPULATION

Table 3.3, Figures 3.3 and Figure 3.4 show the changes in the population within Knightdale's Corporate Limits for the last 40 years according to the Census. The Town's population has grown from approximately 600 people in 1960 to almost 6,000 people by 2000, an increase of 857% over this period. Growth rates have picked up over time as well. Knightdale's population almost doubled between 1980 and 1990, and quadrupled between 1990 and 2000. If population growth in other comparable Triangle cities can be used as a model, it is likely that these trends in population growth will continue well into Knightdale's future.

TABLE 3.3:
Changes in Town of Knightdale Population, 1960-2000

Year	*Population*	*Numeric Increase From Previous Count*	*Percent Increase From Previous Count*
1960	622	-	-
1970	815	193	31.0%
1980	985	170	20.9%
1990	1,884	899	91.3%
2000	5,958	4,074	216.2%

Source: US Census of Population and Housing

FIGURE 3.3:
Changes in Knightdale Population, 1960-2000

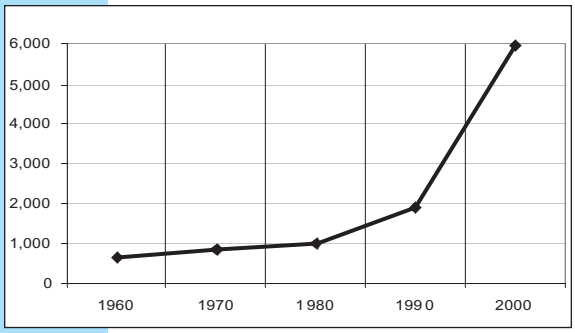


FIGURE 3.4:
Percent Increase in Knightdale Population, 1970-2000

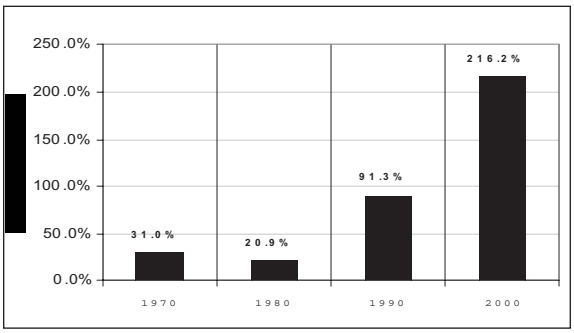


Table 3.4 and Figure 3.5 chart the 2000 population for the Knightdale Corporate Limits as well as the three other sub-areas of the Knightdale Planning Area. The population within the overall planning area is over 15,000 people.

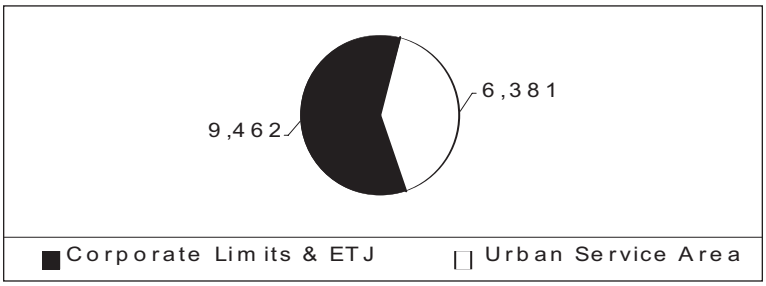
TABLE 3.4:
Population by Knightdale Planning Area, 2000

Area	*2000 Population*	*Percent of Total*
Corporate Limits	5,958	37.6%
Extra-territorial Jurisdiction	3,504	22.1%
Short Range Urban Service Area	3,104	19.6%
Long Range Urban Service Area	3,277	20.7%
Totals	15,843	100.0%

Source: US Census of Population & Housing Block-level Data

Note: Some area boundaries were adjusted to follow census block boundaries for deriving population

FIGURE 3.5:
2000 Population by Planning Area



The population within the Corporate Limits accounts for less than 40% of the Planning Area's population. It is interesting to note that the Short Range Urban Service Area contains less than 20% of the Planning Area's population, but almost 45% of the total land area. This means that population densities within the Short Range Urban Service Area may be somewhat low. Population within the Long Range Urban Service Area is almost entirely concentrated within four large subdivisions located adjacent to South Smithfield Road.

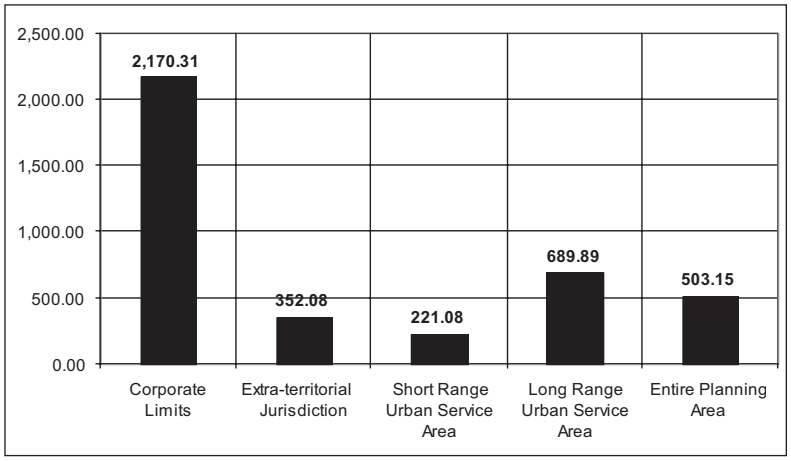
Table 3.5 and Figure 3.6 combine the information contained within the previous charts to illustrate the population density. Population density is the number of people per unit of space, such as square miles or acres. Population densities are higher (over 2,000 people per square mile) within the Corporate Limits due to the large amount of urbanized land within the urban area.

TABLE 3.5:
Population Density for the Knightdale Planning Area, 2001

	2000 Population	*Size in Square Miles*	*Size in Acres*	*Population Density per Square Mile*	*Persons per Acre*
Corporate Limits	5,958	2.75	1,756.95	2,170.31	3.39
Extra-territorial Jurisdiction	3,504	9.95	6,369.46	352.08	0.55
Short Range Urban Service Area	3,104	14.04	8,986.54	221.08	0.35
Long Range Urban Service Area	3,277	4.75	3,043.09	689.89	1.08
Entire Planning Area	**15,843**	**31.49**	**20,156.04**	**503.15**	**0.79**

Sources: US Census of Population & Housing; Wake County GIS (Property Appraiser's Data as of 6/1/01)

FIGURE 3.6:
Population per Square Mile



Population densities drop off very rapidly within the ETJ and SRUSA due to these areas' larger land masses, and smaller populations. The trend reverses within the Long Range Urban Service Area, in part as a result of the boundary's smaller size. However, the population density is four times higher in the LRUSA than in the SRUSA. This indicates that the land within the LRUSA is much more developed than the land in the SRUSA; a fact which could make future annexations in these areas more difficult.

IV. DEMOGRAPHICS

The following tables and figures provide more information on the attributes of the population within the Town of Knightdale. The table showing gender characteristics indicates that over 50% of the population in Knightdale is female, and is increasing over time.

TABLE 3.6:
Gender Characteristics for the Town of Knightdale, 1990 & 2000

	1990	*2000*
Number of Males	906	2,783
Percentage of Males	48.1%	46.7%
Number of Females	978	3,175
Percentage of Females	51.9%	53.3%
Total Population	**1,884**	**5,958**

Source: US Census of Population & Housing

The age structure is also a very important characteristic as it relates to the various needs of the population, such as provision of schools, employment, and service needs. Age groups have been broken down into logical divisions: young children (ages 0-4), school age children (ages 5-19), the working age population (ages 19-64), and the retirement age population (65+).

TABLE 3.7:
Town of Knightdale Population By Age Group, 1990 & 2000

Age Group	*1990*	*1990 Percent of Total*	*2000*	*2000 Percent of Total*
0-4 (Young Children)	174	9.2%	561	9.4%
5-19 (School-age Children)	215	11.4%	858	14.4%
20-64 (Working-age Population)	1,212	64.3%	3,668	61.6%
65+ (Retirement-age population)	111	5.9%	303	5.1%
Total Population	**1,884**	**100.0%**	**5,958**	**100.0%**
Median Age	**31.0**	**-**	**30.5**	**-**

Source: US Census of Population & Housing

Table 3.7 shows that there have been numeric increases across all age groups from 1990 to 2000, but the fastest growing age group is the school-age population, which increased by 300% between 1990 and 2000.

The number of young children and retirement age populations comprised the same proportion of the population between 1990 and 2000 (10% and 6% respectively); but

the working age population declined as a portion of the overall population from 71% to 68%. These figures indicate a greater need for schools and other school-related services, and a smaller working-age population to support these expenditures.

Table 3.8 shows the racial composition of Knightdale, and indicates that Knightdale is becoming more racially diverse. Caucasians declined from almost 90% of the population in 1990 to just under 70%. African-Americans increased over 800% over the decade. The large percentage increase in the "Other Races" category is a function of a different report style utilized by the Census in 2000 which allowed participants to enter one or more races. The Hispanic ethnic group also experienced substantial increases over the period.

TABLE 3.8:
Racial Characteristics for the Town of Knightdale, 1990 & 2000

Race	*1990*		*2000*		*Percent Change*
	Number	*% of Total*	*Number*	*% of Total*	*from 1990-2000*
Caucasian	1,692	89.8%	4,043	67.9%	138.9%
African American	170	9.0%	1,599	26.8%	840.6%
American Indian	0	0.0%	21	0.4%	-
Asian/Pacific Islander	12	0.6%	89	1.5%	641.7%
Other Race *	10	0.5%	206	3.5%	1960.0%
Total Population	1,884	100.0%	5,958	100.0%	216.2%
Hispanic **	28	1.5%	220	3.7%	685.7%

Source: US Census of Population & Housing

** The large increase in the "Other Race" category is attributable to the Census creation of a Two or More Races Category for the 2000 Census*

*** Hispanic origin is considered to be an ethnic group, not a race by the US Census*

Table 3.9 shows the educational attainment of persons in Knightdale in 1990. Approximately 41% of the population within the Corporate Limits had an Associates Degree or higher. Only 11 % of the population lacks a high school degree.

TABLE 3.9:
Educational Attainment in the Town of Knightdale, 1990

Amount of Education	*Number of People*	*Percent of Total*
Less than 9th Grade	50	4.1%
9th to 12th Grade, No Diploma	91	7.4%
High School Graduate	332	26.9%
Some College, No Degree	251	20.4%
Associates Degree	121	9.8%
Bachelor's Degree	303	24.6%
Graduate or Professional Degree	84	6.8%
Percent High School Graduate or Higher		88.6%
Percent Bachelor's Degree or Higher		31.4%

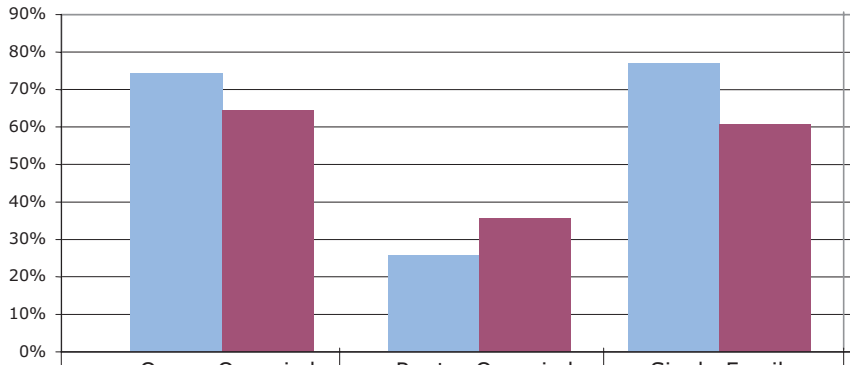
Source: US Census of Population

V. HOUSING AND COMMERCIAL REAL ESTATE MARKET

A. Introduction

Knightdale's housing market is dominated by affordable owner-occupied housing. Much of the housing in Knightdale has been developed and marketed to consumers seeking more value than they could get in many of the region's larger and faster growing housing markets (i.e. Cary, North Raleigh, Apex). Knightdale's housing market is also dominated by single-family housing, a common occurrence in outlying suburban communities with relatively affordable land pricing.

FIGURE 3.7: Knightdale & Raleigh-Durham Region Housing Statistics



	Owner Occupied	Renter Occupied	Single-Family
Knightdale	74%	26%	77%
Region	65%	36%	61%

Source: Karnes Research, 2002.

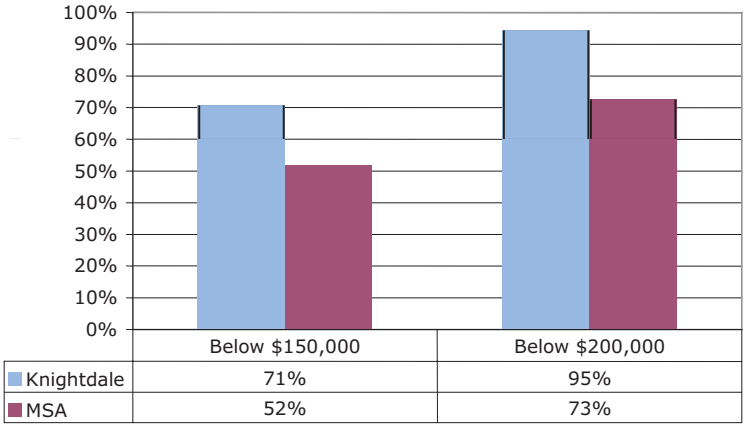
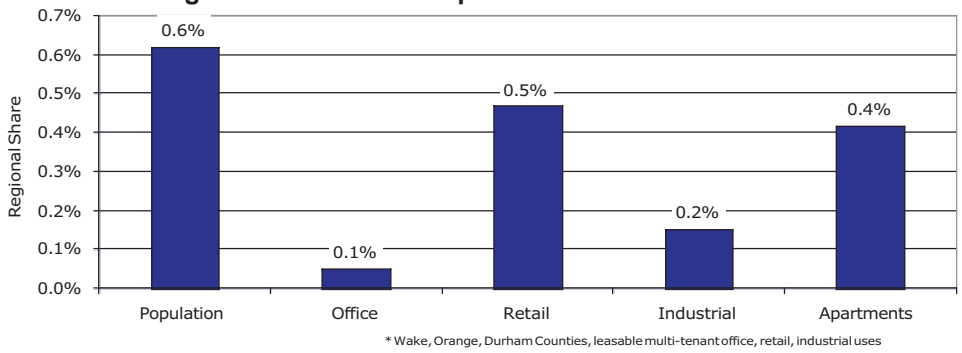


FIGURE 3.8: Affordable Homes Shares: Knightdale vs. Region

Source: Karnes Research, 2002

Apartment development in the Raleigh-Durham region has been more concentrated along the I-40 corridor as it stretches between Raleigh and Durham. This corridor has the highest concentration of employment uses and has attracted the bulk of the region's multi-family rental housing. Some limited apartment development has, however, occurred along US-64 over the past ten years. Much of this product has, however, been marketed as mid-market or affordable and was built to serve persons employed in eastern Raleigh and Wake County. The development and leasing of new apartment units should accelerate in Knightdale with the completion of US-64 Bypass, I-540, and the potential introduction of commuter rail service.

FIGURE 3.9: Knightdale's Share of Population and Commercial Uses



Source Karnes Research

Very little leasable office and industrial space is found in Knightdale. Less direct access and an abundance of business parks with available land more centrally located in the region is responsible for Knightdale's limited regional share of leasable office and industrial space. Like many smaller suburban communities nationally, small companies that serve the growing population base of the community occupy most of the office space in Knightdale. One is more likely, for example, to find branch banks, real estate firms, small medical offices and clinics in a community like Knightdale than large employers that export products and services outside the region.

Most of the industrial space in Knightdale is owner occupied space, which is tenanted by local manufacturers and distributors. Some of Knightdale's largest employers -- Square D, DT Magnetics, and Wake Stone Corporation - are in such space. The development of the I-540, US-64 Bypass, and commuter rail will improve Knightdale's marketability for attracting office, industrial, and distribution uses. Improved regional access, a faster pace of housing and retail growth that will boost the community's labor market, and more services should make Knightdale more attractive to office users.

Most of the retailers in Knightdale serve the needs of local residents as well as some limited retail and service needs of travelers and commuters that use US 64. Grocery stores, restaurants, gas stations, branch banks, and few larger stand-alone discounters are the primary retailers in Knightdale.

No regional or sub-regional centers (i.e. malls or large multi-tenant power centers) are located in Knightdale. A regionally peripheral location and inferior interstate access are responsible for the lack of a regional, or even sub-regional, shopping destination. Population growth from new household formation and increased access that will result from the development of I-540, US-64 Bypass, and the proposed commuter rail line should dramatically improve the feasibility of a large retail center in Knightdale over the next five to ten years.

The development of the proposed commuter rail line, which will connect Knightdale to Downtown Raleigh to the west as well as points in eastern North Carolina, would have a substantial economic impact on Knightdale. Based upon the experience of other metropolitan areas, transit is powerful magnate for new development and redevelopment. A thoughtfully designed rail station and careful attention to surrounding land uses and site design could attract a mix of retailers, new residences, and office occupying businesses that would not consider Knightdale before the introduction of commuter rail service.

Households seeking a small town atmosphere, as well as easy transit access to many

of the region's largest employment centers would find housing near a Knightdale rail station attractive. Retailers and office users that service a residential base could also take advantage of the increased customer traffic. Some employers would also find a locational advantage in the increased commuting options for employees that a transit station in Knightdale would allow.

B. Housing

A household is defined by the Census as one or more people living together in a housing unit. A "family" household is more than one person living together in a housing unit who are related through marriage, birth, or adoption. A non-family household is one or more unrelated people living in a housing unit. An owner-occupied household is a person or group of people living in a housing unit which is owned by the people living within it. A renter-occupied household is a person or group of people living in a housing unit which is rented, not owned.

TABLE 3.10:
Household Characteristics for the Town of Knightdale, 1990 & 2000

	1990	*2000*	*Percent Change 1990-2000*
Total Number of Households	733	2,172	196.3%
Persons Per Household (Average Household Size)	2.57	2.70	5.1%
Number of Owner-Occupied Households	574	1,613	181.0%
Number of Renter-occupied Households	159	559	251.6%
Average Household size of Owner-occupied Housing Units	2.61	2.83	8.4%
Average Household size of Renter-occupied Housing Units	2.43	2.33	-4.1%
Number of Family Households	556	1,627	192.6%
Number of Non-family Households	177	545	207.9%
Average Family Size	2.98	3.13	5.0%
Persons in Group Quarters	0	96	-

Source: US Census of Population & Housing

The number of households increased almost 200% from 1990 to 2000, the majority of which (75%) are owner occupied. However, the percent increase in the number of renter-occupied households was much higher. This indicates that more of the available housing stock is being converted to rentals, or is being built as rentals.

The number of persons per household (or average household size) increased to 2.70 persons per household by 2000, despite declines in the average household size of renter-occupied households. There are more family households than non-family households, and average family size also increased between 1990 to 2000. Knightdale also established its first population in group quarters (a nursing home) between 1990 and 2000.

B. Housing Characteristics

The following tables and figures provide information on the housing unit characteristics for Knightdale, its ETJ and Short and Long Range Urban Service Areas.

Table 3.11 shows the total number of dwelling units in the Knightdale Planning Area for 2000. In some cases, the boundaries between Census Blocks and the existing Planning Area subunits did not match up. For ease in data collection, the Census Block lines were followed.

Census data indicate that there were a total of 6,171 housing units in 2000, the majority of which (3,738 units, or 60%) were located within the Corporate Limits and the ETJ. It is interesting to note that the Short and Long Range Urban Service Areas have about the same number of housing units, despite the fact that the Short Range Urban Service Area is almost ten square miles larger.

TABLE 3.11:
Number of Dwelling Units by Knightdale Planning Area, 2000

Area	*Number of Dwelling Units*	*Percent of Total*
Corporate Limits	2,352	38.1%
Extra-territorial Jurisdiction	1,386	22.5%
Short Range Urban Service Area	1,228	19.9%
Long Range Urban Service Area	1,205	19.5%
Totals	6,171	100.0%

Source: US Census of Population & Housing Block-level Data
Note: Some area boundaries were adjusted to follow census block boundaries for deriving dwelling unit counts

Table 3.12 presents information on the housing unit occupancy figures for the Corporate Limits during 1990 and 2000. Note that the total number of housing units increased almost 200% from 1990 to 2000, but the vacant number of housing units increased 246% for the same period. Homeowner vacancy rates are declining slightly, while rental vacancy rates have tripled. This may indicate a glut in the supply of rental housing; but it is important to remember that annual changes in vacancy rates are highly variable.

TABLE 3.12:
Housing Occupancy Characteristics for Corporate Limits, 1990 & 2000

	1990	*2000*	*Percent Change from 1990-2000*
Total Housing Units	785	2,352	199.6%
Occupied Housing Units	733	2,172	196.3%
Number of Owner-occupied Units	574	1,613	181.0%
Number of Renter-occupied Units	159	559	251.6%
Vacant Housing Units	52	180	246.2%
Homeowner Vacancy Rate	5.9%	5.8%	-
Renter Vacancy Rate	3.0%	10.3%	-

Source: US Census of Population & Housing

Table 3.13 provides additional information on the overall vacancy rate (the combination of owner and renter-occupied units) for all four subunits of the Knightdale Planning Area for 2000. The overall vacancy rates are higher within the Corporate Limits and the ETJ are due in part to the larger overall number of units.

TABLE 3.13:
Vacancy Rates for the Knightdale Planning Area, 2000

Area	*Number of Dwelling Units*	*Number of Vacant Units*	*Vacancy Rate*
Corporate Limits	2,352	180	7.65%
Extra-territorial Jurisdiction	1,386	109	7.86%
Short Range Urban Service Area	1,228	66	5.37%
Long Range Urban Service Area	1,205	51	4.23%
Totals	6,171	406	6.58%

Sources: US Census of Population & Housing Block-level data

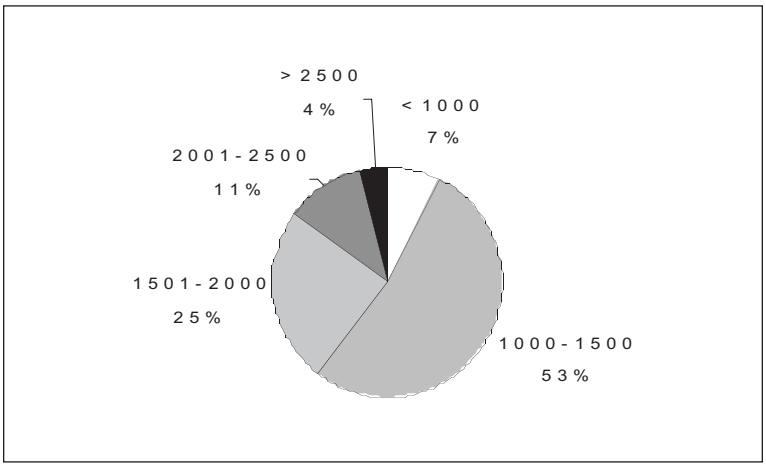
Table 3.14 and Figure 3.10 represent a much more in-depth analysis of single family housing unit sizes across the Knightdale Planning Area. This data was derived from the Wake County Property Appraiser's information on June 1, 2001. The data deals only with single family units, and is organized by square footage ranges across each of the Planning Area subunits.

TABLE 3.14: Single Family Residential Dwelling Unit Sizes in the Knightdale Planning Area, 2001

	<1,000 Square Feet		*1,000-1,500 Square Feet*		*1,501-2,000 Square Feet*		*2,001-2,500 Square Feet*		*>2,500 Square Feet*		*Total*	
	#	*%*	*#*	*%*	*#*	*%*	*#*	*%*	*#*	*%*	*#*	*%*
Corporate Limits	124	6.5%	785	41.1%	599	31.4%	328	17.2%	73	3.8%	1,909	100.0%
Extra-Territorial Jurisdiction	36	4.4%	346	42.1%	302	36.7%	95	11.6%	43	5.2%	822	100.0%
Short Range Urban Service Area	54	9.1%	268	45.2%	162	27.3%	59	9.9%	50	8.4%	593	100.0%
Long Range Urban Service Area	118	9.2%	1,052	82.0%	75	5.8%	22	1.7%	16	1.2%	1,283	100.0%
Total	**332**	**7.2%**	**2,451**	**53.2%**	**1,138**	**24.7%**	**504**	**10.9%**	**182**	**4.0%**	**4,607**	**100.0%**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: This table only includes single family dwellings

FIGURE 3.10:
Dwelling Unit Sizes (In Square Feet) for the Entire Knightdale Planning Area



Homes between 1,000 and 1,500 feet of heated square footage comprised the largest portion of housing sizes. It is interesting to note that the Short and Long Range Urban Service Areas had higher percentages of homes smaller than 1,000 square feet than did the Corporate Limits or the ETJ. Another interesting result of the study is that at least 70% of the single family homes within the Corporate Limits and the ETJ are between 1,000 and 2,000 square feet in size. Overall, almost 78% of the housing stock within the Knightdale Planning Area is between 1,000 and 2,000 square feet in size.

VI. ZONING

The next section in this chapter expands on the current zoning designations within the Knightdale planning area. Typically, zoning is not thought of as an extension of long range planning; rather, it is a means to implement the goals and objectives embodied within the Comprehensive Plan under current planning processes.

Zoning is defined as the designation of a range of appropriate land uses and development standards for a particular piece of property or properties in advance of or following development of that property. Zoning represents the range and variety of development options, as well as the investment-backed expectations associated with a piece of property. Municipalities are given the authority to zone land by the State of North Carolina in the interest of protecting the health, safety, and welfare of the public.

Previously, there has been little study on zoning patterns and their effects on assessed values, rate and timing of development, municipal service delivery, and quality of life within the Town. However, it is often the zoning of land which exerts the greatest effects on these attributes. As a result, this section will present some very basic information associated with the current zoning designations across each of the Knightdale Planning Area sub-areas. The purpose for providing this information is to present a snapshot of current development trends, and identify ways to improve upon these trends in pursuit of consistency with the Town's development goals.

A. Corporate Limits

Table 3.15 shows the breakdown of zoning by number of parcels and acres for parcels located within the Corporate Limits. The data shows that 78% of the land inside the Corporate Limits is zoned for residential uses, 18% is zoned for commercial uses, and 4% is zoned for industrial uses.

TABLE 3.15:
Town of Knightdale Zoning Inside Corporate Limits, as of 6/1/01

Zoning District	*Number of Parcels*	*Number of Acres*	*Percent of Total Acres*
Residential-Agricultural (RA)	71	338.15	19.2%
Residential 20 (R-20)	67	99.953	5.7%
Residential 15 (R-15)	92	80.598	4.6%
Residential 12 (R-12)	19	13.043	0.7%
Residential 10 (R-10)	339	225.308	12.8%
Residential 7 (R-7)	1,167	400.997	22.8%
Multifamily & Townhouse Res. (RMT)	478	214.276	12.2%
Residential Subtotal	2,233	1,372.33	78.1%
Office Professional (OP)	23	63.794	3.6%
Neighborhood Commercial (NC)	42	79.069	4.5%
Retail Commercial (RC)	60	80.621	4.6%
Highway Commercial (HC)	26	89.282	5.1%
Commercial Subtotal	151	312.77	17.8%
Light Industrial (LI & IM)	10	13.303	0.8%
Manufacturing (M1)	23	54.886	3.1%
Industrial Subtotal	33	68.19	3.9%
No Zoning Indicated	20	3.67	0.2%
TOTALS	**2,437**	**1,756.95**	**100.0%**

Source: Wake County GIS (Property Appraiser Data as of 6/1/01)
Note: 20 parcels were lacking zoning designations in the GIS database. These parcels may be streets or other land uses that are not zoned.

B. Extra-Territorial Jurisdiction

Table 3.16 shows the zoning for parcels in the Extra-territorial Jurisdiction. This is the area outside the Corporate Limits where Knightdale retains planning control. These figures show that about 70% of the land is zoned for residential purposes, 20% for industrial, and 10% for commercial land uses.

TABLE 3.16: Knightdale Zoning Inside the Extra-territorial Jurisdiction, as of 6/1/01

Zoning District	*Number of Parcels*	*Number of Acres*	*Percent of Total Acres*
Residential-Agricultural (RA)	1,063	3763.419	59.1%
Residential 15 (R-15)	3	184.345	2.9%
Residential 10 (R-10)	6	155.917	2.4%
Residential 7 (R-7)	5	276.298	4.3%
Multifamily & Townhouse Res. (RMT)	5	56.574	0.9%
Residential Subtotal	**1,082**	**4,436.55**	**69.7%**
Office Professional (OP)	10	21.446	0.3%
Neighborhood Commercial (NC)	3	3.176	0.0%
Retail Commercial (RC)	7	149.963	2.4%
Highway Commercial (HC)	121	476.205	7.5%
Commercial Subtotal	**141**	**650.79**	**10.2%**
Light Industrial (LI & IM)	1	13.593	0.2%
Manufacturing (M1)	32	648.489	10.2%
Manufacturing (M2)	6	620.032	9.7%
Industrial Subtotal	**39**	**1,282.11**	**20.1%**
No Zoning Indicated	6	-	-
TOTALS	**1,268.00**	**6,369.46**	**100.0%**

Source: Wake County GIS (Property Appraiser Data as of 6/1/01)
Note: 6 parcels were lacking zoning designations in the GIS database. These parcels may be streets or other land uses that are not zoned.

C. Short Range Urban Service Area

Table 3.17 shows the zoning designations for parcels in the Short Range Urban Service Area. Note that these zoning designations are different than those utilized within the Knightdale Corporate Limits and the ETJ. Wake County retains planning control of these areas until Knightdale extends its ETJ outwards to encompass these areas. The figures show that almost 90% of the land is zoned for residential uses (the vast majority of which is for 30,000 square foot lots, or about 1.4 units per acre), and the remaining 10% is zoned for commercial.

TABLE 3.17: Wake County Zoning Inside the Knightdale Short Range Urban Service Area, as of 6/1/01

Zoning District	*Number of Parcels*	*Number of Acres*	*Percent of Total Acres*
Residential 80 (R80)	1	0.069	0.0%
Residential 40 (R40)	38	691.964	7.7%
Residential 30 (R30)	1,009	7,106.288	79.1%
Residential 20 (R20)	26	106.202	1.2%
Residential 10 (R10)	3	5.417	0.1%
Mobile Home (MH)	5	163.679	1.8%
Residential Subtotal	**1,082**	**8,073.62**	**89.8%**
Office & Institutional (O&I)	1	10.819	0.1%
Highway District (HD)	44	792.123	8.8%
General Business (GB)	6	6.537	0.1%
Airport District (AD1)	1	66.255	0.7%
Commercial Subtotal	**52**	**875.73**	**9.7%**
Industrial (I-1)	1	1.073	0.0%
Industrial (I-2)	11	36.113	0.4%
Industrial Subtotal	12	37.19	0.4%
No Zoning Indicated	19	-	-
TOTALS	**1,165.00**	**8,986.54**	**100.0%**

Source: Wake County GIS (Property Appraiser Data as of 6/1/01)
Note: 19 parcels were lacking zoning designations in the GIS database. These parcels may be streets or other land uses that are not zoned.

D. Long Range Urban Service Area

Table 3.18 shows the zoning designations for parcels inside the Long Range Urban Service Area. Again, the zoning designations are those utilized by Wake County. No pie chart has been included since virtually all the parcels are designated for residential uses at around two dwelling units per acre or less.

TABLE 3.18: Wake County Zoning Inside the Knightdale Long Range Urban Service Area, as of 6/1/01

Zoning District	*Number of Parcels*	*Number of Acres*	*Percent of Total Acres*
Residential 40 (R40)	278	895.148	29.4%
Residential 30 (R30)	547	1,708.694	56.1%
Residential 20 (R20)	599	320.864	10.5%
Residential 10 (R10)	2	78.927	2.6%
Mobile Home (MH)	3	38.985	1.3%
Residential Subtotal	**1,429**	**3,042.62**	**100.0%**
General Business (GB)	1	0.475	0.0%
No Zoning Indicated	16	-	-
TOTALS	**1,446**	**3,043.09**	**100.0%**

Source: Wake County GIS (Property Appraiser Data as of 6/1/01)
Note: 16 parcels were lacking zoning designations in the GIS database. These parcels may be streets or other land uses that are not zoned.

Table 3.19 shows the summary zoning characteristics by general land use type for each of the subunits of the Knightdale Planning Area. Overall, 84% of the Knightdale Planning Area is designated for residential uses, 9% is targeted for commercial uses, and 7% for industrial uses.

TABLE 3.19: Zoning Summary by Acre for Knightdale Boundaries, June 2001

Land Use Type	*Corporate Limits*	*Extra-Territorial Jurisdiction*	*Short Range Urban Service Area*	*Long Range Urban Service Area*	*Total Acres*	*Percent of Total*
Residential Acres	1,372.33	4,436.55	8,073.62	3,042.62	16,925.12	84.0%
Commercial Acres	312.77	650.79	875.73	0.48	1,839.77	9.1%
Industrial Acres	68.19	1,282.11	37.19	-	1,387.49	6.9%
Un-designated Acres	3.67	-	-	-	3.67	0.0%
Total Acres	**1,756.96**	**6,369.45**	**8,986.54**	**3,043.10**	**20,156.05**	**100.0%**

Source: Wake County GIS (Property Appraiser's Office Data) as of 6/1/01

VII. LAND USES

This section provides information on the land uses in existence as of June 1, 2001. This data is taken from the Wake County Property Appraiser's files as contained within the Wake County GIS system. It is important to note that there are some substantial limitations to this data, but it has been provided in the interest of presenting a more complete picture of the land use and development trends taking place inside the Knightdale planning area.

The land use type categories are those utilized by the Wake County Property Appraiser. Summary tables located at the end of this section summarize the following information by more general land use types.

Table 3.20 shows the number of parcels, total acreage, land value and building value for 16 different land use types in within the Corporate Limits. In addition to the 16 listed categories, there were 2 parcels in the database which did not contain land use type designations, and as such, have been listed as "undesignated". The 16 types of land uses include every parcel within the Corporate Limits as of June 1, 2001.

TABLE 3.20: Land Use Types in the Knightdale Corporate Limits, 2001

Use Type	*Number of Parcels*	*Total Acreage*	*Value*		*Non-residential Square Footage*
			Land	*Building*	
Vacant Land	418	889.11	$22,953,357	$381,654	-
Single Family Homes	1,909	586.51	$50,116,781	$194,232,919	-
Multifamily Homes	20	66.40	$3,724,129	$28,597,902	-
Day Care	2	1.90	$182,952	$1,150,196	16,975
Banks	3	4.19	$894,722	$1,393,020	9,319
Auto Service	6	7.67	$623,219	$599,585	18,098
Office	16	16.71	$2,286,879	$7,409,489	102,310
Eating/Drinking Est.	11	11.29	$2,943,126	$3,383,134	39,115
Retail	28	68.76	$9,910,298	$20,472,316	436,947
Clubs	3	9.79	$24,500	$536,039	5,815
Churches	1	1.22	$159,429	$888,092	21,688
Nursing Home	1	4.88	$533,610	$2,362,942	31,119
Schools	3	52.22	$1,337,085	$19,042,682	164,806
Institutional	4	14.21	$829,772	$4,202,315	28,710
Light Manufacturing	2	3.24	$281,398	$1,032,167	39,577
Warehousing	8	18.61	$1,813,296	$2,698,710	99,892
Undesignated	2	0.24	-	$24,000	-
Totals	**2,437**	**1,757**	**$98,614,553**	**$288,407,162**	**1,014,371**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: Vacant parcels could contain water/sewer systems or other accessory buildings which have building values

Table 3.20 indicates a total of 889 vacant acres within the Corporate Limits with 652 acres of residential land, and about 216 acres of non-residential uses. The total value for all 1,757 acres of land is over $98.6 million dollars. In terms of building values, single family homes are responsible for 67% ($194.2 million) of the $288.4 million dollar total in the Corporate Limits.
The table also indicates that as of June 1, 2001, there was over 1 million square feet of non-residential square footage inside the City Limits. Retail land uses (including grocery and discount stores) accounted for 43% of the total.

It is interesting to note that over half the land within the Corporate Limits is classified as vacant. Note that vacant land could include parks or other recreational uses. Residential uses account for 37% of the acreage inside the City Limits, while all other uses account for less than 13%.

A comparison between the land uses and zoning indicate that 78% of the land inside the City Limits is zoned for residential uses, while residential uses occupy only 37% of the land area. There is a much closer balance between the acreage associated with existing non-residential land uses and non-residential zoning. Non-residential zoning covers 22% of the land area, while non-residential uses account for about 13% of the land area.

Table 3.21 contains the land use information for the parcels located within the Extra-territorial Jurisdiction. Over half of the land area in the ETJ (3,550 acres) is vacant, 40% of the land is occupied by residential uses, and the remaining 4% (253 acres) is occupied by non-residential uses.

TABLE 3.21: Land Use Types in the Extra-territorial Jurisdiction, 2001

Use Type	*Number of Parcels*	*Total Acreage*	*Value*		*Non-residential Square Footage*
			Land	*Building*	
Vacant Land	368	3,550.66	$41,115,710	$685,953	-
Single Family Homes	849	1,961.53	$37,660,424	$77,422,590	-
Multifamily Homes	5	605.19	$1,920,052	$2,685,285	-
Day Care	1	2.24	$38,470	$288,715	4,880
Auto Service	3	7.40	$464,710	$490,788	17,696
Office	3	1.67	$192,972	$279,651	6,406
Eating/Drinking Est.	1	3.62	$78,408	$78,604	1,652
Retail	9	94.61	$2,269,580	$1,442,077	22,464
Clubs	2	18.20	$221,350	$158,992	3,376
Churches	3	10.22	$436,240	$2,070,757	10,983
Funeral Home	1	3.01	$130,680	$835,876	11,064
Light Manufacturing	1	2.73	$301,652	$606,076	30,000
Manufacturing	1	59.62	$1,352,350	$10,491,695	269,260
Warehousing	13	33.11	$1,787,046	$3,306,391	105,248
Undesignated	8	15.67	$152,930	$23,372	-
Totals	**1,268**	**6,369**	**$88,122,574**	**$100,866,822**	**483,029**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: Vacant parcels could contain water/sewer systems or other accessory buildings which have building values

Vacant land dominates the land values within the ETJ, representing 46% ($41.1 million) of the total $88.1 million dollars in land value. Single family homes account for over 76% ($77.4. million) of the total building values in the ETJ. It interesting to note that industrial uses (containing light manufacturing, manufacturing, and warehousing) represent $14.4 million dollars of building value within the ETJ while the Corporate Limits contain only $3.7 million dollars of industrial building value. In terms of zoning, 70% of the ETJ is zoned for residential uses, and 30% of the land is zoned for nonresidential uses. Of the 30% zoned for non-residential uses, 20% is designated for industrial uses. However, these uses account for less than 3% of the acreage in the ETJ. There is a total of 483,029 square feet of non-residential square footage within the ETJ, with industrial uses accounting for over 83% (404,058 sq. ft.).

There is less variety in land use type for the Short and Long Range Urban Service Areas as a result of Wake County zoning patterns. Table 3.22 shows the land use types for the Short Range Urban Service Area. There are 472 vacant parcels which

account for almost 60% (5,256 acres) of the SRUSA. Single Family Homes are the most prevalent land use by far, occupying 3,438 acres, or 39% of the total land area.

One interesting aspect is that total land and building values are remarkably similar in the SRUSA. This would seem to indicate relatively low building values as compared to the associated land values across the SRUSA. Land values are dominated by the vacant and single family residential land use types, which occupy 95% of the total land value. Single family residential uses account for 73% of the total building values. Wake County has zoned about 89% of the land inside the SRUSA for residential land uses, and the remaining 11 %for non-residential uses.

TABLE 3.22: Land Use Types in the Short Range Urban Service Area, 2001

Use Type	*Number of Parcels*	*Total Acreage*	*Value*		*Non-residential Square footage*
			Land	*Building*	
Vacant Land	472	5,256.87	$40,800,543	$3,784,002	-
Single Family Homes	649	3,438.98	$37,421,257	$59,414,467	-
Multifamily Homes	2	4.73	$58,200	$170,638	-
Day Care	1	1.50	$30,000	$242,459	5,040
Auto Service	2	68.24	$468,565	$801,355	6,240
Office	4	8.65	$293,643	$767,579	6,990
Eating/Drinking Est.	1	81.44	$603,616	$58,916	1,500
Retail	6	7.44	$268,375	$513,007	15,219
Churches	2	32.37	$279,780	$3,867,757	48,289
Fire Station	1	3.01	$33,930	$720,696	11,932
Gymnasiums	2	67.29	$929,915	$9,975,832	26,310
Warehousing	4	16.04	$336,034	$760,972	36,700
Undesignated	19	-	-	-	-
Totals	**1,165**	**8,987**	**$81,523,858**	**$81,077,680**	**158,220**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: Vacant parcels could contain water/sewer systems or other accessory buildings which have building values

The final subarea of the Planning Area to consider is the Long Range Urban Service Area. Land use types in this area are identified by Table 3.23. The Property Appraiser's data indicates six different types of land uses in the LRUSA, composed primarily of single family homes, which account for almost 60% of the land area, 84% of the land value, and 98% of the building value. Vacant lands account for only 37% of the land area, in the LRUSA, about the same percentage of the Corporate Limits. There is a total of 23,032 square feet of non-residential land uses in the LRUSA, composed largely (77%) of industrial uses.

TABLE 3.23: Land Use Types in the Long Range Urban Service Area, 2001

Use Type	Number of Parcels	Total Acreage	Value Land	Value Building	Non-residential Square Footage
Vacant Land	138	1,130.52	$6,370,209	$685,678	-
Single Family Homes	1,286	1,798.05	$37,447,743	$101,207,308	-
Retail	2	90.15	$329,662	$36,200	2,864
Churches	1	5.66	$49,850	$125,097	2,344
Light Manufacturing	1	0.60	$18,000	$53,974	3,024
Warehousing	2	18.12	$183,139	$570,938	14,800
Undesignated	16	-	-	-	-
Totals	**1,446**	**3,043**	**$44,398,603**	**$102,679,195**	**23,032**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: Vacant parcels could contain water/sewer systems or other accessory buildings which have building values

Table 3.24 summarizes the data for non-residential land uses across the Knightdale Planning Area. The amount of non-residential square footage within a subunit of the Planning Area declines with distance from the Corporate Limits. In fact, the Corporate Limits contain over 1 million (60%) of the total 1.6 million square feet of non-residential building area within the Knightdale Planning Area. The Knightdale Planning Area contains 115,706 square feet of office uses, with 88% of this being located within the Corporate Limits. It is interesting to note that there is more office space in the Short Range Urban Service Area than in the ETJ.
Retail and service square footage is also concentrated within the Corporate Limits. 82% of the 675,693 square feet of retail and service uses is located within the City Limits, though the ETJ and SRUSA contain over 50,000 square feet each.

TABLE 3.24: Summary of Non-residential Square Footage by Knightdale Planning Area, 2001

	Number of Dwelling Units in 2000	*Office (sq. ft.)*	*Retail/ Service (sq. ft.)*	*Industrial (sq. ft.) **	*Institutional (sq. ft.) ***	*Total Non-residential Square Footage*	*Vacant Acres*
Corporate Limits	2,352	102,310	557,388	139,469	215,204	1,016,723	889
Extra-territorial Jurisdiction	1,386	6,406	61,132	404,508	10,983	484,415	3,551
Short Range Urban Service Area	1,228	6,990	54,309	36,700	60,221	159,448	5,256
Long Range Urban Service Area	1,205	0	2,864	17,824	2,344	24,237	1,130
Total	**6,171**	**115,706**	**675,693**	**598,501**	**288,752**	**1,684,823**	**10,826**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
** Includes warehousing uses*
*** Includes churches, schools, and other government buildings*

Industrial square footage is concentrated within the ETJ, not the Corporate Limits. The ETJ contains 67% of the industrial square feet, while the Corporate Limits contains only 23%. The remaining 10% is located within the Short and Long Range Urban Service Areas. Institutional land uses (including schools, churches, government building, etc.) are concentrated within the Corporate Limits, which contain 74%. The SRUSA contains more institutional square footage than the ETJ.

Retail and Service uses occupy about 40% (675,693 sq. ff.) of the total, followed closely by the industrial land uses, which occupy 36% of the total square footage. Office uses represent the smallest overall portion of non-residential square footage, accounting for only 7% (115,706 sq. ft.) of the total.

VIII. LAND VALUES

The next series of tables summarize the land uses and total values by three generic land use types: vacant, residential, and non-residential for each of the four subareas of the Knightdale Planning Area. Table 3.25 shows the number of parcels devoted to each of the three land use types, the total acreage devoted to a land use type, and the combined land and building value associated with the particular land use type.

TABLE 3.25: Summary of Land Use Types in the Knightdale Planning Area, 2001

	Vacant Land			*Residential Uses*			*Non-residential Uses*		
	Number of Parcels	*Total Acreage*	*Total Value*	*Number of Parcels*	*Total Acreage*	*Total Value*	*Number of Parcels*	*Total Acreage*	*Total Value*
Corporate Limits	418	889	$23,335,011	1,929	653	$276,671,731	88	215	$86,990,973
Extra-territorial Jurisdiction	368	3,551	$41,801,663	854	2,567	$119,688,351	38	236	$27,323,080
Short Range Urban Service Area	472	5,256	$44,584,545	651	3,443	$97,064,562	23	285	$20,952,431
Long Range Urban Service Area	138	1,130	$7,055,887	1,286	1,798	$138,655,051	6	114	$1,366,860
Total	**1,396**	**10,826**	**$116,777,106**	**4,720**	**8,461**	**$632,079,695**	**155**	**850**	**$136,633,344**

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)
Note: These totals do not include parcels with no land use designations shown in the Property Appraiser's Data

Vacant land occupies the largest share of the acreage within the Knightdale Planning Area, and the lowest total value. Vacant lands are concentrated in the Short and Long Range Urban Service Areas. The average value per acre can be derived by dividing the total value by the total number of acres. Vacant land in the Knightdale Planning Area has an average value of $10,786 dollars an acre.

Non-residential land uses occupy the lowest percentage of total acreage in the Planning Area. It is interesting to note that there are 10,000 fewer acres of nonresidential land use than vacant land, but non-residential land use has a higher total value than vacant land despite the vast difference in size. The average value per acre for non-residential land uses in the Knightdale Planning Area is $160,745. It is interesting to note that the SRUSA has the largest amount of non-residential acreage, but a somewhat low value associated with that acreage.

Residential land uses occupy around 8,400 acres in the Knightdale Planning Area, with a total value of over $632 million dollars. This equates to an average value per acre figure of $74,705. It is interesting to note that total values for residential uses in the Long Range Urban Service Area are higher than those in the ETJ, despite the fact that the LRUSA has fewer acres.

Table 3.26 depicts the land and building values by Planning Area subunit, and shows the associated percentage of the total assessed value for the entire Knightdale Planning Area.

The table shows that the Knightdale Planning Area had a total assessed value of over $885 million dollars as of June 1, 2001. Almost 44% of the total assessed value is concentrated within the Corporate Limits, The Corporate Limits also have the highest assessed values per acre, Average assessed value per acre across the entire Knightdale Planning Area is $43,942 dollars per acre.

TABLE 3.26: Land and Building Values in the Knightdale Planning Area, 2001

	Number of Parcels	*Total Acreage*	*Total Land Value*	*Total Building Value*	*Assessed Value (Land + Building)*	*Percent of Total Assessed Value*
Corporate Limits	2,437	1,757	$98,614,553	$288,407,162	$387,021,715	43.7%
Extra-territorial Jurisdiction	1,268	6,369	$88,122,574	$100,866,822	$188,989,396	21.3%
Short Range Urban Service Area	1,165	8,987	$81,523,858	$81,077,680	$162,601,538	18.4%
Long Range Urban Service Area	1,446	3,043	$44,398,603	$102,679,195	$147,077,798	16.6%
Total	6,316	20,156	$312,659,588	$573,030,859	$885,690,447	100.0%

Source: Wake County GIS (Property Appraiser's Data as of 6/1/01)

IX. ECONOMIC CHARACTER

The regional economy of North Carolina and the greater Raleigh area will always be the major influence for the local economic future of Knightdale. Growth of the Knightdale economic character will drive the timing and need for expanded public facilities and services. Knightdale is poised on the brink of a series of significant opportunities to positively affect the changing dynamics and well being of Knightdale's long-term future. Census 2000 occupation, employment, income and housing value comparisons are presented below to support Knightdale's well being.

Tables 3.27, 3.28, 3.29 and 3.30 reveal a Knightdale that is an economic mirror of the greater metropolitan area in terms of occupation and employment, with a median household income 15 % above the MSA. With occupations and employment in agriculture and related farming at one percent or less, Knightdale is no longer a farming community and pressures on remaining farmland and open space will grow as landowners are impacted by growth and economic development trends in the region. Housing value data points to the favorable location and role of Knightdale in the supply of middle income housing. Management and direction of future population growth and economic development pressures generated with the opening the 540 and 64 bypass transportation corridor improvements will have permanent and dramatic impact on the entire eastern tier of the Wake County area.

Table 3.27: Census 2000 Occupation Information

	RALEIGH MSA		KNIGHTDALE	
OCCUPATION (16 & Above)	**627,772**	**%**	**3,301**	**%**
Mgt, Prof., Related	277,821	44.3	1,435	43.5
Services Occupations	74,100	11.8	331	10.0
Sales & Office	155,765	24.8	1,008	30.5
Farming, Fishing, Forestry	2,071	00.3	3	0.1
Construct, Extraction, Maintenance	56,678	09.0	256	07.8
Production, Transportation	61,337	09.8	268	08.1

Source: Karnes Research, 2002

Table 3.28: Census 2000 Employment Information

	RALEIGH MSA		KNIGHTDALE	
SELECTED EMPLOYMENT	**#**	**%**	**#**	**%**
Agri, Forestry, Fishing, Mining	4,673	00.7	16	00.5
Construction	49,910	08.0	251	07.6
Manufacturing	78,739	12.5	398	12.1
Wholesale Trade	18,063	02.9	112	03.4
Retail Trade	64,844	10.3	398	12.1
Trans., Warehousing, Utilities	23,594	09.8	136	04.1
Information	26,171	04.2	128	03.9
Finance, Ins, RE	37,708	06.8	259	07.8
Prof., Scientific, Mgt., Admin.	82,453	13.1	365	11.1
Education, Health, Social Svcs	138,394	22.0	610	18.5
Arts, Entertainment, Accommodations	42,797	06.8	188	05.7
Other Services	27,491	04.4	191	05.8
Public Administration	32,935	05.2	249	07.5

Source: Karnes Research, 2002

Table 3.29: Census 2000 Income Information Based on 1999 Income for Households

	RALEIGH MSA		KNIGHTDALE	
1999 INCOME (Households)	**461,339**	**100%**	**2195**	**0.00476%**
Less than $10,000	36,925	08.0	65	03.0
$10,000 to $14,000	21,162	04.6	58	02.6
$15,000 to $24,999	49,337	10.7	173	07.9
$25,000 to $34,999	54,977	11.9	252	11.5
$35,000 to $ 49,900	72,934	15.8	366	16.7
$50,000 to $74,999	96,589	20.9	661	30.1
$75,000 to $99,000	55,962	12.1	320	14.6
$100,000 to $149,999	47,780	10.4	242	11.0
$150,000 to $199,000	13,778	03.0	33	01.5
$200,000 or more	11,891	02.6	25	01.1
Median Household Income	**48,845**	**-**	**56,021**	**115.0**

Source: Karnes Research, 2002

Table: 3.30: Census 2000 Value Owner-Occupied Units Information

	RALEIGH	MSA	KNIGHTDALE	
VALUE OWNER-OCCUPIED UNITS	**243,897**	**100%**	**2195**	**0.0064%**
Less than $50,000	6,669	02.7	26	01.7
$50,000 to $100,000	45,332	18.6	162	10.4
$100,000 to $149,999	74,709	30.6	918	58.8
$150,000 to $199,999	51,050	20.9	370	23.7
$200,000 to $299,900	42,171	17.3	75	04.8
$300,000 to $499,999	18,584	07.6	8	00.5
$500,000 to $999,000	4,749	01.9	3	00.2
$1,000,000 or more	633	00.3	--	--
Median Value	**146,800**	**--**	**132,600**	**90.3**

Source: Karnes Research, 2002

Major employers in Knightdale consist of the following:

- Square D Corporation
  - Approximately 1000 Employees
  - Manufacturing relays, motor starters and controllers and other industrial controls and control accessories
- DT Magnetics
  - Approximately 275 Employees
  - Builds transformers for telecommunications
- Wal-Mart
  - Approximately 200 Employees
- Wake Stone Corporation
  - Approximately 150 Employees
  - Quarry, Gravel & Stone
- Wellington Nursing Center
  - Approximately 85 Employees
  - Nursing Home
- Winn Dixie
  - Approximately 85 Employees
- Accu-Fab, Inc.
  - Approximately 80 Employees
  - Metal Fabrications
- Food Lion
  - Approximately 39 Employees

The future character, quality and composition of expanding Knightdale residential and non-residential development will significantly impact local revenues and the Knightdale job base and the quality of life experienced by Knightdale residents. The rate, timing and location of future residential and non-residential development will drive or respond,

as the case may be, to the success of Knightdale comprehensive planning efforts and the resultant nature of public utility and service provision. Knightdale's local housing development and supply will be directly responsive to market conditions while job and economic tax base growth will be more a function of land use planning and economic recruitment/retention efforts and attitudes within Knightdale. Both quality and growth of the Knightdale economic character will drive the timing and need for the following public facilities and services.

X. HISTORIC RESOURCES

As more farm and forest land is converted to home, shopping, and manufacturing sites, it is critical that historic resources are adequately documented. A primary objective of the Town is to ensure the identification, conservation, and protection of the archeological, cultural, and historical resources of Knightdale. One of the action items of the historic resources section is to create a database that will identify the location and the significance of the historic resource; the database will be consulted in development projects to determine impacts.

Four subject areas should be included in the database:

1. Churches
2. Cemeteries
3. Individual Structures
4. Downtown District

A. Churches

Church life has always played an important role in the history of Knightdale. Churches not only provide places for worship, but also serve as community centers. Churches will be included in this database because of the importance of these buildings and congregations to the built and cultural landscape of Knightdale.

B. Cemeteries

Knightdale has numerous family, church, and community cemeteries. While most of the cemeteries have been mapped and surveyed in the North Carolina Cemetery Survey, North Carolina Department of Cultural Resources, many have not. Cemeteries will be included in the database to ensure their protection. Cemeteries are special places. Chapter 6 of the North Carolina General Statutes contains the legal procedures regarding the removal and vandalism of cemeteries. North Carolina law allows relocation of cemeteries in some cases. This issue must be addressed on a case-by-case basis.

C. Individual Structures
Historically significant structures in Knightdale that are not located in the downtown area will be included in the database. These will include structures identified as part of the Wake County Historic Architectural Survey. To be included on the Wake County list, one of the following criteria must be met: the structure must be at least 50 years old, must have significant architectural value, or must have played an important role in the history of Wake County or North Carolina.

D. Downtown
Historic structures located in downtown Knightdale will be included in the database. Downtown Knightdale is on the State's National Register Study List. Placement on the study list is a prerequisite to nomination to the National Register. The town should work with the Wake County Historic Preservation Commission to designate downtown Knightdale as a historic district. This designation would put the town in a better position to qualify for various grant and loan programs. It would also provide a measure of dignity to an area that has played the central role in the development of Knightdale.

E. Objectives
The Objectives and Action Items are provided to direct the planning and implementation strategies related to historic preservation in Knightdale and are in accordance with the overall goals of the 2027 Comprehensive Plan.

The primary historic resources objectives for Knightdale are to:

1. Preserve and enhance its' historic buildings and landscapes, by building upon the strengths of its origin as a railroad and agricultural center even as these elements of its past are allowed to change and evolve;
2. Promote the use of incentives to ensure historic preservation
3. Ensure that historic resources are considered during the development process
4. Promote education and provide access to historic resources
5. Promote the establishment of a historic district in downtown Knightdale.

F. Action Items
The following are the tasks which provide a course of action to implement the objectives for historic preservation.

3.1 The Town shall establish an official historic resources database, which will be mapped, and shall be used in the development review process.

3.2 The Town shall connect significant historical, cultural, and natural areas with greenways, open space and recreational areas.

3.3 The Town will complete Phase II of the Caboose Project so that the Heritage Museum can be opened to the public.

3.4 The Town will seek designation of the downtown area so that it will be placed on the National Register of Historic Places.

3.5 The Town shall sponsor educational programs and work with the local public schools to ensure that historic preservation is communicated and made public.

3.6 The Town shall prepare Small Area Plans for geographic areas of the Town that contain significant historic structures and / or landscapes including: downtown, and sites within the Countryside District.

3.7 The Town shall establish a Town Center District Commission that includes property owners and merchants from the downtown area to promote reinvestment and revitalization in downtown Knightdale.

3.8 The Town shall establish a Historic Preservation Commission that is charged with:
(1) encouraging historic preservation,
(2) reviewing development plans of historical significance
(3) promoting public education of historic preservation within the planning area.

3.9 The Town shall actively pursue grants and other funds to further historic preservation programs.

3.10The Town shall coordinate its historic preservation program with the Wake County Historic Preservation Commission.

XI. ENVIRONMENT AND NATURAL RESOURCES

The following is a brief snapshot of the topography, soils and vegetation found in the Knightdale Planning Area.

A. Topography

Knightdale is located east of the Neuse River and west of Wendell. Buffalo Creek separates Knightdale from Wendell. The historic town center was located along the ridge that separates the Neuse River and Buffalo Creek. Mark's Creek flows south from the center of the corporate boundaries and serves as the primary drainage basin

for the older portions of Knightdale. Within the last 50 years, the town has seen a new development pattern of residential and commercial activities reaching along the Highway 64 corridor towards Raleigh. Development has also spread along the waterways of Mingo Creek, the Neuse River, and Mark's Creek. North of Highway 64, the land is still mostly agrarian thus preserving the gently rolling topographic character of Knightdale.

B. Soils

The soils within the Knightdale planning area are primarily of the Cecil and Wedowee classifications. The Cecil class is found mainly within the western area of Knightdale while the Wedowee class is predominant in the central and eastern parts of town.

C. Vegetation

The Knightdale ecosystem is in an altered state. Current land cover figures can be estimated by using 1996 Land Sat imagery and newly updated orthographic photography. The study boundary covers approximately 39,500 acres of land. Within the study area approximately 2% of the land is developed, 18.5% is used for cultivated agriculture, 5.5% is managed herbaceous cover, and 1.5% is occupied by water bodies. That leaves 72.5% of the landscape as being in an undisturbed state. It is estimated that there is 10% more impervious surface area since the 1996 Land Sat imagery was taken.

The 72.5% of undisturbed land is split primarily between yellow pine forest, evergreen shrub land, bottomland and hardwood swamp forests, and upland hardwood forests; yellow pine forest being the most common and upland hardwood forests being the least common, respectively. The remaining portion of the undisturbed land is split between several smaller classifications that occur only in isolated areas. The bottomland and hardwood swamp forests are of the highest importance due to their location along stream and river corridors. These areas serve as the migration corridors for numerous species of wildlife as well as vital habitat because of their relatively intact linear coverage. Within this class exists the cypress swamp ecosystem, this ecosystem is very rare in the piedmont area due to the relatively arid climate and any known sites should be prioritized as a preservation goal. Robertson Mill pond and areas along Mark's Creek and Buffalo Creek contain such swamps. The cultivated areas of Knightdale are primarily reserved for the production of soybeans and livestock pastureland. These areas are concentrated in the north with the exception of a prominent band of equestrian facilities in the south. The cultivated areas are vital to the preservation of Knightdale's scenic quality and should be considered important when redefining development guidelines for the 64 corridor, the future 540 corridor and 64 By-Pass.

D. Environment and Natural Resource Primary Objective

The Objectives and Action Items are provided to direct the planning and implementation strategies related to Knightdale's environment and natural resources and are in accordance with the overall goals of the 2027 Comprehensive Plan.

The primary objective of the environment and natural resource section is to promote, protect, preserve, and enhance existing natural systems to ensure the environmental health of the air, land, and water that is within the ultimate physical limits of the Town.

E. Environment and Natural Resources Action Items

3.1 The Town shall study design standards that encourage the maintenance of natural conditions during and after development, including natural drainage ways, mature trees, and topography.

3.2 The Town shall adopt a tree ordinance, which mandates tree preservation and regulates clear cutting.

3.3 The Town shall inventory critical and sensitive features in the natural environment, including their location and significance, and then adopt regulations to protect the identified natural features.

3.4 The Town shall evaluate the existing erosion control regulations to determine if amendments to the regulations are warranted.

3.5 The Town shall develop and implement standards for stormwater management, including development and implementation of National Pollutant Discharge Elimination System Phase Two Stormwater Rules in order to help mitigate against flooding and water quality deterioration.

3.6 The Town shall regulate areas served by wells in order to protect the quantity and quality of ground water.

3.7 The Town shall educate residents and visitors about the natural environment, ecological systems, physical fitness, wellness and lifelong recreational activities.

3.8 The Town shall provide recreation facilities and programs that promote awareness and stewardship of the natural resources that exist at the site.

3.9 The Town shall design, construct and maintain parks and greenways that are sensitive to the surrounding environment.

3.10 The Town shall adopt minimum standards for undeveloped space at future park facilities.

3.11 The Town shall be sensitive to the need to preserve large trees and natural areas.

CHAPTER 4

community services

I. INTRODUCTION

This portion of the Comprehensive Plan addresses community services. The Town of Knightdale must ensure that it will have adequate services for the growing population. The Community Services chapter contains five primary sections:

- Education
- Health Care
- Public Safety
- Solid Waste
- Objectives and Action Items

In Knightdale, as with many suburban communities, significant public facility, service delivery and decision-making systems are vested in other governmental entities by law or agreement. Therefore, some of the long term planning, capital facility provision and ongoing maintenance and operating costs of such facilities and services reside in other decision-making entities. Education, health, water supply and sewage treatment facilities and services are examples of such operating services now vested by law or shared through pending agreements beyond the direct operating control of Town officials while parks and public safety services are the direct operating responsibility of the Town of Knightdale. Transportation and transit facilities and services decision-making, with the exception of the local and connector street systems, involve local, regional and State cooperative decision-making also.

The process of community facilities and public services planning consists of determination and application of level of service standards for the various physical components and requirements necessary to serve a community's existing and future population growth and development. One of the roles of the Comprehensive Plan is to establish public policy concerning the quality, quantity and optimum location criteria for each facility and service. Provision of such facilities and services are designed in a manner that reinforces and supports the vision, goals and objectives of a community relative to growth, development and accommodation of future population. Planning for Knightdale facilities and services are related to and have accounted for:

- Topography, geography and size of the area to be served
- Population
- Density of housing and intensity of non-residential uses
- The Land Use Plan
- The governmental and institutional nature of the service provider and service provision relationships

II. EDUCATIONAL FACILTIES

Public educational services for the Town of Knightdale for students in kindergarten through twelfth grade are provided by the Wake County School District. The District is responsible for provision of educational services county-wide. The FY 2001-2002 Wake County School District total student enrollment was 101,745. The District has adopted a 4% annual growth rate and anticipates an enrollment of 112,144 by the term year 2003-2004. In general, the District projects an increased enrollment figure of an additional 60,000 students by 2020 for capital and operational planning purposes.

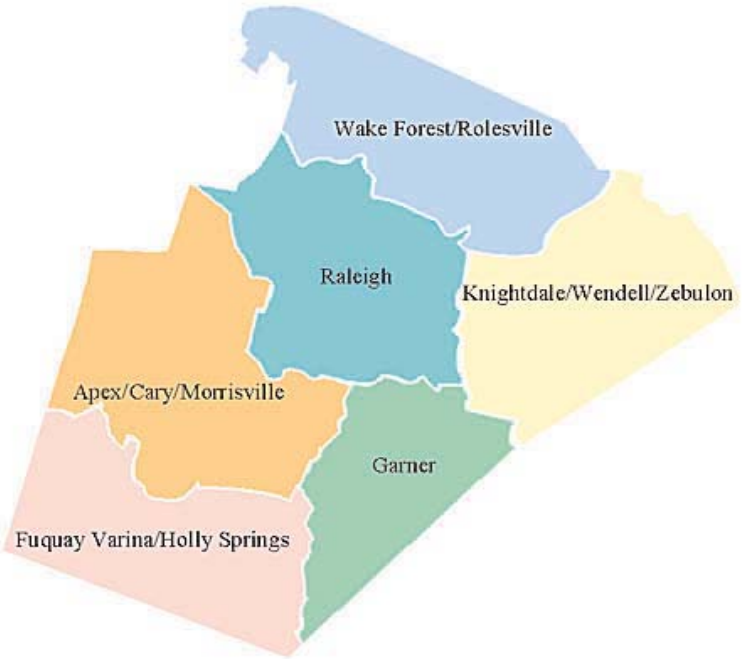


FIGURE 4.1

Wake County divides its attendance zones into six regions as illustrated above. Region F serves Knightdale, Wendell and Zebulon. Individual town and municipal jurisdictional boundaries of various local communities do not play a part in School District efforts to provide educational services to all students. Region F 2000-01 enrollment was 7,898, with 2004-05 enrollment forecast at 8,569 for an increase of 671 students. During the school year 2002, the Wake County School District provided

a total of 124 program facilities open or under construction. This consisted of seventy-five (75) elementary school, twenty-five 25 middle school, sixteen (16) high school and five (5) special school campus facilities within the Wake County attendance area. The Wake County School District Plan 2000 sets policy for the total system utilizing the series of six (6) Planning Regions.

In Knightdale, both an elementary and a high school are scheduled for completion in fall 2004. Forestville Road Elementary will open with a full-size gym, multi-purpose field and a soccer field. Knightdale High will open with a football stadium, baseball field, softball field, two Little League baseball fields, practice field, six tennis courts, and two basketball courts. Future athletic and park facilities, to be developed by the town, include: a community center with indoor pool, amphitheater, greenway, small lake area, softball fields, volleyball courts, and tennis courts.

County-wide district school attendance zoning boundary processes are the determining factor in the assignment of school service zones. Therefore, a school zone may include students from multiple localities. Because of this it is impossible to assess the educational delivery system from a purely local facility or quality of service perspective. Region F is well served and school facility plans in process will accommodate the student growth for the foreseeable future. Capital facility improvements planned for Region F in the Plan 2000 bond program are indicated below:

	Elem	Middle	High	Spec/Opt	Total
Total Schools	6	2	1	0	9
Major Renovations/Additions	2	0	1	0	3
Misc. Improvements	2	2	0	0	4
Total Improvements	4	2	1	0	7
New Schools	1	0	1	0	2

III. HEALTH CARE

Health and hospital services for the Town of Knightdale are regional in nature to Wake County generally. Knightdale area residents have access to a variety of hospital facilities in the greater Raleigh area:

FIGURE 4.2

The most immediately available hospital services are provided by the Wake Medical Center. The Wake Medical Center facility is located on New Bern Avenue in a campus with 515 beds, and providing 24-hour adult emergency department that treats more than 76,000 patients a year. It is Wake County's designated regional trauma center.

Wake Medical Center provides a broad range of services including Neurosciences which contains Wake County's only neuro intensive care unit and a nursing unit dedicated to neuroscience. Knightdale patients have access to Raleigh's only neuro-pathologist and neuro-radiologist, and one of only a few neurosurgeons in the world. Orthopedics include specialized hand and arthroscopic surgery, as well as artificial joint replacements, with more than 200 artificial joint replacement surgeries performed each year. Specially trained orthopedic nurses help patients from referral through discharge by providing care and education about the surgery and recovery process.

Alcoholism Treatment Center	3000 Falstaff Road
Carolina Rehabilitation Association	3000 New Bern Avenue
Central Prison	1300 Western Boulevard
Columbia Raleigh Community Hosp	3400 Wake Forest Road
Dorothea Dix Hospital	820 South Boylan Avenue
Healthsource	2308 Wesville Court
Integrated Health Services	3830 Blue Ridge Road
Radiology	3400 Wake Forest Road
Raleigh Community Hospital	3400 Wake Forest Road
Raleigh Community Hospital	3410 Executive Drive # 209
Rex Hospital	4420 Lake Boone Trail
Wake Medical Centre	3000 New Bern Avenue

FIGURE 4.3

WakeMed Rehab also has a broad continuum of trauma, neurological and orthopedic care with treatment of patients recovering from stroke, head and spinal cord injuries, brain injuries, arthritis and neuromuscular disorders. The 68-bed rehabilitation hospital is one of the largest and most comprehensive in the state, and is complemented by day treatment and outpatient rehabilitation services in Raleigh and Cary.

WakeMed provides a 16-bed Express Care and an eight-bed Chest Pain Observation Unit within the emergency department and includes North Carolina's only 24-hour freestanding Children's Emergency Department and a Telephone Call Center providing telephone medical advice for adults and children as a support for physician offices. All are conveniently located off the Raleigh Beltline (I-440) at New Bern Avenue (SR 64).

The Zebulon/Wendell Outpatient Rehab Program is located in Zebulon, North Carolina providing Skilled Nursing care and outpatient services with a comprehensive program.

IV. PUBLIC SAFETY AND SERVICES

A. Introduction

In July of 2002 the Town of Knightdale began operation of a public safety department. A "Public Safety" department is one in which there is some degree of integration of police and fire services. Across the country, this integration may range from separate departments that share a single administrator or department head to a fully integrated department composed of cross-trained officers who seamlessly function in both police and fire roles in a single shift. The definition encompasses many agencies in a range of governmental entities.

The Knightdale Department of Public Safety led by a Director of Public Safety. Separate police and fire divisions are organized under the leadership of this single Director. Knightdale's Public Safety Department has police officers which are trained as volunteer firefighters in order to supplement a skeleton crew of firefighters from the Fire Division. The cross training in this example only goes one way. The police officers can function as firefighters, but the firefighters cannot functions as police officers.

An example of another level of integration would be a department that is fully cross-trained, but not cross functional. Its members are trained as police officers, firefighters, and paramedics. Although trained in all job functions, these department members are assigned to one job function. They report to fixed assignments as a police officer or firefighter/paramedic. Training is maintained in all aspects of the job and transfers can be made from one job function to another. Knightdale may explore the various public safety structure options in the future.

B. Public Safety Department Benefits

There are three main benefits to various public safety organization models. First, is the obvious potential to save money in personnel costs. The use of personnel in both the police and firefighter roles allows equal coverage with fewer personnel in certain cases. Depending upon the organization chosen for the public safety system, employee idle time can be greatly reduced. This, of course, has to be weighed against the call load, size, geography, and demographics of the area being protected. If the police or fire services are already being taxed to the limit by the number of calls for service then there is little hope that integrating the services will allow any reduction of personnel. The second benefit to be derived from a public safety system is that there is a unified organization and command structure. This benefit has two major points.

First, if all personnel are within a single department under a single management team it eliminates much of the inter-departmental rivalry that is common between police and fire departments. Since all personnel are members of the same department, what benefits one benefits all. The second, point is that in emergency situations there is already a unified command structure present. There is only one chain of command to direct both police and fire operations. The third benefit to the public safety concept is the first responder speed of delivery of fire and EMS services. In traditional fire and EMS systems personnel respond from the station or a fixed staging point. This necessitates a longer response time to remote locations. If cross-trained personnel are available to respond from police patrol districts it is highly likely that these personnel will be closer and able to respond quicker in an emergency. The first minutes of any emergency are crucial in determining the outcome and resources required to mitigate the emergency. If CPR can be started in the critical first four minutes or a fire can be extinguished before it gains headway then lives and property can be saved. This is the real benefit to a public safety system.

C. Fire Protection

The Knightdale Fire Division protects life and property from the harm caused by fire. Municipalities are required to provide fire protection services to all of its residents. The Town of Knightdale started its own fire division in 2002 to provide this service. Prior to establishing the Town's department, fire protection was provided by the Knightdale Volunteer Fire Department.

D. Fire Department Operations

Fire departments often consist of engine companies and ladder companies. Engine companies usually include at least one truck that includes hoses, nozzles and an on board tank. Engine companies are the first to respond to a fire call. Ladder companies ordinarily play a supporting role in fighting fires and provide above ground rescue. The need for ladder companies is based upon the amount and type of urban development. In a highly urbanized area, there is usually one ladder company for every two to three engine companies. In more rural areas, the ladder company function is assigned to an engine company carrying additional equipment. Fire departments also include special apparatus vehicles, such as off-road, hazardous materials, and command.

Water distribution and well trained fire fighters are the most important factors in providing fire protection services. The strengths of a water distribution system is measured by using three criteria: capacity, coverage, and reliability. Capacity for fighting fires is determined by the amount of water available in the system to fight a fire. Coverage is determined by the size and location of fire hydrants and water

mains. Reliability is determined by how much confidence there is in the system that there will be adequate water and water pressure available when the demands on the system are greatest.

In general, fire division services are judged by standards of service such as follows:

- Fire fighting, rescue and extrication response within three minutes, 90% of the time.
- Emergency medical aid within a three-minute response time, 90% of the time.
- Initial engine company response to all fire calls within three minutes and a fire attack with charged lines, 2=1/2" inch diameter within four minutes from time of dispatch.
- Ladder company response to all fire calls within five minutes from time of dispatch.
- Sufficient manpower on fire apparatus to provide safety of fire fighters and ability to perform basic fire and rescue operations within one minute of apparatus arrival on scene.
- Comprehensive in-service pre-plan fire inspections and systems training.
- Comprehensive school drills.

E. North Carolina Insurance Service Office

The North Carolina Insurance Service Office (ISO) establishes ratings for fire departments and municipalities in North Carolina. Each department or municipality is rated on a scale from 1 to 10, with 10 being unprotected. A property owner's fire insurance premiums are directly impacted by the ISO rating. Fire insurance is based upon cost per 100 dollars of value insured. Cost is determined by building materials and design and the ISO grade for the area that the building is located. A change from a rating of 9 to a rating of 6 could result in a 50% reduction in fire insurance premiums. A change from a rating of 6 to a rating of 4 could result in a 10% reduction in fire insurance premiums. The Town of Knightdale currently has an ISO rating of 6.

F. Master Planning and Intergovernmental Cooperation

A successful fire protection program results from dedicated and well trained fire fighters, proper management, and proper financing. Proper management ensures that fire service are provided for in an efficient and equitable manner. Efficiency ensures that the Town receives the desired level of fire protection at the least cost. Equity ensures that all areas and all people receive a similar level of service.

Since fire departments in Wake County have a Mutual Aid Agreement and depend on each other for equipment and personnel, the Town should work with Wake County and

other municipalities within Wake County in the provision of fire protection services to ensure desired level of fire protection at the least cost.

G. Police Services

Police responsibilities involve the prevention and suppression of crime, the investigation and apprehension of offenders and the protection of residents and visitors. Activities among the criminal justice system are interrelated, and therefore should remain in close proximity to affect close coordination. Automation and cooperation can reduce the amount of staff expansion needed without reducing the effectiveness of various components of federal, state, county and local police functions. Automatic aid agreements among other fire jurisdictions are essential to coordinated and cooperative service provision.

The Public Safety Department combination of local police and fire services in Knightdale can serve to support and advance the effectiveness of each division through planned co-location and facilities and the cross training and support of police as first responders to fire scenes.

H. Facility Needs and Standards

The Town of Knightdale has one fire station on Robertson Street and is researching the need for additional stations in the Town's planning area. The Town's police division and administrative unit is located at Knightdale Town Hall. Since the response time to a fire from a fire station is an important factor in fighting a fire, fire departments are organized on a system of decentralized fire stations. Fire station organization should allow for a concentration of stations for response into high risk areas, such as central business districts, industrial parks, schools, and multi-family developments. Areas at equal risk should have equal response times. Natural or artificial barriers that divide a town, such as the Mingo Creek and U.S. 64 in Knightdale, can limit response time and may make additional fire stations necessary.

The following general locational criteria should be used when siting new fire stations. Fire stations should be:

- Located adjacent to areas where development is most intense.
- Buffered from residential areas and low intensity development.
- Located near the center of its primary response area.
- Located near, but not on major roadways, because of the hazards on entering heavy traffic
- Located so as to minimize U turning movements.
- Located so as to ensure proper sight distance for entering and exiting the station, not on a curve or at the bottom of a hill.

- Located away from signalized intersections and railroad crossings so that traffic does not block egress from the station.

Generally, the ISO recommends that all structures or fire hydrants within the corporate limits be located within 1.5 miles of a fire station. The 1.5 mile radius should result in a maximum response time of four to five minutes. New fire stations should be built if the following criteria is met: the total number of fire hydrants outside, yet contiguous to the 1.5 mile radius, is equal to or greater than one-half the total number of hydrants within the 1.5 mile radius. For example, if there were 100 hydrants within the 1.5 mile service radius, there would need to be 51 more hydrants located outside, yet contiguous to the 1.5 mile radius to require the construction of a new fire station. Knightdale should work with the Volunteer Fire Department and the ISO when locating new fire stations.

The Town is researching a permanent location and development of a central fire station and administrative facility station in probable proximity to the Town Hall/Library complex. As development continues and growth increases a second station will be needed in the easterly reach of the Town. For a suburban community like Knightdale, a three-mile typical service radius with good road access permitting 3-5 minute fire apparatus response is a desirable distance separation criterion. Enhanced communication facilities incorporating technical advances and an established level of staffing dedicated to the co-delivery of police and fire services will strengthen the effectiveness of both divisions. Insuring connectivity among existing and future subdivisions and major land uses will serve to increase public safety and fire response times.

V. SOLID WASTE

The Town of Knightdale provides for solid waste removal for homes and apartments in the corporate limits. Knightdale contracts with a private waste disposal company for this service. Commercial and industrial users must contract independently with private waste disposal companies. A solid waste program includes collection, recycling and composting, and disposal. All of these services are included in the contract with the private waste disposal company.

A. Recycling

The Town provides for curb-side pick-up of the following recyclable materials: glass, plastic, aluminum, and newspaper. Recycling facilities are also provided for at Lockhart Elementary School and Knightdale Elementary School through a program established by Wake County. These facilities accept glass, plastic, aluminum, and office paper. The Town should encourage recycling by sponsoring educational

programs.

B. Composting

The Town has established a yard waste program. The collection of yard trash is performed by the private waste disposal company. The Town should encourage private composting by sponsoring educational programs. The Town should investigate the desirability of a municipal composting facility. The Town should stand as a model for using composted or recycled yard waste on Town owned lands.

C. Hazardous Waste

Hazardous waste is defined as a solid waste, or a combination of solid waste that because of its quantity, concentration, or physical, chemical, or infectious attributes, may: (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

To help reduce the amount of hazardous waste in Knightdale, the Town should coordinate with Wake County to sponsor a Household Hazardous Waste Collection Day. A Household Hazardous Waste Collection Day program allows people to bring hazardous waste to a set location, somewhere in the corporate limits of Knightdale, for disposal without a charge. The City of Raleigh and Wake County currently co-sponsor this program. All residents can participate in this program. The existing pick-up locations are in the City of Raleigh.

D. Projected Demand

Since there are huge economies of scale (this means that the unit price to dispose of a unit of garbage decrease as the size of the facility increases), Knightdale should work with Wake County and other municipalities in Wake County to ensure landfill capacity. As Knightdale's population increases and the demand for this service increases, the Town should monitor its contract with the private waste disposal company to ensure that this service is provided in an efficient and cost effective manner.

VI. COMMUNITY SERVICES OBJECTIVES AND ACTION ITEMS

The Objectives and Action Items are provided to direct the planning and implementation strategies related to community services in Knightdale and are in accordance with the overall goals of the 2027 Comprehensive Plan.

A. Objectives:

The Town of Knightdale seeks to:

1. Direct and guide development so as to achieve optimum utilization of the public infrastructure and public safety; and
2. Ensure that public utilities and public safety will maximize fiscal efficiency and contribute to the overall economic, social, and physical health of the community.

B. Action Items:

The following are the tasks which provide a course of action to implement the objectives for community services.

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

4.2 The Town shall, on an annual basis, monitor its contract with the private waste disposal company to ensure that this service is provided in an efficient and cost effective manner.

4.3 The Town shall provide training for operational and field personnel on recycling, composting, and hazardous waste.

4.4 The Town shall sponsor educational programs on the benefits of recycling and composting.

4.5 The Town shall investigate the feasibility of a municipal composting facility.

4.6 The Town shall stand as a model for using composting and recycled yard waste on Town owned lands.

4.7 The Town shall stand as a model for using recycled materials.

4.8 The Town shall coordinate with Wake County to sponsor an annual or semi-annual Household Hazardous Waste Collection Day.

4.9 The Town shall work with Wake County and other municipalities in Wake County to ensure adequate landfill capacity.

4.10 The Town shall use the following general criteria when locating new fire stations.
Fire stations should be:

- Located adjacent to areas where development is most intense;
- Buffered from residential areas and low intensity development;
- Located near the center of its primary response area;
- Located near, but not on, major roadways;
- Located so as to minimize U turning movements;
- Located so as to ensure proper sight distance for entering and exiting the station;
- Not on a curve or at the bottom of a hill; and,
- Located away from signalized intersections and railroad crossings so that traffic does not block egress from the station.

4.11 The Town shall work towards the following location standard for siting fire stations: that all structures or fire hydrants within the corporate limits be located within 1.5 miles of a fire station. The 1.5 mile radius should result maximum response time of five minutes.

4.12 The Town shall prepare and implement a Fire Protection Plan. The Plan shall define current and future fire protection services, establish fire protection service levels, identify the necessary resources to meet the fire protection service levels, and provide a process to implement and maintain service levels.

4.13 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.

CHAPTER 5

DESIGN DISTRICT MASTER PLAN

i. INTRODUCTION

Through the course of the public participation process for updating the Comprehensive Plan, a major issue was raised concerning the creation of a new land use plan. Knightdale residents are concerned with the general quality of the design of the man-made environment. Residents want a Comprehensive Plan that promotes good design, enhances the quality of life and maintains both the historic and the rural character of Knightdale. They want to raise the level of community expectations of the built environment. They want their community to be attractive and enhance both the community's attractiveness and functional utility. Knightdale residents want a plan that encourages excellent design opportunities and promotes Knightdale as "the" place to live, work and visit.

The 1993 Comprehensive Plan references two land use plans: 'The Land Use Development Plan' and 'The Land Use Design Plan'. The Land Use Development Plan identified the location and timing of development in five-year increments; The Land Use Design Plan managed the content and design of development by giving a general indication of the land uses allowed in each area of town.

Not only town staff and elected officials, but also the public often confused these plans.

- Developments often conflicted with the timing increments for development as provided on the *Land Use Development Plan*.
- The *Land Use Design Plan* was being used to show which uses were allowed in each area of town.
- The *Land Use Design Plan* often 'duplicated' the Town's official zoning map.

The Comprehensive Plan Update Committee, Town Staff and the consultants realized that a different type of land use map would be more useful and user friendly. This led to the concept of a design district form of a Master Plan in which land uses are determined by the zoning map and the design and layout of those uses are dictated by the 2027 Comprehensive Plan's Design District Map and Design Guidelines.

Therefore, the Design District Master Plan does not prescribe specific land uses for each area of town. The Design District Master Plan provides for distinct districts defining how the structures and site should be arranged and projected through a series of design guidelines.

What Design Districts do...

- Ensure fundamental site design and age-tested town design principles
- Include the fundamental principles of sound infrastructure and multi-modal transportation planning
- Promote natural and historic resource preservation
- Respond to citizen preferences and public demands for more choice
- Acknowledge fiscal limitations and the need for enhanced efficiency

What Design Districts do NOT do...

- Do not prescribe specific land use
- Do not replace the Zoning Map
- Do not limit the development rights of private property owners
- Do not limit growth, economic growth, or consumer choice

II. DESIGN GUIDELINES

In accordance with the goals of the 2027 Comprehensive Plan, a two-tier approach is provided as a series of design guidelines for the planning of each Design District. It is the intent of the design guidelines to ensure that future development responds to and reflects the existing town character. It is the intent of the guidelines to enable development of the area to be in accordance with community aspirations. Developed through a process of public participation and consultation, professional planning and design input, it is the Town of Knightdale's intent to incorporate these guidelines into the Town's Unified Development Ordinance as required standards.

The guidelines are intended to be flexible and encourage creative solutions that will enhance the character of the neighborhoods. Continuing change is therefore expected and appropriate new design approaches should be encouraged while respecting historic resources.

The Design Guidelines provide a tool to retain, recognize or modify significantly the urban and rural character emerging throughout Knightdale. The Guidelines set the parameters for appropriate development as specifically indicated per Design District.

The purposes of the design guidelines are as follows:

- To inform property owners about the design characteristics of the town;
- To focus on preserving the integrity of the community's historic resources and compatible new construction;
- To indicate an approach to design that will help sustain the character of the community that is so appealing to residents and visitors;
- To provide information that property owners may use in making decisions about their buildings by addressing basic principles of design;
- To maintain a cohesive neighborhood identity that respects the unique natural setting of Knightdale;
- To provide a series of guidelines to be used throughout the Town of Knightdale and it's ultimate planning area.

The Design Guidelines form the backbone of a development plan review system involving the Town Staff, Town Boards, development community and the public. They are specific guidelines outlining the treatments that are appropriate and inappropriate for construction or renovation of features, such as:

- building orientation
- scale and mass
- materials
- architectural features
- landscaping
- parking
- streets
- site treatment

The Guidelines will assist:

- Developers, engineers, architects, and other design professionals, with the planning and design of development plans;
- The development site review assessment;
- Town staff, elected officials and board members, with recommendations and decision making on development proposals;
- Members of the community.

III. OVERALL DESIGN DISTRICT GOALS

A set of goals are developed to guide development in Knightdale:

- Provide a highly aesthetic and functionally built environment.
- Preserve the natural environment and encourage responsive and appropriate development.
- Improve and enhance economic performance and a strong local economy.
- Enhance the 'sense of place' and preserve the local character of Knightdale.
- Provide quality places to live, work and visit and a vibrant atmosphere for residents and visitors.
- Create places that are enjoyable and effective, encompassing working, living, social, cultural and recreational activities.
- Encourage mixed-uses in compact settings.

IV. OVERALL DESIGN DISTRICT GUIDELINES

The overall Design Guidelines respond to a number of guiding principles that were identified through the plan creation process. These seek to embrace development and expand upon opportunities created through the location, natural environment and character of Knightdale. All new construction should conform to the design guidelines set forth in this document.

The *Design Districts* are conceived within the context of the following design guidelines of town building:

1. Preserve and enhance the community's history and character through preservation of historic buildings, features and landscapes.
2. Architecture and landscape design should develop from local vernacular, climate and history.
3. Encourage a coherent townscape by encouraging individual architectural projects to be seamlessly linked to their surroundings.
4. Preservation of open space to preserve rural character and to preserve the environment shall be encouraged.
5. Civic buildings and public gathering places should be located in prominent areas to reinforce community identity.
6. Concentrations of civic, institutional, and commercial activity should be embedded in neighborhoods and districts, not isolated in remote, single-use complexes. Schools should be sized and located to enable children to walk or bicycle to them.
7. Development shall adequately accommodate automobiles in ways that respect the pedestrian and the form of public spaces.
8. Encourage mixed-use, transit-oriented development around proposed commuter rail station locations to make them pedestrian friendly.
9. Enhance highway related uses by encouraging unity of development and strong, vibrant architectural treatment of building facades and other amenities.
10. Enhance residential neighborhoods by providing passive and active recreational amenities.
11. Make a variety of experiences and activities available to the community and individuals.
12. Provide secure and safe places.
13. Recognize local culture, as well as physical identity and diversity.
14. Provide substantial pedestrian environments.
15. Create inviting and competitive places to encourage commercial viability and prosperity.

16. Promote appropriate development, which minimizes energy and water use, waste and pollution.
17. Enhance experience of those traveling through the town.

While these guidelines generally apply to all areas of Knightdale, there is also a series of guidelines that requires a more specific approach, in order to further enhance the qualities of each Design District.

The overriding theme of the 2027 Comprehensive Plan is “Town and Country”; the Plan’s main goal is to preserve the rural town fringes while allowing more dense and intense development in the town center areas. To achieve this goal, the plan contains a Design District Master Plan, which includes a design district oriented land use plan rather than a traditional land use oriented plan. Each design district has a series of design guidelines. Districts vary on a scale from the most rural (Countryside) to the most urban (Town Center). The Design Matrix (Figure 5.2) illustrates the density and intensity levels of development on a scale from rural to urban. The matrix is provided to visually show the differences between rural and urban development patterns.

V. DESIGN DISTRICT DEFINITIONS

The Town of Knightdale set a goal to be a community where both town (urban) and country (rural) areas coexist in the midst of the rapidly growing Triangle region. To achieve this goal, the 2027 Comprehensive Plan outlines a series of design districts and locates the Design Districts on the Design District Map.

The Design Districts are defined below:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

The Design District Map (Figure 5.1) identifies the locations of each District. The Design District Map has been well received by the public at public meetings.

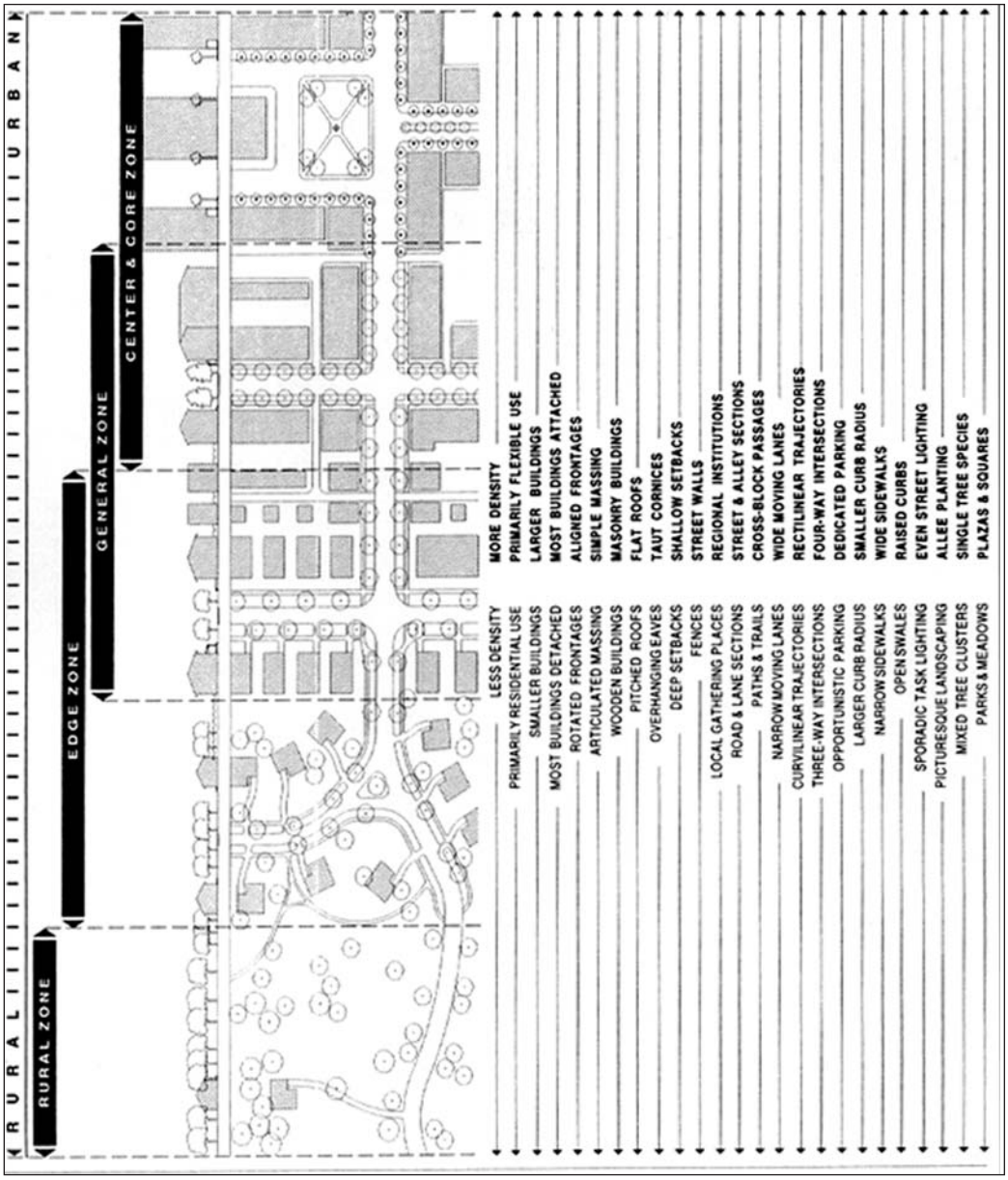
The Design Districts indicate the functional form of growth within the different areas of town. They are a direct response to the directions given by the Comprehensive Plan Update Committee and the public at large. The Design Districts are a means for the Town to realize the Vision it possesses for its future self.

The following sections separate each Design District and include

1. District Definition
2. A Map identifying the District location(s)
3. District Guidelines.

SEE FIGURE 5.1 DESIGN DISTRICT MAP

FIGURE 5.2: Design Matrix



DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

COUNTRYSIDE DISTRICT

The Countryside District encourages the development of compact neighborhoods and rural compounds that set aside significant natural vistas and landscape features (rural heritage features) for permanent conservation. Density of development is regulated on a sliding scale; permitted densities rise with increased open space preservation. Development typologies associated with the Countryside District are farms, the single house, the farmhouse cluster, the residential neighborhood, and the mixed-use Traditional Neighborhood Development, available as a floating zoning district. The Parks and Recreation Open Space Map shows the general location of major open space areas to be preserved.

COUNTRYSIDE VILLAGES

The Countryside Village is a form of village cluster within the countryside district that provides for the location of shops, services, small workplaces, civic and residential buildings central to a neighborhood (or grouping of neighborhoods), and within walking distance of dwellings. A countryside village shall be developed with an interconnected pattern of streets, with safe and convenient pedestrian access, and is limited to approximately ¼ mile in radius. Uses in the countryside village will have a primary market area of the countryside district, and with buildings compatible to the surrounding residences and with respect to the surrounding landscape.

The Design District Plan does not show the general location of these villages within the larger countryside district although it is expected that when a commercial development is proposed in this district it will be setting the standards and location for all commercial development that follows in this district.

SEE FIGURE 5.3 COUNTRYSIDE DISTRICT MAP

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

COUNTRYSIDE DISTRICT DESIGN GUIDELINES

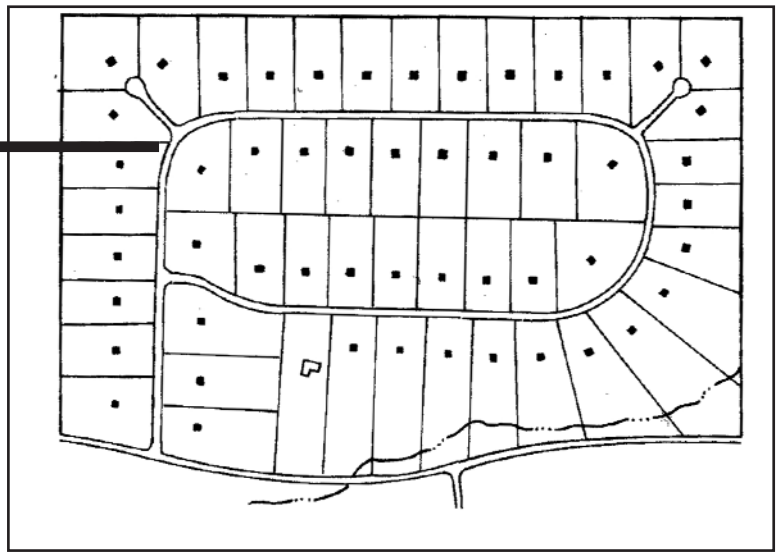
1. Significant natural vistas and landscape features shall be preserved for permanent conservation.
2. Rural road design is encouraged.
3. Conservation is encouraged by economically-rewarding agricultural uses, property tax credits, and land trusts.
4. Preservation of open space is encouraged through application of density credits or cluster subdivision standards.
5. Riparian corridors are to be preserved and utilized as community features; where residential subdivisions are proposed streets are encouraged to parallel riparian corridors so lots front on the corridor, as in Raleigh's Cameron Park.
6. Primarily residential uses and agricultural uses are encouraged.
7. Residential, Commercial, and even industrial uses can be accomodated in this district when design standards for conservation and environmental enhancement are met.
8. Adjacent buildings should be architecturally compatible through similar silhouettes, spacing between facades, setbacks, proportions, treatments, exterior materials, scale, massing, and/or architectural style.

DESIGN DISTRICTS:

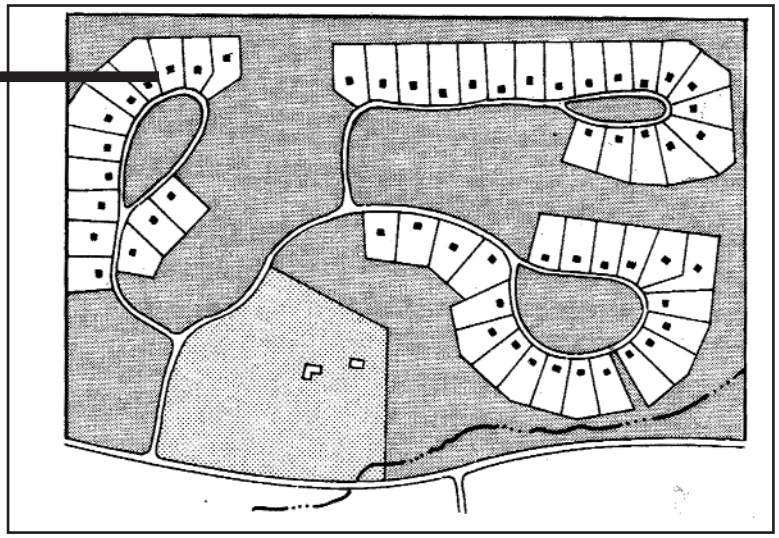
1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

COUNTRYSIDE DISTRICT - HOW IT WORKS

Prototypical Site Design



Conservation Site Design



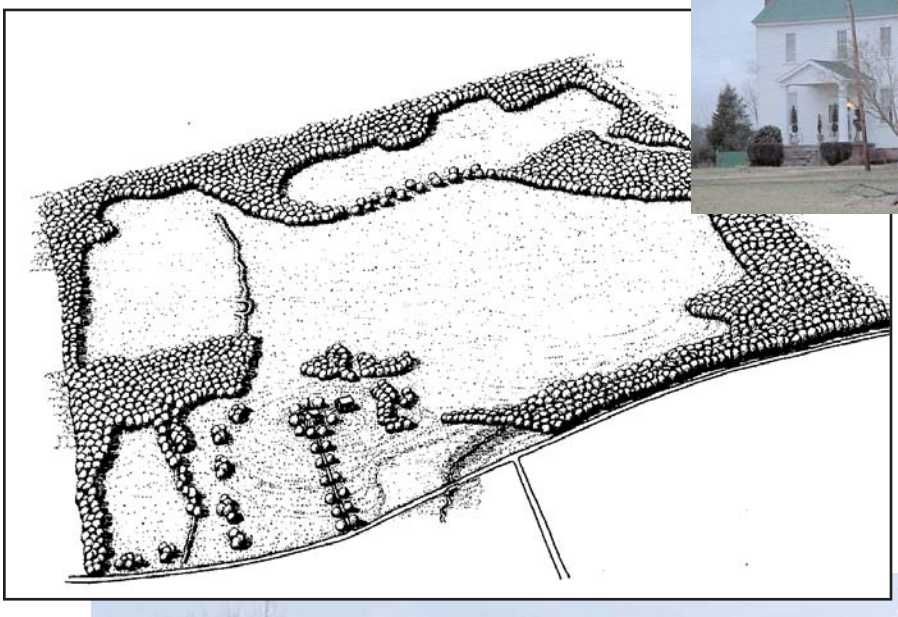
Ultimately, Both Layouts Yield the Same Number of Lots (54 each). Conservation Site Design preserves open space with smaller lot sizes, but can accommodate same size houses.

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

COUNTRYSIDE DISTRICT - HOW IT WORKS

The following example graphically explains how a site can be developed for a single family subdivision and still preserve open space:

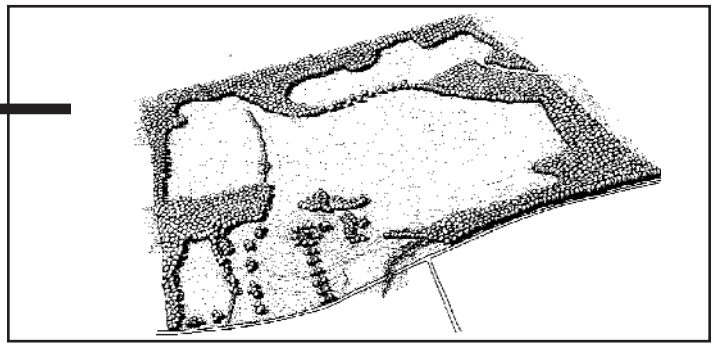


DESIGN DISTRICTS:

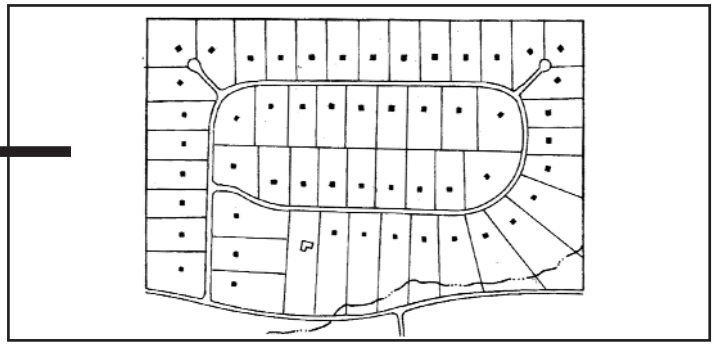
1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. Special Use District

COUNTRYSIDE DISTRICT - HOW IT WORKS

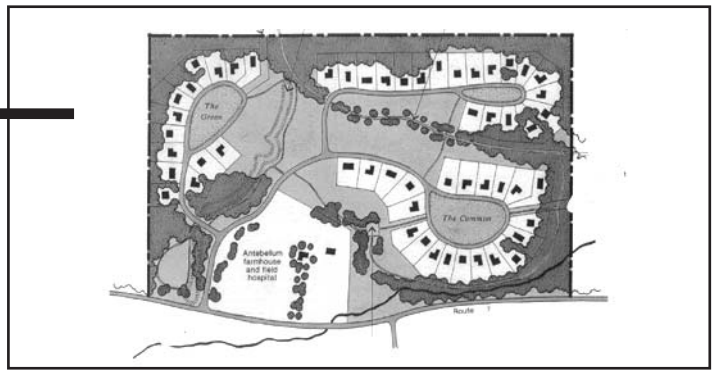
The Site



Prototypical Site Design



Alternative Site Design Benefits Investors, Residents, and the Town



DESIGN DISTRICTS:

1. Countryside District
2. ***Neighborhood District***
3. Town Center District
4. Highway District
5. Special Use District

NEIGHBORHOOD DISTRICT

The Neighborhood District provides for residential infill development surrounding the traditional town center and its logical extensions. This district also provides for town-scaled residential development within walking distance (generally ½ mile) of satellite town centers, referred to below as "Neighborhood Villages". Streets in the Neighborhood District are to be interconnected, unless prevented by environmental regulations. Streets and housing will be arranged to highlight significant natural features as envisioned, for example, by Frederick Law Olmsted's Master Plan for Riverside, IL, Myer's Park in Charlotte, or Cameron Park in Raleigh. A range of housing types is encouraged. Low-intensity business activity is permitted in mixed-use buildings at residential scale, according to locational criteria. The building type that corresponds to the use regulates the intensity to which permitted uses may be built.

NEIGHBORHOOD VILLAGES

The Neighborhood Village is a form of village cluster within the neighborhood district, which provides for the location of shops, services, small workplaces, civic and residential buildings central to a neighborhood (or grouping of neighborhoods), and within walking distance of dwellings. A neighborhood village shall be developed with an interconnected pattern of streets, with safe and convenient pedestrian access, and is limited to approximately ¼ mile in radius. Uses in the neighborhood village will have a primary market area of 1 or 2 miles, and buildings compatible with surrounding residences; integration of adjoining natural features is not critical here and should not interfere with the development of a compact neighborhood center. If a neighborhood village is the focus of a planned transit stop, it should be designed to serve the neighborhood's residential base plus transit riders.

The Design District Plan does not show the general location of these villages within the larger neighborhood district although it is expected that when a commercial development is proposed in this district it will be setting the standards and location for all commercial development that follows in this district.

SEE FIGURE 5.4 NEIGHBORHOOD DISTRICT MAP

DESIGN DISTRICTS:

1. Countryside District
2. ***Neighborhood District***
3. Town Center District
4. Highway District
5. Special Use District

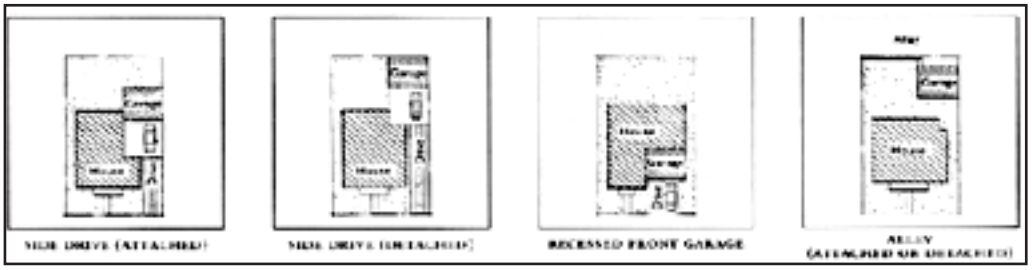


FIGURE 5.4 - Refer to Guideline #6 below.

Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

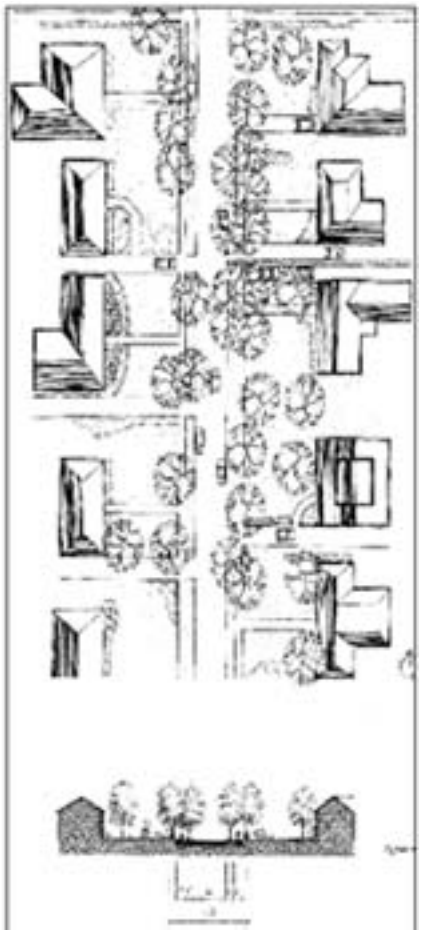
NEIGHBORHOOD DISTRICT GUIDELINES

1. Pedestrian scale is encouraged throughout any development with sidewalks on both sides of the street.
2. Streets are to be interconnected; except when significant natural features or existing historic buildings preclude interconnectivity.
3. Streets should be safe, comfortable and interesting to the pedestrian. Connections to adjacent neighborhoods through bike and pedestrian access shall be desired to assure a safe and pleasant bike/pedestrian environment.
4. Riparian corridors are to be preserved and utilized as community features; streets are encouraged to parallel riparian corridors so lots front on the corridor, as in Raleigh's Cameron Park.
5. Civic, professional, and retail uses are to be accessible in scale and by design for all residents and by all modes of mobility.
6. Residential garage doors shall not dominate the front plane of a residence. Garages are to be set back from the front plane of the house or are to be detached and located at the rear of the main residential structure (See Figure ** above). On street parking is encouraged.
7. Street trees shall be installed along all streets (commercial or residential).
8. The front elevations facing the street and the overall massing should be pedestrian in scale.
9. Adjacent buildings should be architecturally compatible through similar silhouettes, spacing between facades, setbacks, proportions, treatments, exterior materials, scale, massing, and/or architectural style.
10. Within neighborhoods, a broad range of housing types and price levels should be encouraged to bring people of diverse ages, races, and incomes into daily interaction, strengthening the personal and civic bonds essential to an authentic community.
11. Many activities of daily living should occur within walking distance, allowing independence to those who do not drive, especially the elderly and the young.
12. Interconnected networks of streets should be designed to encourage walking, reduce the number and length of automobile trips, and conserve energy.
13. Concentrations of civic, institutional, and commercial activity should be embedded in neighborhoods and districts, not isolated in remote, single-use complexes.
14. Schools should be sized and located to enable children to walk or bicycle to them.
15. All neighborhood villages should be mixed-use and contain uses including, but not limited to, single family and multi-family dwellings, office buildings, retail storefronts, live-work units, and multi-story housing with ground level retail/office uses.
16. All neighborhood villages shall provide squares, plazas or other open space for community interaction.

DESIGN DISTRICTS:

1. Countryside District
2. ***Neighborhood District***
3. Town Center District
4. Highway District
5. Special Use District

NEIGHBORHOOD DISTRICT - STREET PLANS AND ELEVATIONS



Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

Typical Neighborhood District Architecture & Housing Mix

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. ***Town Center District***
4. Highway District
5. Special Use District

TOWN CENTER DISTRICT

The Town Center District provides for revitalization, reuse, and infill development in Knightdale's traditional town center. A broad array of uses are expected in a mixed-use pattern which integrates shops, restaurants, services, work places, civic, educational, and religious facilities, and higher density housing in a compact, pedestrian-oriented environment. The Town Center anchors the surrounding residential neighborhoods while also serving the broader community. The district is coded to accommodate the higher overall intensity of development required to support a proposed regional transit stop. It is to be expected that the Town Center District will be expanded over time through the rezoning process to an approximate ½ mile radius to meet growth in demand for downtown facilities and services.

SEE FIGURE 5.5 TOWN CENTER DISTRICT MAP

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. ***Town Center District***
4. Highway District
5. Special Use District

TOWN CENTER DISTRICT GUIDELINES

1. Pedestrian scale is encouraged throughout any development with sidewalks on both sides of the street.
2. All town center areas should contain mixed-use development and contain uses including, but not limited to, single family and multi-family dwellings, office buildings, retail storefronts, live-work units, and multi-story housing with ground level retail/office uses.
3. The town center area shall provide squares, plazas or other open space for community interaction.
4. Streets are to be interconnected; except when significant natural features or existing historic buildings preclude interconnectivity.
5. Block faces should have a length not to exceed 660 feet.
6. Mid block and rear alleys should be utilized for access to parking, utilities, service and loading areas to minimize the number of driveways along the main pedestrian path.
7. Many activities of daily living should occur within walking distance, allowing independence to those who do not drive, especially the elderly and the young.
8. Interconnected networks of streets should be designed to encourage walking, reduce the number and length of automobile trips, and conserve energy.
8. Civic, professional, and retail uses are to be accessible in scale and by design for all residents and by all modes of mobility.
9. Transit corridors should be planned which can help organize metropolitan structure and revitalize urban centers. In contrast, highway corridors should not displace investment from existing centers.
10. Appropriate building densities and land uses should be within walking distance of transit stops, permitting public transit to become a viable alternative to the automobile.
11. The garage doors of residential construction shall not dominate the front plane of a residence. Garages are to be setback from the front plane of the house or are to be detached and located at the rear of the main residential structure.
12. Street trees shall be installed along all streets (commercial or residential).
13. Locate buildings close to the pedestrian street, with off-street parking behind and/or beside buildings.
14. Mixed-use developments shall incorporate a unity of development to encourage compatibility among buildings, signage, street and pedestrian system and landscape treatment.
15. The front elevations of commercial buildings facing the street and the overall massing should be pedestrian in scale.
16. Adjacent buildings should be architecturally compatible through similar

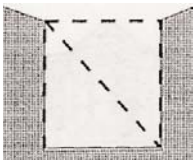
DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. ***Town Center District***
4. Highway District
5. Special Use District

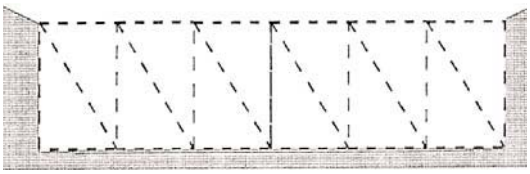
silhouettes, spacing between facades, setbacks, proportions, treatments, exterior materials, scale, massing, and/or architectural style.

17. Canopies and awnings should be canvas or similar material and should be permitted to encroach over a sidewalk to within two feet of a public street curb and may be illuminated by external lighting only.
18. Ground mounted mechanical equipment should be located to the rear or side yard and screened from off-site view. Roof-mounted mechanical equipment should be screened from off-site view by a parapet wall.
19. Loading and service delivery areas should be located to the rear or side yard away from the primary street frontage.
20. Vertical mixed-uses shall be encouraged.
21. Buildings serve to spatially define streets. Proper spatial definition shall be achieved with buildings or other architectural elements (including certain tree plantings) making up the street edges aligned in a disciplined manner with an appropriate ratio of height to width.
22. Building articulation is encouraged to take place primarily in the vertical plane or facade. The condition of alignment occurs when the facades of buildings cooperate to delineate the public space, as walls form a room. Appendages such as porches, balconies, and bay windows are encouraged to promote the visual transition.
23. Spatial enclosure is encouraged for shopping streets, which must compete with malls, which provide very effective spatial definition. A 1:6 height-to-width ratio is the absolute minimum required for appropriate urban spatial definition. An appropriate average ratio is 1:3. As a general rule, the tighter the ratio, the stronger the sense of place. In the absence of spatial definition by facades, disciplined tree planting is an alternative. The proportions are outlined below:

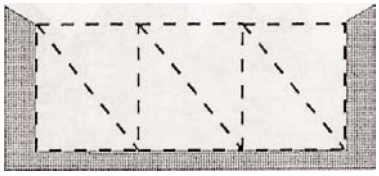
RATIO 1:1



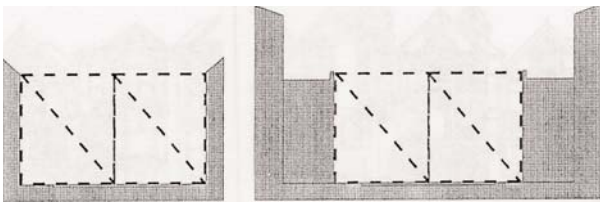
RATIO 1:6



RATIO 1:3



BY FAÇADE BY RECESS LINE



DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. ***Highway District***
5. Special Use District

HIGHWAY DISTRICT

The Highway District is established to provide primarily for auto-dependent uses in areas not amenable to easy pedestrian access and a comfortable pedestrian environment. It is the intent of the Highway District to serve not only the Knightdale community, but interstate travelers as well. Because of the scale and access requirements of uses in this category, they often cannot be compatibly integrated within the Town Center or Neighborhood Center Districts. Development at district boundaries must provide a compatible transition to uses outside the district; property boundaries adjacent to freeways or expressways will require a 50-foot foliated buffer yard; and frontages on major or minor thoroughfare or collectors will require formal street tree planting.

SEE FIGURE 5.6 HIGHWAY DISTRICT MAP

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. ***Highway District***
5. Special Use District

HIGHWAY DISTRICT GUIDELINES

1. 'Big box' retailers are encouraged to use materials reflective of the local architectural vernacular.
2. A protective and landscaped buffer yard shall be required along all developments that are adjacent to I-540 or the US-64 Bypass.
3. All facades of a building that are visible from adjoining properties and/or public streets should contribute to the pleasing scale features of the building and encourage community integration by featuring characteristics similar to a front façade.
4. Facades greater than 100 feet in length shall incorporate recesses and projections along at least 20% of the length of the façade. "Uniterrupted length of any façade" in excess of 100 horizontal feet shall be discouraged.
5. Windows, awnings, and arcades must total at least 50% of the façade length abutting a public street.
6. Smaller retail stores that are part of a larger principal building shall have display windows and separate outside entrances.
7. No more than 50% of the off-street parking area for the entire development shall be located between the front façade of the principal building and the primary abutting street.
8. Vertical mixed-uses shall be encouraged for all highway district development.
9. The elevations on all sides of a building and the overall massing should be pedestrian in scale.
10. Adjacent buildings should be architecturally compatible through similar silhouettes, spacing between facades, setbacks, proportions, treatments, exterior materials, scale, massing, and/or architectural style.
11. Ground mounted mechanical equipment should be located to the rear or side yard and screened from off-site view. Roof-mounted mechanical equipment should be screened from off-site view by a parapet wall.
12. Loading and service delivery areas should be located to the rear or side yard away from the primary street frontage.

DESIGN DISTRICTS:

1. Countryside District
2. Neighborhood District
3. Town Center District
4. Highway District
5. ***Special Use District***

SPECIAL USE DISTRICT (AIRPORT AND QUARRY)

The Special Use District is established to accommodate uses that may constitute health or safety hazards, have greater than average impacts on the environment, or diminish the use and enjoyment of nearby property by generation of noise, smoke, fumes, odors, glare, commercial vehicle traffic, or similar nuisances. Because uses permitted in the Special Use District vary as to their impacts on the community, they may likewise vary as to effective mitigating conditions.

SPECIAL USE DISTRICT GUIDELINES

1. A natural or vegetated buffer shall be imposed along the perimeter of sites approved for difficult or nuisance uses.

SEE FIGURE 5.7 SPECIAL USE DISTRICT MAP

VI. POTENTIAL IMPACT OF THE 2027 COMPREHENSIVE PLAN ON GROWTH AND DEVELOPMENT

With a thoughtful implementation, the design district categories will be able to help the community meet many of the stated values of the "functional framework". These may also help Knightdale develop a strong economy that will provide high-paying jobs, a strong tax base, and a variety of housing options (i.e. affordable vs. up-scale locations, amenities and design; high- vs. low-density construction; rural, suburban, or urban environments).

The design district categories are not meant to be restrictive, by disallowing specific uses. They are meant to allow for a variety of uses that must conform to design standards that adhere to characteristics established by the community. The design district designations will not hinder Knightdale's competitiveness for attracting a wide-variety of new developments. Single-family housing, apartments, retail centers, office parks, and industrial uses will still be allowed in Knightdale. These uses will just have to conform to community-based design standards that will be thoughtfully developed in conjunction with local residents, businesses, landowners, professional planners, urban designers and developers. The fact that most uses will be allowed in most of the categories, as long as they adhere to the design characteristics in the category, may even allow for a broader range of businesses and housing prototypes than are currently allowed under existing code.

The "Countryside" and "Suburban" districts will have the highest potential for attracting residential development. Retail, office, and industrial uses will only be allowed as long as they do not violate the basic tenants of each use (i.e. land conservation, natural views, and traditional neighborhoods). The "Town Center District" is ideal for attracting a variety of higher density housing, retail, and office developments. These uses will, however, have to be located and designed to maximize synergy and minimize negative impacts that the uses might have on each other.

From a market perspective, the "Highway Districts" are ideal locations for higher density housing and retail development. The locations of these districts in the plan also adhere to basic market principles, mainly superior interstate access and visibility, and should prove to be strong contributors to the local employment and tax bases. Disallowing prototypical site and building designs would not adversely affect the town's ability to attract development or be detrimental to businesses as long as the design code is thoughtfully written to understand the market needs of the regulated uses.

Finally, the "Special Purpose Districts" are set aside for attracting large export-oriented

businesses to Knightdale. This district type was located in areas that are attractive to such companies, but less attractive to housing and retail uses.

Non-prototypical developments can have a higher rate of success as long as they are still focused on important market fundamentals. The placement and design of these centers must still be mindful of market fundamentals regarding access, visibility, parking availability, competitive locations, and tenant mix. The most successful non-prototypical developments create an inviting sense of place, increasing spending at the businesses as they become attractive destinations and draw people from a wider market area. This is especially true in metropolitan areas like Raleigh-Durham that have limited numbers of unique, or differentiated, retail destinations.

Increased convenience and pedestrian connectivity that result from "better design" also encourage consumers to browse multiple stores and increase the amount of time spent shopping, dining, and being entertained. Almost all of the national retailers have experience with and prototypes that fit the types of non-prototypical development designs discussed in this report.

Some residents may be discouraged by the externalities often associated with the preceding criteria - mainly problems associated with congestion. Without thoughtful planning, many of the criteria that make Knightdale attractive to retailers, businesses, and new residents will, over time, lead to many negative externalities that will discourage business formation, employment growth, and household formation. The primary externality is increased congestion, which will erode the community's standard of living by increasing travel times; air, water, soil pollution; and create visual blight that will be much more costly to address reactively versus proactively.

VII. LAND USE AND COMMUNITY DESIGN OBJECTIVES AND ACTION ITEMS

The Objectives and Action Items are provided to direct the planning and implementation strategies related to land use and community design in Knightdale and are in accordance with the overall goals of the 2027 Comprehensive Plan.

A. Objectives:

The Town shall seek to:

1. Promote a variety of land uses which are compatible to one another and provide a vibrant and varied local economy, which will attract and support a wide diversity of business opportunities and community services.
2. Promote site design which clearly provides a system of coordinated land

uses and that encourages decision makers, the development community and town staff to view each new development proposal in a larger and regional context.

B. Action Items:

The following are the tasks which provide a course of action to implement the objectives for land use and community design:

5.1 The Town shall amend the unified development ordinance to allow for both horizontal and vertical mixed-use developments and master planned developments.

5.2 The Town shall encourage a full range and mix of residential structure types, densities and cost levels by amending the unified development ordinance to allow for varying densities and density credits within mixed-use, planned unit and master planned communities and by providing design standards for residential development.

5.3 The Town shall work with adjacent municipalities and Wake County to coordinate land use planning efforts and to adopt joint land use plans.

5.4 The Town shall adopt design standards that will:

- protect and enhance the quality of the Town's built and natural environments
- protect the small town character of Knightdale.

5.5 The Town shall continue to work with private developers in creating community spaces by encouraging pedestrian scale developments that include gathering areas. Gathering areas may include benches, fountains, shade trees, or picnic tables. Residential sites shall be integrated with, and strongly linked to, abutting residential areas allowing residents to safely access the site by car, bicycle or foot. To the extent possible, public spaces such as churches, schools, libraries and parks shall be physically linked to community spaces.

5.6 The Town shall adopt a streetscape design, which includes a tree lawn associated with the sidewalk program. The streetscape plan shall result in tree lined streets that provide a shady area for drivers, and a buffer from traffic for pedestrians.

5.7 The Town shall encourage residential areas to be designed to link with each

other to avoid the need to travel along U.S. Highway 64.

5.8 The Town shall investigate mainstreaming the major residential subdivision approval process by amending existing regulations to insure quality design and defined standards which will allow more administrative review and approval of certain subdivisions.

5.9 The Town shall adopt residential street design standards sensitive to the needs of all pedestrians.

5.10 The Town shall continue to provide public spaces, including parks, and walkways.

5.11 The Town shall research crime prevention through environmental design and incorporate appropriate design guidelines into development regulations that ensure Knightdale remains a safe community.

5.12 The Town shall prepare a Small Area Plan that addresses the issues of appearance, economic development, and revitalization in the Town Center and also addresses enlarging the Town Center boundaries.

5.13 The Town shall adopt a minimum housing code that requires decent, safe and sanitary housing for all residents.

5.14 The Town shall actively encourage the Wake County Housing and Community Revitalization Committee to allocate state and federal housing funds to programs that will address the development needs of Knightdale, including home rehabilitation programs.

5.15 The Town shall examine and revise, as necessary, the standards required for land use and design issues along US Highway 64 Business and Bypass and the I-540 Eastern Wake Expressway.

CHAPTER 6

PARKS AND RECREATION
MASTER PLAN

I. INTRODUCTION

The Town of Knightdale grew rapidly during the 1980's, and changed from a rural community with few demands for municipal services to a small town of more than 6,000 people. The Town is expected to have more than 14,500 people by the year 2010. Associated with this growth is an increasing demand for many services, including parks and recreation facilities. To date, the community needs for parks and recreation facilities have been served by a combination of county, school/parks and private facilities, with the Town playing a fairly minor role. As a result, parks and recreation facilities have not been developed in a consistent and coordinated manner, and some facility needs are not being met.

The Town's recognition of these issues led to a decision to update the 1994 Parks and Recreation Master Plan, and provide a new Open Space and Greenway Master Plan. The intent of the updated Parks and Recreation Master Plan is to guide the development of the parks and recreation system to meet the needs of existing and future Knightdale residents. Responding to the need for a more comprehensive parks and recreation system is a major challenge, but Knightdale has a timely opportunity to develop an exceptional system that preserves the Town's attractive setting and incorporates its outstanding natural and cultural features.

Knightdale has historically served and will continue to serve as the commercial and social center for St. Matthew's Township. Although Knightdale will not realize its maximum geographic boundaries for many years, Knightdale's parks and recreation facilities already serve the larger area of its extra-territorial jurisdiction (ETJ). Currently, 15,000 people in the Town's ETJ rely heavily on the Town of Knightdale to meet their recreational needs. The surrounding development is also impacting the character of the region, with progressively more of the natural landscape being converted into residential neighborhoods. Clearly, the Town and Wake County must work collaboratively to meet the needs of Knightdale area residents and preserve the outstanding natural heritage of the region.

This portion of the Comprehensive Plan presents the Parks and Recreation Master Plan. The Town of Knightdale must ensure that it will have adequate facilities for the growing population. The Parks and Recreation Master Plan includes:

- An assessment of existing parks and recreation facilities and a brief assessment of needs.
- References to demographic and population information used to define the need for future parkland and specific facilities.
- An inventory of facilities provided by the Town, as well as those provided by

Village Green

Community Space

adjacent jurisdictions. In addition, important natural resource areas are identified in the inventory.

- Park, recreation and open space definitions and classification standards
- Parks and recreation objectives and action items

Please note that greenways, or linear parks, and open space, are not included in this chapter, but are included in Chapter 7, Open Space and Greenways.

II. EXISTING PARKS AND RECREATION FACILIITIES

Currently, Knightdale has one main park facility and two community park facilities within the study area. Harper Park is located in Downtown Knightdale and includes a tennis court, playground, picnic tables, grills and 2 picnic shelters (Please refer to the Open Space and Greenway Plan at the end of this chapter). In addition, the Town partners with the Wake County School System and Wake County Parks and Recreation on two community parks located at Knightdale Elementary School and East Wake Middle School. These community parks provide recreational sports facilities during non-school hours. Knightdale and Wake County Parks and Recreation maintain the community park ball fields jointly. The Knightdale Parks and Recreation Department maintain Harper Park and other Town properties.

A recent addition to the parks of Knightdale is the Environmental Park located behind the Knightdale Town Hall. This signature project successfully integrates protected open space, a greenway component and connections to the nearby library and elementary school. Future additions to the park include boardwalk trails, educational components, a dock and picnic areas. Connections to future greenway corridors are also planned. June 5, 2002 marked the groundbreaking of an even newer component to the Knightdale Park system. The Knightdale Community Park, located at the intersection on Forestville Rd. and Horton Rd., will include 7 ball fields, 4 multipurpose fields, a greenway system with boardwalk trails, an amphitheatre, picnic areas, playgrounds and volleyball courts. Connections to future greenway corridors are also planned. This site will also incorporate a High School and Elementary School.

Knightdale open space opportunities are primarily among three sites along the Neuse River. The recreational facilities at Anderson Point, East Neuse Park, and West Neuse Park provide passive recreation amenities such as canoe put-ins and trail access along the Neuse River Greenway. The Neuse River Greenway, which runs from Anderson Point to North Neuse Park along the west bank of the Neuse River, is currently not connected to Knightdale, however it could be connected via the Mingo Creek corridor. There are several viable locations for future Knightdale parks along the

east bank of the Neuse River that would provide connections to existing open space.

III. INVENTORY OF FACILITIES

Outlined in Figure 6.1 (See page 147) is an inventory of parks, recreation and open space facilities which list each facility within the Knightdale long-range urban service area and the amenities at each site. Need is determined by population served.

IV. METHODOLOGY

Both remote research and direct observation were used to analyze the existing Knightdale Parks and Recreation condition. By examining the study area through graphic representations (objective data) and direct observation of actual conditions (subjective experience), a more comprehensive understanding is achieved. Remote research consisted of gathering background data from previous studies and recently produced data. Studies and reports made available to the consultants include:

- Knightdale Comprehensive Plan (1993)
- Wake County Open Space Plan (1999)
- US 64 Corridor Plan (1999)
- Inventory of the Natural Areas of Wake County (1987)
- Capital Area Greenway Master Plan Update (1989)
- North Carolina's 303(d) List (1998) of streams deficient in water quality by Clean Water Act standards.

Additional data was gathered from websites maintained by the U.S. Census Bureau, the Neuse River Foundation and sites offering environmental and cultural information specific to Knightdale. Finally, thematic maps were produced from Wake County Geographic Information Systems (GIS) data to graphically illustrate important conditions relative to geographic position. Thematic maps are found in Chapter 7, Open Space and Greenways.

V. PARKS AND RECREATION DEFINITIONS AND STANDARDS

The following presents definitions and standards for evaluating Knightdale's current conditions and future needs.

A. Recommended Facility Standards

Municipal standards for each facility type are based on an averaging method. Where there were four or more municipalities within Wake County with established standards, the lowest and highest values were dropped and the remaining standards were used

to calculate the countywide average. Below are the facility standards:

Recommended Facility Standards:

Community Center	1 per 21,667
Gymnasium	1 per 5,000
Amphitheater	1 per 20,000
Swimming Pool	1 per 19,167
Softball/Baseball Field	1 per 3,889
Football/Soccer Field	1 per 3,721
Multi-Purpose Field	1 per 3,500
Outdoor Basketball Court	1 per 2,000
Tennis Court	1 per 1,838
Outdoor Volleyball Court	1 per 3,226
Track	1 per 20,000
Picnic Shelter	1 per 5,626
Playground Tot Lot	1 per 2,863

B. Parks and Recreation Classifications

Five classifications of parks, open space, and trails are proposed for the Town of Knightdale:

- Pocket Parks
- Neighborhood Parks
- Community Parks
- Open Space/Open Land
- Greenways

Definitions are provided for each of the classifications below. Standards are provided for each classification and are based on the Town acquiring park sites of ample acreage and avoiding parcels under 10 acres, except when adjacent to other public property. Marginally developable sites or sites that are mainly storm water detention areas should also be avoided. The rationale for acquiring larger park sites is based on the facts that larger parks:

- Are visited more often by a larger segment of the population because they offer a wide variety of activities that can be enjoyed by the entire family.
- Permit greater opportunity for development of facilities and programming.
- Are more economical to construct and maintain.
- Provide opportunities for buffering incompatible uses both on and off site.

Pocket Parks

Pocket Parks are small parks or specialized facilities that serve a specific population

(e.g., tot lot for preschool children, or horseshoe pits/shuffleboard courts). Parks of this small scale are encouraged within residential subdivisions to serve the neighboring community. An example of a successful pocket park is in The City of Raleigh's Oakwood neighborhood has a successful pocket park which is maintained and owned by the Oakwood homeowners. Many residents would prefer to have a smaller park that is within a few blocks of their homes rather than a larger neighborhood park that may be a half-mile or farther away. Residents could then walk or bike to the park. Maintenance of pocket parks shall be the responsibility of homeowners associations within residential subdivisions.

Pocket Park Standards:

- Level of Service Standard: 0.5 acre/1,000 population.
- Service Area: The service area is up to 1/4-mile radius.
- Size: Less than 5 acres.
- Location: Within development areas with street access on at least two sides.
- Provide good pedestrian and bicycle linkages.
- Type of Facilities: The facility development of these parks will depend directly on the population served; however, usual facilities include turfgrass areas, picnic tables, benches, and playground apparatus.

Neighborhood Parks

Neighborhood Parks should be equitably distributed throughout the Town, and one should usually be provided in every square mile section where a residential development occurs. The purpose of a neighborhood park is to provide a stage for individual and group recreational activities. The park should be a common area for neighbors of all ages to gather, socialize and play, and to provide relief from the urban environment. They should be centrally located and easily accessible, preferably via a walkway system that minimizes the need to use vehicles to get to the park and that does not require crossing major roadways.

Neighborhood Park Standards:

- Level of Service: 1 acres/1,000 population.
- Service Area: Residences within walking distance or up to ½ mile maximum.
- Size: 10 to 16 acres (minimum 5 acres if associated with a school site that has publicly available playfields).
- Location: Preferably adjacent to an elementary or junior high school or near the center of the square mile section, with good neighborhood pedestrian access and served on at least two sides by local streets. The site should have less than 30% of its boundaries bordered by the backs of lots.
- Typical Facilities: Neighborhood Parks should not have a standard design.

The parks will vary in size, topography and vegetation, and site designs should take advantage of these characteristics. A mixture of facilities should be provided which are suited to the site and the social-recreation preferences of surrounding residents. Parking and restrooms may or may not be desirable. Neighborhood Parks should have adequately sized areas with topography gentle enough to construct an open multi-purpose playfield (generally considered to be 1½% to 5% slopes). Irrigated turf should be limited to high use areas, such as around playgrounds, group use areas and playfields. In the event that a neighborhood park is located in conjunction with a school, a joint use agreement and distribution of facilities should be negotiated. School facilities are not considered full-time park facilities and only partially satisfy the recreational needs of a neighborhood. The following is a partial list of facilities that are suitable for neighborhood parks:

- Modified sports fields
- Fitness course
- Walks and bike paths
- Water features
- Restrooms
- Children's play area
- Free play turf area
- Floral displays
- Community gardens
- Native vegetation areas
- Volleyball, tennis, street hockey, shuffleboard & basketball courts
- Gathering areas
- Picnic shelters, tables & benches
- Environmental, historical or cultural interpretation

Community Parks

Community Parks serve as the focal point for community-wide activities and, as such, are intended to provide either the facilities or intensity of activities that would be inappropriate for Neighborhood Parks due to noise, lights or vehicular traffic. Natural resource areas such as water bodies, streams and wetland areas should serve as focal points when available, and views to the mountains or other natural resource areas should be optimized. Irrigated turf should be limited to only the high use areas such as sports fields, open play areas, playgrounds, adjacent to parking lots and group picnic areas. Topography should be evaluated to ensure that athletic fields and other facilities can be accommodated. Community Parks should be directly linked to the community-wide trail system and the regional trail system if possible.

Community Parks are intended to serve as neighborhood parks for the immediately adjacent neighborhoods, but they also serve larger overall community needs. A typical Community Park should not have more than 40% of its area devoted to active sports fields, courts and parking so that other community activities can be accommodated.

Community Park Standards:

- Level of Service Standard: 5 acres/1,000 population.
- Service Area: The service area is approximately 4 to 5 square miles, and is intended to serve the needs of several neighborhoods located within the 1½ mile radius.
- Size: Ranging from 40 to 100 acres, with an optimum size of 60 to 80 acres. Site size should correspondingly increase if special facilities, such as swimming pools and recreation centers, are included.
- Location: Dependent upon park size and program. Large park sites and those with facilities that do not routinely generate disruptive amounts of traffic, noise and lights are preferably located adjacent to natural open space areas or near the center of four neighborhoods. Park sites that are at the smaller end of the scale may not provide adequate buffer area between intensive use areas, such a lighted ballfields and residential areas or wildlife habitat. Smaller regional parks with active sports facilities require careful site selection or co-location with non-sensitive open space areas to provide sufficient buffers.
- Special use community parks, such as a youth or adult sports complex, may be most appropriately located in a commercial or industrial park to minimize impacts. All regional parks should have good access from a collector or arterial street.
- Typical Facilities: Because of a larger, more diverse user base, community parks provide a wider variety of recreational opportunities. Suitable facilities include those listed under Neighborhood Parks, as well as the following:
    - Regulation sports fields
    - Recreation centers
    - Swimming pools
    - Special event areas
    - Ice skating
    - Permanent water bodies, features or streams
    - Free play areas of improved turf (meadows)
    - Large group picnic areas and gathering areas
    - Amphitheaters and Performance plazas
    - Wildlife habitat
    - Horticultural displays and gardens
    - Environmental, historical or cultural interpretation centers

Open Space/Open Land

Open space/open land can vary in function and size, and is defined as land or water protected in a relatively undeveloped condition. It is required that a minimum of 10% of

land within a development be dedicated for active and passive recreation opportunities. Open space is counted as passive recreation land. Open space should be left in a natural condition, except as needed to provide trail access and other compatible recreational uses. Open space/open land offers opportunities for unstructured recreation such as hiking, biking, jogging, or horseback riding, and provides an opportunity to relax and enjoy nature. The network of open space/open land can be used for trail corridors to connect various activities within the Town, such as schools, parks, housing, and shopping. It can be used to give the Town form and definition by providing buffer areas between land uses. Open space/open land protects floodplains and environmentally sensitive areas, preserves wildlife, vegetation and unique natural features and, in some cases, can be designed so that it recreates a natural environment. Open land areas must be left in their natural condition, not altered by grading or mowing.

Open Space/Open Land Standards:

- Level of Service Standard: Variable; an exact acreage standard is impractical to establish due to the fact that open space areas should be preserved based on the natural features of the land.
- Service Area: The service area is the entire Town and environs.
- Size: Variable, depending on the natural resource(s) that are desired to be preserved.
- Location: As shown on the Master Plan map and as determined by the natural resource(s) and layout of the development. These include but are not limited to: stream/creek corridors, gulches, steep slopes, water bodies, areas of significant environmental quality, significant stands of trees, geological hazard areas, or corridors connecting parks, schools, and residential areas.
- Typical Facilities: Open space protects natural areas and provides many passive uses, including:
    - Important vegetation/wildlife habitat
    - Wetlands
    - Scenic areas or vistas
    - Land for grazing or agricultural uses
    - Floodplains in their natural configuration and condition
    - Steep slopes
    - Buffer areas between urban development
    - Areas for low intensity recreation, such as hiking, biking, horseback riding, casual picnicking, nature study, interpretation and fishing
    - Parking for trailheads

Trails
Trails are off-street transportation and recreation systems for bicycling, jogging, walking, and equestrian use. Trail systems should also be used to connect various activities within the Town, such as subdivisions, business and commercial areas, schools, and other park sites. Off-street parking shall be provided for trail access where appropriate.

Trail Standards:

- Level of Service Standard: Variable.
- Size: 50' right-of-way is optimum, with 10' concrete paved width for trail and a parallel natural surface equestrian trail where appropriate.
- Location: Along drainageways, connecting parks and open space areas, and through parks and open space areas.
- Visual Features: Mainly consisting of bicycle, equestrian, and pedestrian facilities in existing natural environment.

When setting standards for Greenways, accessibility, continuity and linkage with other trails should be considered. The average standard for Greenways in Wake County is 1.7 acres per 1000 citizens.

In 1994 the Knightdale Town Council unanimously adopted the Master Plan for the Mingo Creek Greenway. The plan designates property along the sewer right-of-way, adjacent to Mingo Creek, for a trail that will connect downtown Knightdale, Mingo Creek Park, three subdivisions and Hodge Road Elementary School.

VI. TARGETED PARKS AND RECREATION LAND ACQUISITION

As a result of community meetings, staff and stakeholder comments, it is recommended that the Town of Knightdale supplement existing park systems with the following parks and open space acquisitions. These acquisition recommendations are broadly defined within this plan to cover geographical areas of the community, which were agreed upon throughout the participatory planning process.

First - The Town of Knightdale is in the process of completing the Environmental Park on Smithfield Road. It is proposed that this park be a key component of Knightdale's parks system. Because of the Environmental Park's proximity within the new town center design district, town hall, library, and schools, and because of the potential for education and research program elements, it should be allowed to evolve into a symbol of Knightdale's role in the larger, education / research rich Triangle region.

Second - There is a need to establish a community park in the northeast area of the community along Mark's Creek. There is a chance that this park could be developed jointly with Wendell and Triangle J Council of Governments (TJCOG).

Third - A community park was suggested in the northwest area of the town near East Wake Middle School and Neuseoca Lake.

Fourth - A joint regional park with Wendell, and possibly TJCOG, is proposed with Wendell at Lake Myra.

Fifth - There is an opportunity to develop a community park at the intersection of the Neuse River and Poplar Creek.

Sixth - An area of farmland preservation is urged roughly from Highway 64 south to the Neuse River and from Hodge Road east to Mark's Creek Scenic Corridors.

Maps which show parks, recreation and greenways facilities are found in Chapter 7: Open Space and Greenways. Please Refer to this chapter for pertinent maps.

VII. PARKS AND RECREATION FUNDING SOURCES

In order to pursue further development of the Town's Park and Recreation Facilities, a number of funding sources have been identified as outlined in Chapter 7, Open Space and Greenways Master Plan. It is pertinent with fiscal constraints that innovative funding sources be explored to ensure a high level of service for Knightdale's citizens. Chapter 7 outlines the following funding sources in great detail.

FEDERAL GOVERNMENT FUNDING SOURCES

- The Intermodal Surface Transport. Efficiency Act (ISTEA)
- Surface Transportation Program (STP) Funds
- STP Transportation Enhancements Program
- Community Development Block Grant Program
- Land and Water Conservation Fund (LWCF) Grants
- Urban and Community Forestry Assistance Program
- Small Business Tree Planting Program
- Design Arts Program

STATE FUNDING SOURCES

- North Carolina Department of Transportation (NCDOT)
- North Carolina Division of Parks and Recreation

- North Carolina Wildlife Resources Commission
- North Carolina Department of Corrections
- North Carolina Division of Water Resources
- PL 566-Watershed Protection and Flood Prevention Act

LOCAL FUNDING SOURCES

- Local Private-Sector Funding
- Greenway Sponsors
- Volunteer Work
- "Buy-a-Foot" Programs
- Private Foundations and Corporations
- Walking Magazine Trail Restoration Fund
- Coors Pure Water 2000 Grants
- World Wildlife Fund Innovative Grants Program

VIII. OPERATIONS, MAINTENANCE AND MANAGEMENT

A. Overview

Operating, maintaining and managing a system of parks and recreational facilities in Knightdale will require a coordinated effort among all Town departments and individuals. The following text defines key aspects of Parks and Recreational Facility management, including:

- Governance structure for the system
- Definition of operational policies
- Facility management
- Land management
- Safety and security
- Risk management program

B. Governance Structure

For a successful Parks and Recreation System to be developed it is critical for the players to understand their role in supporting and managing the system.

Role of Knightdale

The Knightdale Parks and Recreation System will be developed and managed by the Town and its departments. Listed below are the key departments and organizations that will play a role in this implementation.

Role of Department of Parks and Recreation
As the primary developer of parks and recreational facilities, the Parks and Recreation Department is the most prominent participant in the Parks and Recreation Master Plan. The Department will be responsible for the design, management and maintenance of the park system. The Parks and Recreation Department will need to work closely with the Planning Department in planning the location of recreational sites.

Role of the Planning Department
The Planning Department should provide support for the Parks and Recreation Master Plan and assist with future implementation of the system. This can be accomplished by defining future facilities within related planning efforts; utilizing the rezoning process to encourage dedication of lands, including sidewalks and bicycle facilities for the Parks and Recreation System and the Open Space and Greenway System; and planning transportation improvements in coordination with greenways.

Role of Department of Public Works
The Department of Public Works is an important player in the implementation strategy for the Parks and Recreation System. The Department manages the system of sanitary and stormwater sewers which offers enormous potential for shared use with greenway development objectives. For the expansion and development of new sanitary sewer lines, the Department should consider the use of a joint-use easement document during right-of-way negotiations to acquire subsurface and surface rights from willing sellers. The Department could function as a greenway developer in partnership with the Parks and Recreation Department.

Role of Department of Public Safety
The Department of Police Services should assist the Parks and Recreation Department with patrolling and law enforcement for Parks and Recreation System lands and facilities.

Role of Local Businesses, Corporations and the Private Sector
Knightdale businesses, corporations and the private sector might choose to sponsor amenities for parks or recreational facilities for development or maintenance. Businesses, corporations and the private sector can work with the Parks and Recreation Department to give money, materials, products and labor toward the development of a facility.

Role of Civic Organizations
Local civic groups and organizations, including the Junior League, Boy Scouts and Girl

Scouts, garden clubs, YMCA, Kiwanis and Rotary Clubs, to name a few, can be participants in the Knightdale Parks and Recreation System. These organizations can play a vital role in building sections of greenway trails, helping build other recreational facilities, and co-hosting events that raise money for the Parks and Recreation System.

Role of Individual Citizens

Local residents who are interested in the development of Knightdale's Parks and Recreation System can participate by agreeing to donate their time, labor, and expertise to the Parks and Recreation Department. Residents might choose to partner with a friend or form a local neighborhood group that adopts a park or greenway for maintenance and management purposes. As an adopt-a-park or adopt-a-greenway organization, individuals might help pick-up trash, plant flowers and trees, care for newly planted vegetation and serve as additional "eyes and ears" for safety and security on open space and greenway lands. All volunteer efforts would be recognized by the Parks and Recreation Department through a community-wide program.

C. Land Acquisition Procedures

Land acquisition procedures can be used to conserve, protect, and preserve parks, recreation facilities and open space of Knightdale. Those procedures are outlined in Chapter 7, Open Space and Greenways Master Plan as land acquisition procedures can be used for parks, recreation facilities, greenways and open space acquisition. Chapter 7 offers a menu of tools that landowners, land conservation organizations and local government can use to expand the Parks and Recreation System. Dedication should be negotiated in a manner that is consistent with local, state and Federal laws that permit and govern such action.

D. Parks and Recreation Facility Management

Parks and recreation facilities shall be maintained in a manner that promotes safe use. Knightdale or its designee should manage all public parks and recreation facilities. Property owned or used by Knightdale for the Parks and Recreation System shall be maintained in a condition that promotes safety and security for users and adjacent property owners. Property that is owned or managed by other entities should be managed and maintained in accordance with the policies of that public body responsible for the affected parcel.

E. Safety and Security

In order to provide a standard of care that offers reasonable and ordinary safety measures, Knightdale shall cooperatively develop and implement a Safety and Security Program for the Parks and Recreation System. This program will consist of

well-defined safety and security policies; the identification of trail management, law enforcement, emergency and fire protection agencies; the proper posting, notification and education of the user policies; and a system that offers timely response to the public for issue or problems that are related to safety and security. The safety and security of the Parks and Recreation System will need to be coordinated with local law enforcement officials, local neighborhood watch associations, and Adopt-a-Greenway organizations.

Important components of the safety and security program include the following. Knightdale should:

- Post User Rules and Regulations at all parks and recreation facilities
- Prepare a Safety Checklist for the Parks and Recreation System
- Prepare a User Response Form for complaints and complements and provide copies at all facilities
- Work with management agencies to develop a system for accident reporting analysis
- Conduct a regular Maintenance and Inspection Program, and share the results of these investigations with all management agencies.
- Coordinate other Public Information Programs that provide information about parks and recreation events and activities that Town residents can participate in
- Have an ongoing evaluation of program objectives

F. User Rules and Regulations

Parks within Knightdale are open for public use from sunrise to sunset, 365 days a year, except as specifically designated. Individuals who are found to be using unlighted facilities after dusk and before dawn should be deemed in violation of these hours of operation and treated as trespassers. Knightdale shall enforce trespassing laws as defined under North Carolina General Statutes for publicly owned lands and facilities.

G. Risk Management Plan

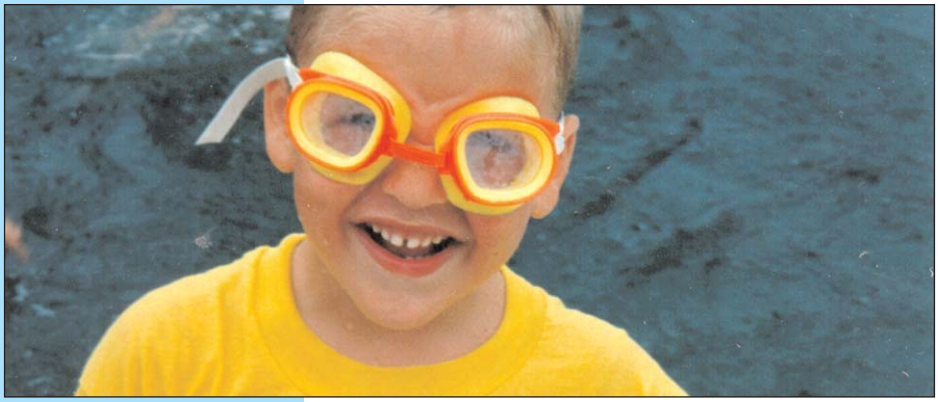
The purpose of a Risk Management Plan is to increase safety for the users of the Knightdale Parks and Recreation System and reduce the potential for accidents to occur within the system or on lands adjacent to the system. While it is impossible to guarantee that all risk will be eliminated by a Risk Management Plan, implementation of a plan is in fact a critical step to reduce liability and improve safety. A Risk Management Plan establishes a methodology for greenway management that is based on current tort liability and case law in the United States related to the development, operation and management of public use lands and facilities.

The ultimate responsibility for managing the Parks and Recreation System, as defined within this Plan, rests with Knightdale. The Risk Management Plan has as its major goals:

- Risk Identification: determining where risk (threat to safety or potential loss) exists within the corridor.
- Risk Evaluation: conducting appropriate examination of areas defined as a risk and determining the factors that contribute to risk.
- Risk Treatment: defining and implementing an appropriate solution to the area of risk in accordance with one of the four options:
    - Risk avoidance: prohibiting use of a risk area.
    - Risk reduction: limit use of area and repair risk area immediately.
    - Risk retention: obtain waivers from all potential users of the risk area.
    - Risk Transfer: transfer risk area (property) to an agency better suited to manage the area.

The following sixteen step plan should be implemented by Knightdale to establish a Risk Management Plan for the Knightdale Parks and Recreation System:

1. Develop a policy statement about risk management.
2. Conduct a needs assessment for the greenway program.
3. Determine goals and objectives for risk management - what are acceptable and not acceptable management levels.
4. Develop specifications for site and facility development.
5. Establish a clear and concise program for risk management.
6. Define supervision and responsibility for risk management.
7. Define appropriate rules and regulations that govern the use of the trail system.
8. Conduct routine/systematic inspections and investigations of the trail system.
9. Develop an accident reporting and analysis system.
10. Establish procedures for handling emergencies.
11. Develop appropriate releases, waivers and agreements for use and management.
12. Identify best methods for insuring against risk.
13. Develop a comprehensive in-service training program for employees of the Town.
14. Implement a public relations program that can effectively describe the risk management program and activities.
15. Conduct periodic reviews of the Risk Management Plan by outside agents to ensure that the Plan is up to date.



16. Maintain good legal and insurance representation.

H. Liability

The design, development, management, and operation of the Knightdale Parks and Recreation System must be carefully and accurately executed in order to provide a resource that protects the health and welfare of the public. Liability may occur when a facility has been under-designed to handle its intended volume of use; when management of the facility is poor; or when unexpected accidents occur because the manager failed to recognize the possibilities of a potentially hazardous situation. To reduce the possibility and exposure to liability, the Town should have in operation the following measures prior to opening any park or recreational facility:

- A thorough Maintenance Program that provides the appropriate duty or level of care to users
- A Risk Management Plan that appropriately covers all aspects of the Parks and Recreation System
- A comprehensive working knowledge of public use laws and recent case history applicable in North Carolina

Knightdale's existing program may be adequate to protect the Town government from financial loss that might occur through the development and operation of the Parks and Recreation System. The Town should review its current policy and check coverages to be certain that all aspects of its policies are up to date. Knightdale should exercise reasonable care in the design and construction of all facilities to reduce hazardous, public nuisance and life threatening situations.

IX. PARKS, RECREATION, OPEN SPACE AND GREENWAYS OBJECTIVES AND ACTION ITEMS

The Objectives and Action Items are provided to direct the planning and implementation strategies related to the parks, recreation, open space and greenway system in Knightdale and are in accordance with the overall goals of the 2027 Comprehensive Plan. Please note that the objective and action items outlined below are a result of the findings and recommendations of Chapter 6, Parks and Recreation Master Plan and Chapter 7, Open Space and Greenways Master Plan.

A. Objectives:

The Town shall seek to:

1. Enhance the quality of life for the citizens of Knightdale and Eastern Wake County by providing a wide variety of both passive and active leisure opportunities.
2. Provide a system of parks, greenways, recreation facilities and open space areas

that will assure quality recreation opportunities for present and future citizens of Knightdale and Eastern Wake County.

B. Action Items:

The following are the tasks which provide a course of action to implement the objectives for parks, recreation, open space and greenways:

6.0 The Town shall regularly evaluate the unmet parks and recreation needs of the community and work to try and meet them. A yearly evaluation is encouraged.

6.1 The Town shall work to provide for future generations and to reduce pressure and overuse of existing facilities.

6.2 The Town shall continue to update yearly a Capital Improvement Program to guide the provision for parks, recreation and greenway facilities.

6.3 The Town shall ensure that adequate land is available for future park development by placing a priority on and actively pursuing land acquisition in advance of its needs.

6.4 The Town shall provide facilities or recommend facilities through its recreation dedication ordinance that are easily accessible for people of all ages and physical conditions and within walking distance of every home and close to places of employment.

6.5 The Town shall develop facilities that provide a wide range of both active and passive recreational experiences.

6.6 The Town shall cooperate with the private sector to provide a variety of recreational opportunities.

6.7 The Town shall identify recreational needs that the public sector cannot provide and encourage the private sector to fill the void.

6.8 The Town shall promote and encourage public participation in the design of parks, greenways and open space areas.

6.9 The Town shall initiate a proactive, not reactive, approach to planning that maximizes citizen involvement.

6.10 The Town shall serve as a proponent of the School/Park concept and encourage future collaboration in the design process for new facilities.

6.11 The Town shall coordinate development efforts with Wake County Parks and Recreation and Wake County Schools to ensure optimal utilization of scarce fiscal, natural and human resources.

6.12 The Town shall provide funding for an increase in personnel and equipment to keep pace with the demands of a growing park system.

6.12 The Town shall coordinate with other public and private agencies in the maintenance of existing and future parks.

6.13 The Town shall coordinate with adjacent municipalities to create and enhance greenway linkages and access to regional park facilities.

6.14 The Town shall prepare a Risk Management Plan for parks, recreation, open space and greenways.

FIGURE 6.1: Town of Knightdale Inventory of Existing Parks, Recreation and Open Space Facilities

Facility	Acres	Amphitheater	Benches	Community Center	Dedicated Pedestrian Link	Outdoor Educational Area	Greenway (miles)	Grills	Gymnasium	Link to Greenway System (Y/N)	Multi-purpose Field	Multi-purpose Room	Outdoor Basketball Court	Passive Open Space	Picnic Shelters	Picnic Tables	Pond	Pool	Restrooms	Soccer / Football Field	Softball / Baseball Field	Tennis Courts	Tot Lots	Track	Volleyball Court
East Wake Middle School	36.9								1	N	1					2	1			1	2		1	1	
Lockhart Elementary School	1.8								1	N	1												1		
Knightdale ES	13.5		3						1	N	2									3			1		
Hodge Road ES	5.0									N		1													
Harper Park	4.6		3					6		N					2	6			1			2	1		
Environmental Park	8.0						0.2			N						2	1								
Caboose	0.5									N															
Mingo Creek Park	8.0									N				1											
Planters' Walk	9.3						0.46			N			1	1				1					1		1
Panther Rock	2.0									N															
Knightdale Recreational Center	18.8									N	1		1	1	1	2		1	1				1		1
Knightdale Community Park ***	69.0									N															
Total Acreage*	177.4																								
Total		0	6	0	0	0	0.66	6	3	x	5	1	2	3	3	12	2	2	2	4	2	2	6	1	2
Deficit / Surplus*		-1	x	-1	x	-1	29.09	x	-1	x	0	x	-7	x	0	x	x	2	x	-1	-3	-8	0	0	-4
Wake County Standard		1	x	1	x	1	29.75	x	4	x	5	x	9	x	3	x	x	1	x	5	5	10	6	1	6

*** - Under construction

x - No standard

Knightdale NorthCarolina

2002 Open Space and Greenway Plan

Greenways Incorporated

Acknowledgments

This Open Space and Greenways Plan study was made possible by the joint efforts of the Knightdale Planning Department and the efforts of local citizens. This public-private partnership represents the broad commitment by individual members of the Knightdale community to work together to improve the quality of life for area citizens.

A special thank you is given to the persons listed below for their time, support and participation in the completion of this Plan.

Town Council

Joe Bryan, Former Mayor
Jeanne Bonds, Mayor
Mike Chalk, Mayor Pro Tem
Jeff Eddins
Steve Meadows
Tim Poirier and William Wilder

Gary L. McConkey, Town Manager

Town Staff

Vivian Coleman, Planning Director
Mike Ciriello, Senior Planner
Tina Cheek, Parks and Recreation Director

Chapter 1: Introduction

Purpose

The Town of Knightdale, a community that represents a crossroads character as it enters the 21st Century, has prepared this Open Space and Greenways Master Plan in order to protect the natural and cultural resources that community residents value most. There are three principal goals of the plan: 1) to identify parcels and corridors of land that are in need of protection and conservation measures; 2) to establish a comprehensive approach that will link green space lands and corridors to residential, commercial, institutional and central business areas of the community; and 3) to define a concise set of strategies for protecting and conserving these corridors and at the same time developing public use facilities that would provide residents with access to these lands and corridors.

If the goals of this program are met, Knightdale will have achieved success in preserving the scenic and cultural character of the town while helping to shape future development in a sustainable direction. The protection of green space and the creation of connections to these areas will lead to a higher quality of life for Knightdale residents through recreation, increased property values and pedestrian friendly environments.

Consistency with Wake County Program

This Open Space Plan has been prepared to be consistent with a larger comprehensive Open Space Plan for Wake County. The County launched its open space planning efforts in 1999 to preserve natural and cultural landscapes. The County has encouraged and supported the preparation and adoption of municipal open space plans to ensure that there is continuity across jurisdictions. In order to comprehensively evaluate land in Wake County, each municipal government was asked to prepare its own open space plan. Because the character of the land within a municipal area helps define the character of a town, these individual assessments are viewed as critically important for the protection of resources and the way of life throughout the County. Further, the County adopted the following definition for open space to ensure a functional relationship between municipal plans and the county's open space program:

"Open space is a functional system of natural and cultural resources protected and maintained for the benefit of residents, businesses, and visitors."

The County's Open Space Program began with a focus on four key watersheds within the County: Falls Lake, Neuse River, Swift Creek and Harris Lake. This initial plan was adopted by County government and has led to the passage of a $15 million dollar bond referendum and the establishment of Partners for Open Space and the Environment (POSE). Wake County is currently engaged in a comprehensive open space planning effort that will tie together each of the twelve municipal plans.

As Wake County continues to grow in the 21st Century, it is hoped that these efforts of planning for the protection and conservation of open space will ensure that future generations will have access to the special landscapes and waterways that are unique to the County. Preserving and protecting these resources will also enhance the quality of life for future residents and ensure that Wake County is one of the great places to live, work and raise a family.

2

Inventory of Existing Conditions

History of Knightdale

In 1927, Knightdale was incorporated within the St. Matthew's Township in Wake County, North Carolina. The town is located 5 miles east of Raleigh. Many of Knightdale residents work for government, university, and commercial interests in Raleigh and in Research Triangle Park. Until the 1980's, Knightdale was a railroad and farming community. However, with the development of US 64 and Interstate 40, combined with Knightdale's proximity to Raleigh and Research Triangle Park, the town's transformation into a regional center (serving eastern Wake County) and a bedroom community (a suburb of the Raleigh-Durham metropolis) is underway.

By 2006, Interstate 540 will link Knightdale directly to the Research Triangle Park and Raleigh-Durham International Airport. The US 64 Bypass will be completed to I-440 by 2006, as well. The completion of this segment of US 64 will create a limited-access vehicular corridor from Raleigh, east to Greenville and Williamston. Future plans call for the road to attain interstate highway status from Raleigh to Norfolk, Virginia. I-540 will intersect US 64 Business, US 64 Bypass, and Forestville Road leading to residential and commercial development pressure at these locations. Knightdale would like to be prepared for this future growth and development. Preparation of this Open Space Plan is one of several growth management efforts that the town currently has underway.

Despite the role of the automobile in the town's more recent transformations, an active rail line runs through the community and is a principal connection between North Carolina's industrial Piedmont and the ports at Norfolk and Portsmouth, Virginia. Significantly, the town is included in the Triangle's proposed rail transit system with at least two stations proposed for the Knightdale by 2015.

Between 1990 and 2001, Knightdale's population increased from 1,700 to more than 6,000 residents, making it the seventh fastest growing town in North Carolina. The town's population has increased 216% during the past ten years. Although Knightdale continues to grow at a rapid rate, the people and events in Knightdale's history have left a lasting imprint in the cultural, architectural, and physical landscape of the area.

Bounds of the Study Area

The Knightdale Study Area is defined by extending a 2-mile radius around the current Urban Service Area (USA). This area is defined geographically by the I-440 Beltline to the west, Rolesville Road to the east, Poole Road to the south and Watkins Road to the north. This insures that the Open Space and Greenway Plan will account for future growth within the Knightdale area. This study area covers approximately 39,478 acres within eastern Wake County.

Topography

Knightdale is located east of the Neuse River and west of Wendell. Buffalo Creek separates Knightdale from Wendell. The historic town center was located along the ridge that separates the Neuse River and Buffalo Creek (see Figure 2-1). Mark's Creek flows south from the center of the corporate boundaries and serves as the primary drainage basin for the older portions of Knightdale.

Within the last 50 years, the town has seen a new development pattern of residential and commercial activities reaching along the Highway 64 corridor towards Raleigh. Development has also spread along the waterways of Mingo Creek, the Neuse River, and Mark's Creek. The landscape to the south of Highway 64 has a noticeably altered is has led to an altered appearance on the natural topography south of Highway 64 in general. North of Highway 64, the land is still mostly agrarian thus preserving the gently rolling topographic character of Knightdale.

Soils

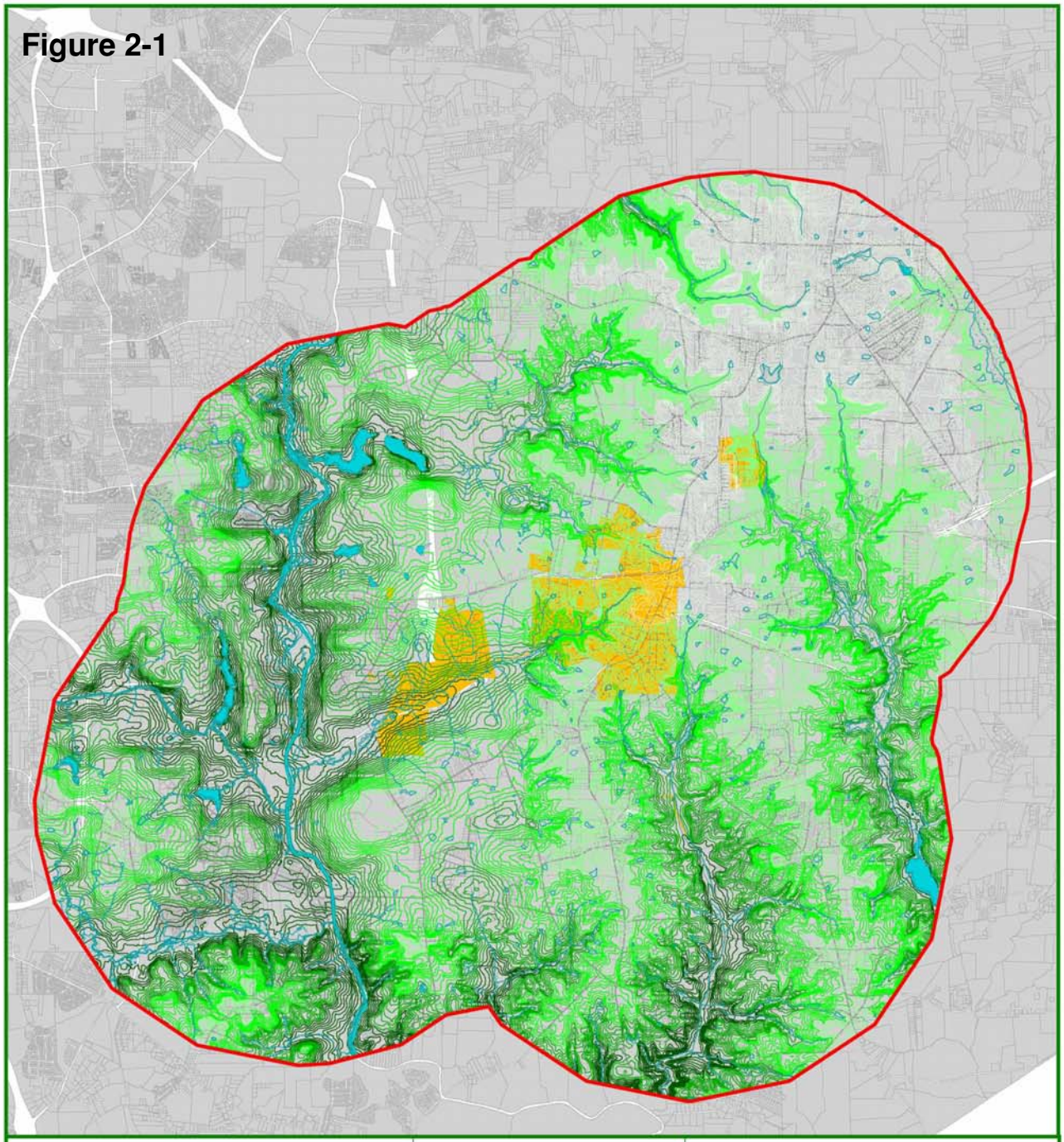
The soils within the Knightdale planning area are primarily of the Cecil and Wedowee classifications. The Cecil class is found mainly within the western area of Knightdale while the Wedowee class is predominant in the central and eastern parts of town.

Cecil soils occupy over 106,000 acres, or approximately 20 percent, of Wake County. They are found mostly in the northern and central portions of the county. From a distance, Cecil soils look like red clay and are easily spotted during construction projects and road improvements.

Cecil soils commonly have brown, sandy loam topsoil and red clay subsoil. These soils are formed from weathered granite, gneiss, and schist bedrock. They are deep soils with a depth to bedrock of no less than 6 feet and commonly more than 20 feet. Cecil soils are well drained. Water will move through the soil at a moderate rate. They are found on gently sloping to moderately steep uplands and have little problems with flooding.

Cecil is well-suited for a wide range of uses, such as agriculture, pasture and hay land, woodland, and urban development. For agriculture, the problems of erosion and low fertility are its biggest drawbacks. However, conservation practices such as terraces and diversions, strip cropping, contour tillage, no-till farming, and crop residue management help to control the soil erosion and surface runoff and improve the soil's ability to

Figure 2-1



Topography

Prepared by:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

3000 0 3000 Feet

Legend
- Contract boundary
- Streams
- Lakes

Topography
- 145 - 200
- 201 - 240
- 241 - 280
- 281 - 325
- 326 - 390

- Streets
- Knightdale
- Wake County

N

absorb water. Soil testing and timely applications of lime and fertilizer help to overcome the problem of low fertility. Cecil soils have no significant limitations for pasture and hay land or woodland. For urban areas, again, the biggest drawback is erodibility. Quickly vegetating disturbed areas and providing erosion control structures, such as sediment fences and catch basins, helps to keep the soil on-site and out of nearby streams.

Wedowee soils are found on approximately 13,000 acres or nearly two and a half percent of the county. Found scattered throughout the eastern and central parts of the county, Wedowee soils are most abundant in the Rolesville to Knightdale area.

Wedowee soils commonly have brown sandy loam topsoil and strong brown or yellowish brown clay subsoil. They formed from weathered granite, gneiss and schist bedrock. They are very deep soils with a depth to bedrock of more than six feet. Wedowee soils are well-drained and allow water to move through them at a moderate rate. These soils are found on gently sloping to steep uplands with no hazard of flooding.

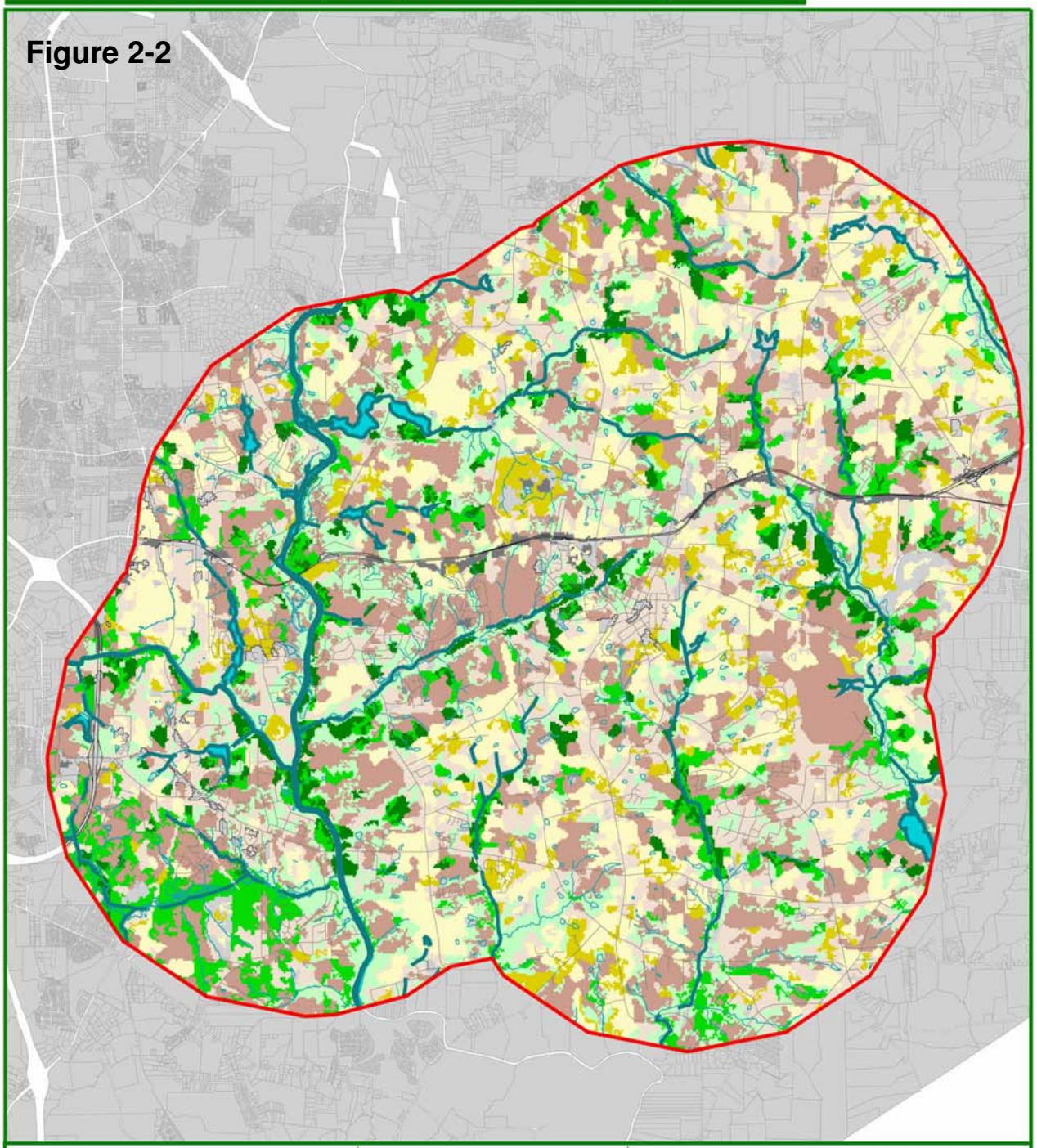
Wedowee soils are well-suited for a wide range of uses such as agriculture, pasture and hay land, woodland, and urban development. The erosion hazard is a concern for any land use where the soil will be left bare, even for short periods. Using best management practices that limit and control surface runoff and keeps the soil covered and helps to prevent erosion. Low fertility is also a limitation of Wedowee soils. Soil testing and timely applications of lime and fertilizer are needed for high yields or rapid plant growth. For areas of the county not served by municipal sewage, Wedowee soils are moderately suited for septic tanks.

While the Cecil and Wedowee soils cover the majority of the study area, there are areas that are made up of different classes. Soils found in areas around streams and the Neuse River are transitional with the seasons. They are hydric soils, meaning they are poorly drained and relatively fragile in terms of erosion and contamination (see Figure 2-2). These soils are deposited from flooding and runoff sedimentation. Hydric soils are on the verge of becoming wetland areas and support the fragile bottomlands/ swamp forest ecosystems. They are poorly suited for building and agricultural usage and should be considered for preservation programs.

Vegetation

The Knightdale ecosystem is in an altered state. Current land cover figures can be estimated by using 1996 Land Sat imagery and newly updated orthographic photography. The study boundary covers approximately 39,500 acres of land. Within the study area approximately 2% of the land is developed, 18.5% is used for cultivated agriculture, 5.5% is managed herbaceous cover, and 1.5% is occupied by water bodies. That leaves 72.5% of the landscape as being in an undisturbed state (see Figure 2-3). It is estimated that there is 10% more impervious surface area since the 1996 Land Sat imagery was taken.

Figure 2-2



Land Cover

Prepared by:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

3000 0 3000 Feet

Legend
- Study Boundary
- Unmanaged Herbaceous Wetland
- Managed Herbaceous Cover
- Cultivated
- Bottomland Forest/Hardwood Swamps
- Mixed Hardwoods/Conifers
- Mixed Upland Hardwoods
- Evergreen Shrubland
- Southern Yellow Pine
- Low Intensity Developed
- High Intensity Developed
- Streets
- Streams
- Lakes

N

The 72.5% of undisturbed land is split primarily between yellow pine forest, evergreen shrub land, bottomland and hardwood swamp forests, and upland hardwood forests; yellow pine forest being the most common and upland hardwood forests being the least common, respectively. The remaining portion of the undisturbed land is split between several smaller classifications that occur only in isolated areas. The bottomland and hardwood swamp forests are of the highest importance due to their location along stream and river corridors. These areas serve as the migration corridors for numerous species of wildlife as well as vital habitat because of their relatively intact linear coverage. Within this class exists the cypress swamp ecosystem, this ecosystem is very rare in the piedmont area due to the relatively arid climate and any known sites should be prioritized as a preservation goal. Robertson Mill pond and areas along Mark's Creek and Buffalo Creek contain such swamps.

The cultivated areas of Knightdale are primarily reserved for the production of soybeans and livestock pastureland. These areas are concentrated in the north with the exception of a prominent band of equestrian facilities in the south. The cultivated areas are vital to the preservation of Knightdale's scenic quality and should be considered important when redefining development guidelines for the 64 corridor, the future 540 corridor and 64 By-Pass.

Wildlife Habitat

According to the North Carolina Natural Heritage Survey information for Wake County, the historic habitat areas for Small's Portulaca are located in the northern regions of the study area. This Portulaca is part of a highly specialized microclimate that occurs within the fragile flatrock ecosystem. Flatrock is discussed further in the geology section of this report.

There are two broad categories of wildlife that are of concern to this planning effort: "interior" forest species wildlife and "edge" species wildlife. Most species of wildlife that inhabit urban areas are known as "edge" species. These mammals, birds, amphibians and insects have adapted to urbanized landscapes and have developed harmonious relationships with urban residents. "Interior" species wildlife require undisturbed forest environments to survive and, because of the human population growth and resulting land development, have experienced significant habitat loss and population declines.

Habitats for rare and common "interior" and "edge" species exist in various forms throughout the Knightdale area. Migration corridors allowing plant and animal species to move through the landscape typically connect diverse habitats. The migration corridors most important to the study area are along streams. The Knightdale Open Space and Greenway Plan is concerned with both the remnants of "interior" forest species and the "edge" environments that exist within the floodplains of the study area. These resource areas are the most valuable for wildlife in that they provide food sources, water and shelter. Approximately, eighty

percent of all wildlife depends on riparian corridors for survival. Therefore, the protection of floodplains is crucial to sustaining a diverse wildlife population in Knightdale.

During site visits, evidence was found of beaver, squirrel and deer populations. Opossum and raccoons are expected to be in abundance. Bird species that one can expect to find within the study area include: black-capped chickadee, red-bellied woodpecker, northern cardinal, and barred owl. Studies provided by Professor George Hess and his students illustrate habitat areas of the barred owl and bobcat within the study area through a combination of field research and GIS based habitat modeling. These models were used in conjunction with land cover thematic maps and aerial photography prior to field inventory.

Through the use of North Carolina Natural Heritage Inventory information, distributed from the CGIA, we were able to locate several endangered species' habitat areas. These species include the red cockaded woodpecker, the three-toed salamander, and the lesser brook lamprey. Freshwater mussels are located in the northern portions of Mark's Creek, Buffalo Creek and parts of the Sugar River.

Geology

Knightdale is located within the Rolesville Pluton. This geologic area is underlaid with granite. Knightdale is one of the few planning areas within the Eastern Piedmont of North Carolina to contain what is known as flatrock. Flatrock is a type of granite outcropping that occurs at the soil surface and can cover in excess of 900 square feet. These areas create arid microclimates that support an extremely fragile ecosystem reliant upon the very fine layer of topsoil. Temple Flatrock is the only protected outcropping of this type within the Knightdale study area. However, several areas towards the north are in the process of becoming protected. Any additional areas with this flatrock should be protected as they support Small's Portulaca (*Portulaca smallii*). This is a rare type of moss rose. It is listed as an endangered species identified through the North Carolina Natural Heritage Program. Several unprotected sites are currently being monitored in the northwestern portion of the study area and should be considered in preservation plans.

Field investigations have also revealed several areas of naturally occurring granite outcroppings similar to those found along Swift Creek and in western North Carolina. These areas occur along Mark's Creek and Buffalo Creek in close proximity to the Highway 64 corridor. This type of outcropping is exceptionally rare in the Piedmont.

Population

Knightdale has a population of 5,958 based upon the 2000 US Census. Given current development patterns within Wake County, the population is expected to grow by 25% in the next 10 years. Since 1990 the population of Knightdale has grown 216 percent.

Infrastructure

Currently, Knightdale purchases rights to sewer and water from the City of Raleigh. Knightdale maintains its sewer easements, however. The primary sewer line runs from Raleigh via the Neuse River and along Mingo Creek (see Figure 2-4). This is a potential greenway connection between the two municipalities. Spurs tie into this main line with the exception of the Covington Hills area. They maintain a separate septic system that may be connected to the larger sewage system in the near future.

Expansions of sewer lines and easements are planned along the Highway 64 Bypass to service future development within the interchange areas.

High-tension power lines run north-south along Mark's Creek Road (adjacent to the Square D property) and two lines run east-west parallel to Poole Road and the Norfolk Southern Rail Line. These two corridors provide a possible alternative connection to the towns of Wendell and Zebulon in eastern Wake County.

The rail line runs through downtown Knightdale and connects the region to the ports of Norfolk and Portsmouth, Virginia. This line is a potential rail trail corridor between Raleigh, Knightdale, Wendell, and Zebulon. Historically significant buildings lie along this railway including the old station building and the original caretaker's house. The importance of this corridor as a major transportation route will increase with the development of the Triangle Transit Authority's commuter rail system.

Land Use

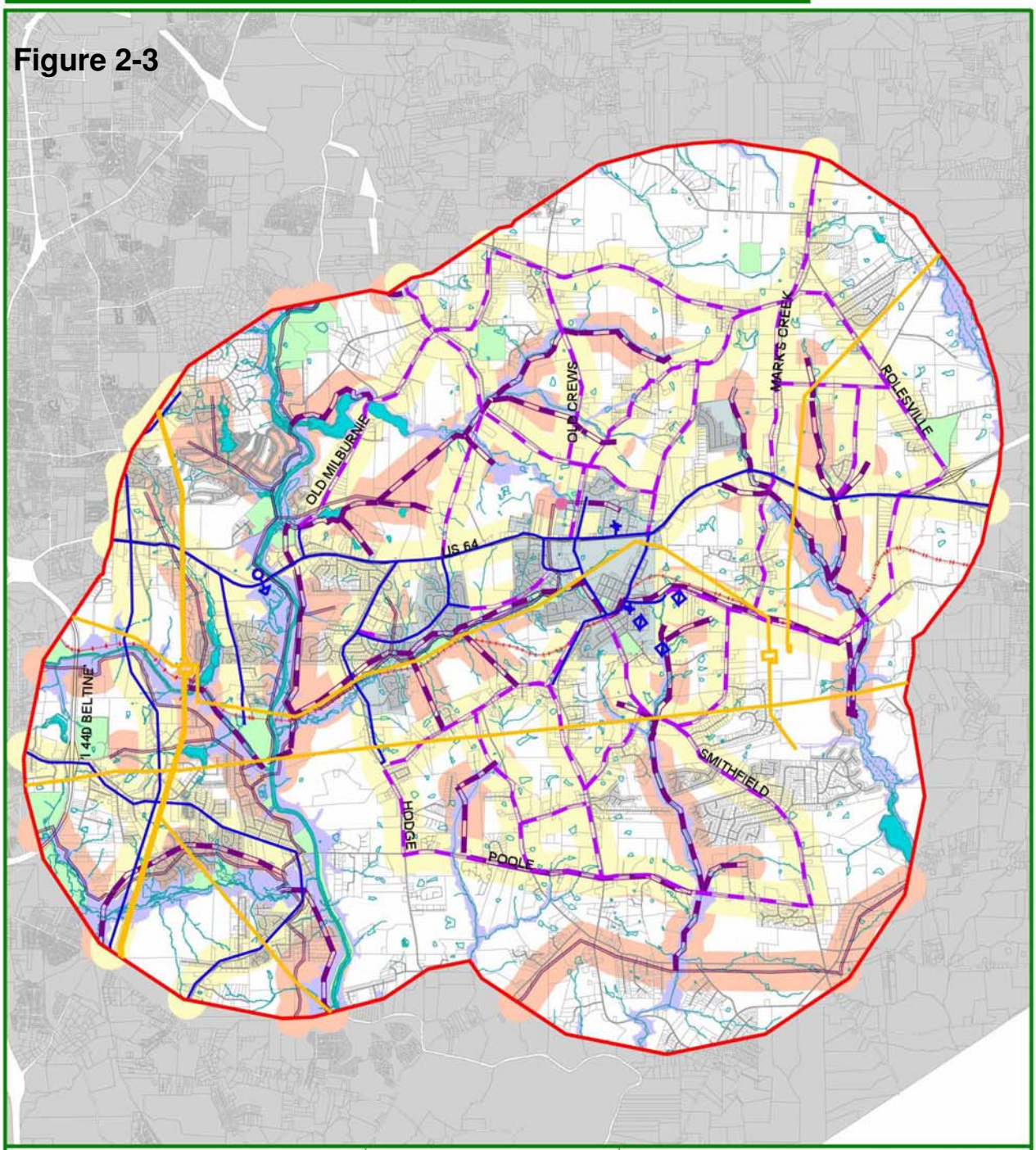
Knightdale is predominately an agrarian town with over 44% of the study area used for agricultural production (see Figure 2-5). 18.9% of the study area is currently developed for residential usage with an emphasis on detached single-family home development. Less than 0.1 % of the total residential development is used for apartments and high-density development. Currently, 15.9% of the area is vacant and in transition awaiting a new classification. The remaining 21.1% is classified as commercial, industrial or exempt land uses that include utility company property, churches, and schools.

Open Space/ Greenway Resources

Currently, Knightdale has one main park facility and two community park facilities within the study area. Harper Park is located in Downtown Knightdale and includes a tennis court, playground, picnic tables, grills and 2 picnic shelters. In addition, the Department partners with the Wake County School System and Wake County Parks and Recreation on two community parks located at Knightdale Elementary School and East Wake Middle School. These community parks provide recreational sports facilities during non-school hours. Knightdale and Wake County Parks and Recreation maintain the community park ball fields jointly. The Knightdale Parks and Recreation Department maintains Harper Park and other Town properties.

KNIGHTDALE Open Space and Greenway Plan

Figure 2-3



Infrastructure

Prepared by:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

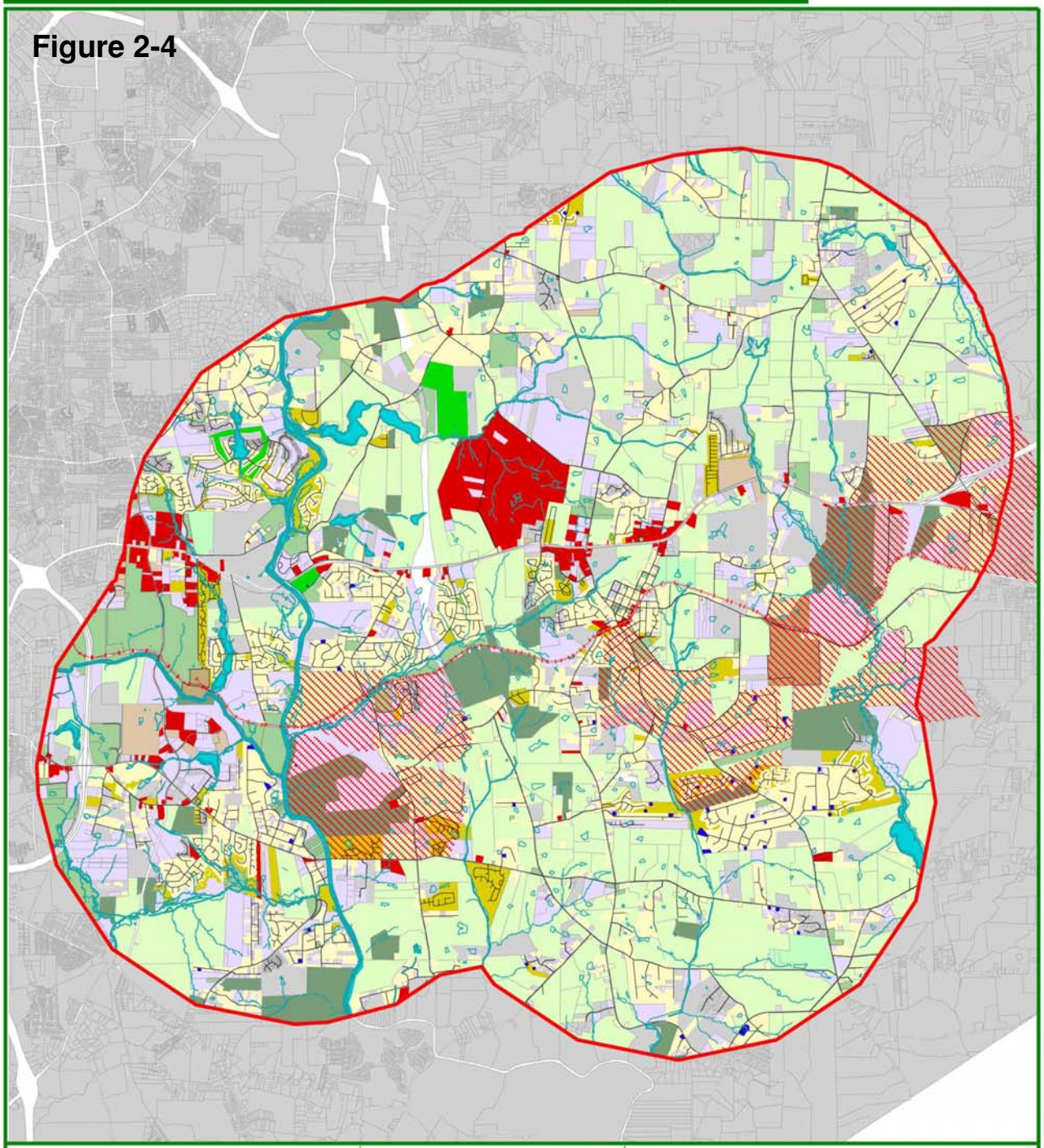
3000 0 3000 Feet

Legend

- Study Boundary
- Waste Water Facilities
- Sewer Lines
- Water Lines
- High Tension Powerlines
- Streets
- Railroad
- Parks
- FEMA
- Streams
- Lakes
- Potential Growth - Water Line Related
- Potential Growth - Sewer Related

N

Figure 2-4



Land Use

Prepared by:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

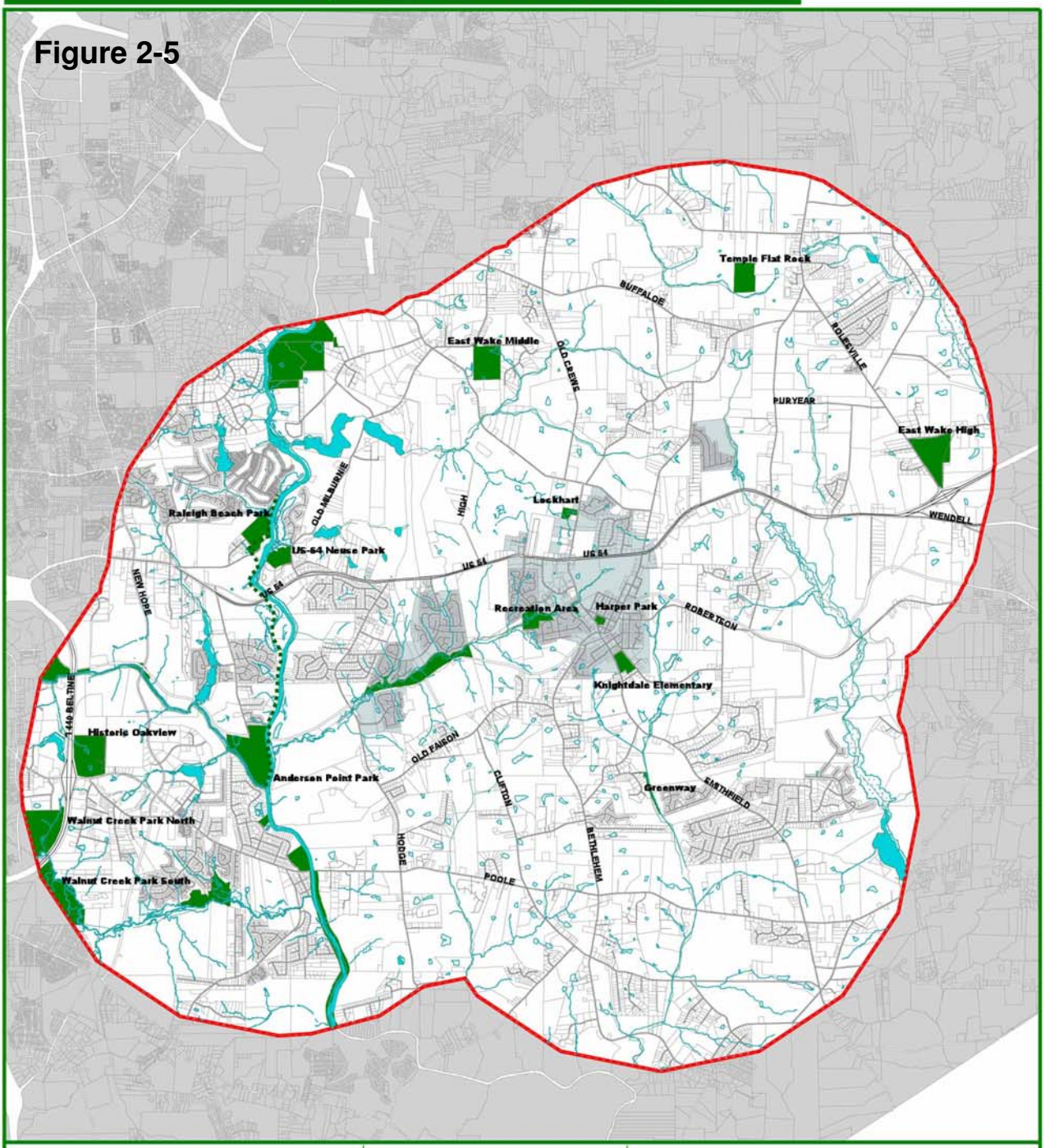
3000 0 3000 Feet

Legend

- 64 Bypass Interchanges
- Residential >10 acres
- Commercial
- Industrial
- Exempt
- Agri-Farm
- Residential <10 acres
- Study Boundary
- High Density
- Leased
- State Assessed
- Vacant
- Water/Sewer Sys.
- Golf Course
- Farm App.- Forestry
- Farm App. - Horticultura

N

KNIGHTDALE Open Space and Greenway Plan



Open Space

Prepared by:

GREENWAYS INCORPORATED

Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

3000 0 3000 Feet

Legend
- Study Boundary
- Existing Greenways
- Streets
- Streams
- Lakes
- Parks
- Knightdale
- Wake County

N

A recent addition to the parks of Knightdale is the Environmental Park located behind the Knightdale Town Hall (see figure 2-6). This signature project successfully integrates protected open space, a greenway component and connections to the nearby library and elementary school. Future additions to the park include boardwalk trails, educational components, a dock and picnic areas. Connections to future greenway corridors are also planned.

June 5, 2002 marked the groundbreaking of an even newer component to the Knightdale Park system. The Knightdale Community Park, located at the intersection on Forestville Rd. and Horton Rd., will include 6 ball fields, 3 multipurpose fields, a greenway system with boardwalk trails, an amphitheatre, picnic areas, playgrounds and volleyball courts. Connections to future greenway corridors are also planned. This site will also incorporate a High School and Elementary School.

Knightdale open space opportunities are primarily among three sites along the Neuse River. The recreational facilities at Anderson Point, East Neuse Park, and West Neuse Park provide passive recreation amenities such as canoe put-ins and trail access along the Neuse River Greenway. The Neuse River Greenway, which runs from Anderson Point to North Neuse Park along the west bank of the Neuse River, is currently not connected to Knightdale, however it could be connected via the Mingo Creek corridor. There are several viable locations for future Knightdale parks along the east bank of the Neuse River that would provide connections to existing open space.

Watershed Areas

The Triangle Land Conservancy manages Temple Flatrock in the northern portion of the study area. This important site provides habitat for Small's Portulaca. Access is limited to this site. While it is not accessible as open space, it does serve as a successful example of environmental preservation.

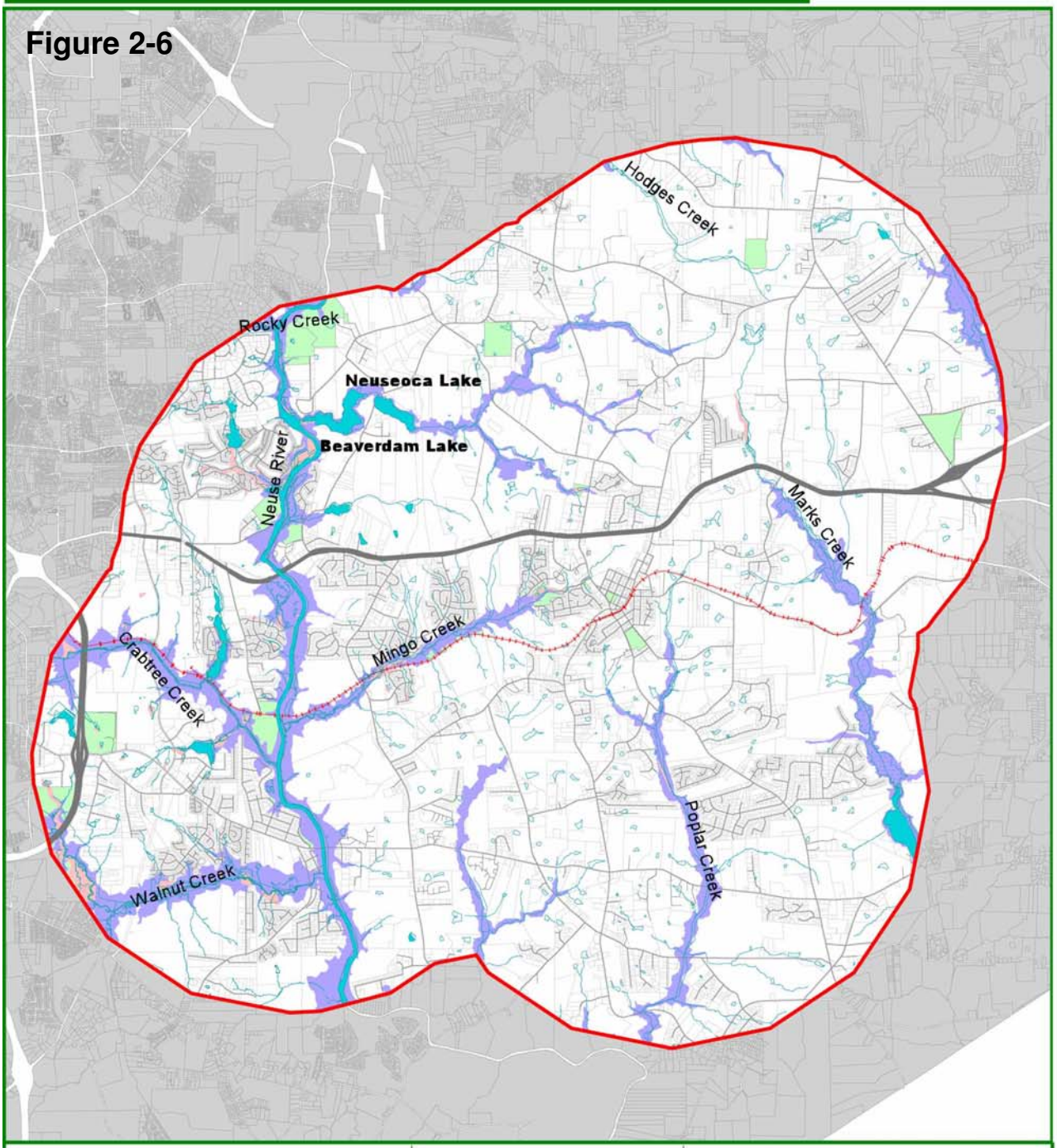
Potential recreational resource areas in the center and east of the study area are located along Neuse River feeder streams. Greenways could be established along the three major power line areas, Mark's Creek and Mingo Creek, and the two large sewer easements running throughout the town.

Neuse River

The Neuse River is the primary water body within the Knightdale study area. It is the major drainage basin for all of Wake County, with the exception of a small portion of the Cape Fear Basin located in the southwest corner of the county. The Neuse River basin is the primary source of drinking water in the downstream counties of coastal North Carolina.

The Neuse River is profoundly important to the ecological and societal

Figure 2-6



Flood Zones

Prepared by:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Data Sources:
Wake County GIS
NC CGIA Database
Knightdale Planning Department

Prepared:
November 20, 2001

3000 0 3000 Feet

Legend
- Study Boundary
- Railroad
- Roads
- Streams
- Lakes
- Wetlands
- FEMA Floodzones
- Wake County

N

health of North Carolina. This river is a source of drinking water, irrigation, recreation, and commercial activity. Yet, this river is extremely fragile as recent studies have shown. Due to increased development in the Neuse River basin, there has been an increase in flooding, a decline in water quality, and unhealthy outbreaks of the pfisteria bacteria. The Knightdale study area is located entirely within the Neuse River basin. Wake County's Water Quality Study, conducted by CH2Mhill, has illustrated that several of Knightdale's subbasins are impacted (see Figure 2-7). These subbasins contain Knightdale's most developed areas. The majority of the subbasins are restorable through a combination of smart growth initiatives and open space preservation.

Mark's Creek

Mark's Creek runs to the east of Knightdale in a north-south flow. It maintains a rather broad floodplain demonstrated by the extent of wetlands observed at major road crossings and various points along the corridor. This corridor is a vital habitat connection for the migration of deer, beaver and migratory birds as indicated by the abundant supply of hickory and oak trees along the edges.

This stream is currently protected only by the Neuse River Buffer Rules. It serves as a drainage facility for the Square D industrial area.

Towards the northern end of the corridor, the stream appears to be in good health. The banks are not overly subjected to encroaching development, and there appears to be enough upland area suitable for greenway and open space establishment.

Buffalo Creek

Buffalo Creek falls on the edge of the study boundary but is within the growth patterns anticipated by the Wake County Planning Department. This creek corridor is significant because of its unique ecosystem. It supports bald cypress swamps, like Robertson Mill Pond, towards its northern end. This creek is also a historic habitat for the lesser brook lamprey and for two species of fresh water mussel. Both of which are on the State's 303b List of significant species.

Mingo Creek

Mingo Creek flows, in a northeast to southwest direction, from the center of Knightdale to the Neuse River where it merges just north of Anderson Point Park. This creek corridor is planned to host a greenway through the Planter's Walk community to the center of town. Plans are currently suspended on the project awaiting land acquisition and public support. This corridor will be greatly impacted by the proposed outer beltline, as it will cross the creek in an undeveloped area between Planter's Walk and the historic center of Knightdale.

This creek is threatened by the 540 Outerloop and the proposed infill along the future Highway 64 Bypass. Both thoroughfares will spur development within the remaining vacant parcels further impacting water quality, flood containment, and the visual experience of the corridor along Highway 64 and Poole Road. The existing development along Faison Road is near the floodplain and has already impacted the creek corridor.

According to existing land use maps, several recreation areas are identified, but upon field verification, they are not publicly accessible. These areas would serve as staging areas for the greenway.

Knightdale is defined by three distinctive characteristics. These characteristics are: a crossroads community as seen from the Highway 64 corridor; a suburban bedroom community as seen through the numerous subdivisions south of Highway 64; and as a farm community north of Highway 64 along Forestville and Smithfield roads.

The separation between Raleigh and Knightdale along Highway 64 is disappearing rapidly in the wake of urbanization. The completion of the Highway 64 Bypass and the 540 Outer Beltline, and the accompanying new development, will greatly impact the Knightdale by blurring any remaining separation between the two municipalities.

Chapter 3: Greenspace System Recommendations

Methodology

Both remote research and direct observation were used to analyze the existing Knightdale Open Space condition. By examining the study area through graphic representations (objective data) and direct observation of actual conditions (subjective experience), a more comprehensive understanding is achieved.

Remote research consisted of gathering background data from previous studies and recently produced data. Studies and reports made available to the consultant include the Comprehensive Plan (1993), the Wake County Open Space Plan (1999), the US 64 Corridor Plan (1999), the Inventory of the Natural Areas of Wake County (1987), the Capital Area Greenway Master Plan Update (1989) and North Carolina's 303(d) List (1998) of streams deficient in water quality by Clean Water Act standards. Additional data was gathered from websites maintained by the U.S. Census Bureau, the Neuse River Foundation and sites offering environmental and cultural information specific to Knightdale. Finally, thematic maps were produced from Wake County Geographic Information Systems (GIS) data to graphically illustrate important conditions relative to geographic position. GIS applications are tools used to analyze spatial data and allow detailed geographic analysis. The strength of these applications is their ability to overlay separate layers of data and reveal patterns of interrelated landscape components.

In addition to the remote research conducted in the office, field research was done to verify these conditions, as well as to familiarize the consultant team with the distinct character of Knightdale. Field visits included vegetation identification, observation of water quality and soil conditions, photo documentation, identification of greenway opportunities and constraints, examination of residential and industrial development patterns, and ecological health estimations. Consultant visits to the field verified the office research and will serve to authenticate subsequent recommendations.

Linkages

Connectivity is the central concept of the Wake County Open Space Program. For each of the municipal plans to function together successfully, they must be completed with neighboring landscapes and municipalities in mind. Knightdale has cultural opportunities to connect to Raleigh, Wendell, Garner and Johnston County. Natural opportunities exist to connect to the Neuse River, Mark's Creek and Lake Myra.

Knightdale's primary consideration is to preserve its small town charm while allowing for future growth. Providing greenway linkages to the community and open space will accentuate that character and encourage the preservation of the most culturally, historically and naturally significant places in Knightdale. Greenways and open space will provide buffers from adjacent land uses, preserve the character of the landscape and allow people to access Knightdale via alternative, slower-paced modes of transportation. The preservation of these special places will also increase the value of land in Knightdale and encourage growth in the area.

Greenspace Elements

Targeted Open Space Acquisition

As a result of community meetings, staff and stakeholder comments, it is recommended that the Town of Knightdale supplement existing park systems with the following parks and open space acquisitions. These acquisition recommendations are broadly defined within this plan to cover geographical areas of the community which were agreed upon throughout the participatory planning process.

- First - The Town of Knightdale has just completed a park off of Forestville Road. It is proposed that this park be used as Knightdale's "central park" because of its proximity to the new town center and schools.

- Second - There is a need to establish a community park in the north-east area of the community along Mark's Creek. There is a chance that this park could be developed jointly with Wendell and Triangle J COG.

- Third - A community park was suggested in the northwest area of the town near East Wake Middle School and Neuseoca Lake.

- Fourth - A joint regional park with Wendell, and possibly Triangle J, is proposed with Wendell at Lake Myra.

- Fifth - There is an opportunity to develop a community park at the intersection of the Neuse River and Poplar Creek.

- Sixth - An area of farmland preservation is urged roughly from Highway 64 south to the Neuse River and from Hodge Road east to Mark's Creek (See map on page xxx).

Scenic Corridors

Knightdale has four main entry-ways (Highway 64, Hodge Road, Poole Road and Smithfield Road) into the community and a significant thoroughfare coming online (Highway 64 Bypass). Each of these corridors is significant for the first-impression that visitors receive as they enter Knightdale. Scenic value along these roads should be preserved for the residents and visitors of Knightdale. Preserving open space and establishing buffers alongside these corridors will promote the scenic qualities of Knightdale.

Highway 64

The Highway 64 Corridor is Knightdale's major east-west connector and its main access road. It bisects the center of town and connects it with Wendell and Raleigh. It is used as a major thoroughfare for commuters to and from Raleigh. The corridor is lined with commercial parcels without any buffers. This will make it difficult to preserve open space and protect buffers along the corridor. Some roadside beautification/planting has been done in the center median of the highway. As Knightdale continues to grow, the beautification of this corridor will become increasingly important.

Hodge Road

This north-south corridor is a major entrance into the town from Garner, Raleigh and Johnston County. Road improvements are already planned to accommodate the increased traffic. Buffer preservation is necessary along this roadway to protect its rural character.

Poole Road

Poole Road skirts the south side of Knightdale, from east to west. It connects Knightdale to south Raleigh and Garner. The large grouping of farms along this corridor give it a rural feel. Poole Road also crosses the Neuse River and Mark's Creek/Lake Myra, two of Knightdale's most ecologically sensitive areas. Since this road's access opportunities, adjacent scenic farmland and ecologically sensitive areas, it is important to preserve this viewshed.

Smithfield Road

Smithfield Road is the main north-south axis into Knightdale. This road connects old downtown Knightdale with the new town center. It also connects the town with Johnston County to the south. Even though there are several neighborhoods located off of Smithfield Road, as you leave town, this corridor becomes increasingly rural. It is important to preserve this rural farmland character as the town of Knightdale continues to grow around it.

Highway 64 Bypass

The Highway 64 Bypass is a concern and a relief for many Knightdale residents. Many welcome the diversion of traffic and the economic growth of the town to the south, but fear of the degradation of the landscape as a result of the construction. While the bypass is designed to move traffic quickly around the downtown core, it does not have to be a design of convenience, only. Even though commercial development districts are planned near the interchanges, it is important to buffer the site and sound of the highway from the surrounding development. This will be

welcomed by the residents and enjoyed by commuters. Today's vehicular society draws many of its perceptions of a community through the windshield.

Greenway System

Overview

The future of open space and greenways in Knightdale is envisioned as a system of outdoor spaces that function as healthy, protected ecosystems. Contiguity is critical to the concept of preserving open space in Knightdale. The benefits of open space and greenways is maximized when they are linked together. Contiguous natural areas are better equipped to function as healthy, interrelated ecological systems. As such, they are more stable, provide more "edge" habitat for wildlife and allow a place to retain its natural character.

Despite common public perceptions of open space and greenways, this plan does not view these outdoor resources solely as passive recreation areas. Rather, these natural resources should fulfill multiple objectives. Objectives should include progressive floodplain management, wildlife habitat and improved water quality. Areas that are well-suited to host trails can provide passive recreation facilities, environmental education and alternative transportation routes.

Recommendations for a system of open space and greenways in Knightdale are based largely on community input that includes civic organizations, public agencies and the general public. Corridors and open space locations were identified and presented in map form at meetings with and public workshops. All public comments received from these meetings and workshops were incorporated into the recommendations for the open space and greenways system.

Proposed greenways are located along natural and human-made linear corridors that generally follow streams and roadways within the study limits. In this manner, greenways will fulfill objectives related to alternative transportation, natural resource conservation, water quality and floodplain management, in addition to their function as recreational resources. Corridors were also selected to ensure development of a continuous system off greenways located throughout Knightdale and extending to neighboring jurisdictions. It is expected that many Knightdale neighborhoods will want to connect their greenway systems to the larger, municipal system. This is encouraged. However, it will be necessary for groups wishing to connect to the Knightdale municipal system to seek permission from the Knightdale Planning Department. Efforts to join systems will require coordination between the Planning Department and neighborhood associations. It must be clear to all parties that connecting to the municipal system does not transfer the neighborhood greenways responsibilities of safety, security and/or maintenance to the Knightdale Planning Department.

Proposed open space areas (as opposed to greenways) are not necessarily linear corridors. Open spaces identified in this plan are larger properties that contribute to the preservation of Knightdale's natural character and scenic beauty as well as preform ecological functions. In fact, open space preservation does not require public access or ownership in order to meet the desired objectives. Open space protection serves as a cultural resource and/or as an environmental resource. Opportunities to express the cultural and environmental resources in Knightdale can be manifest in the creation of a central park feature. Such a facility could serve as a destination point and an organizing feature for the community and the greenway system.

The strength of executing the open space and greenways system recommendations will be in the contiguity of natural resources. However, it is not practical to consider the acquisition of properties and easements and the development of facilities as a single unit. The following pages highlight individual segments of a contiguous system. The segments are described and the objectives for incorporation are discussed.

Greenway Descriptions and Objectives

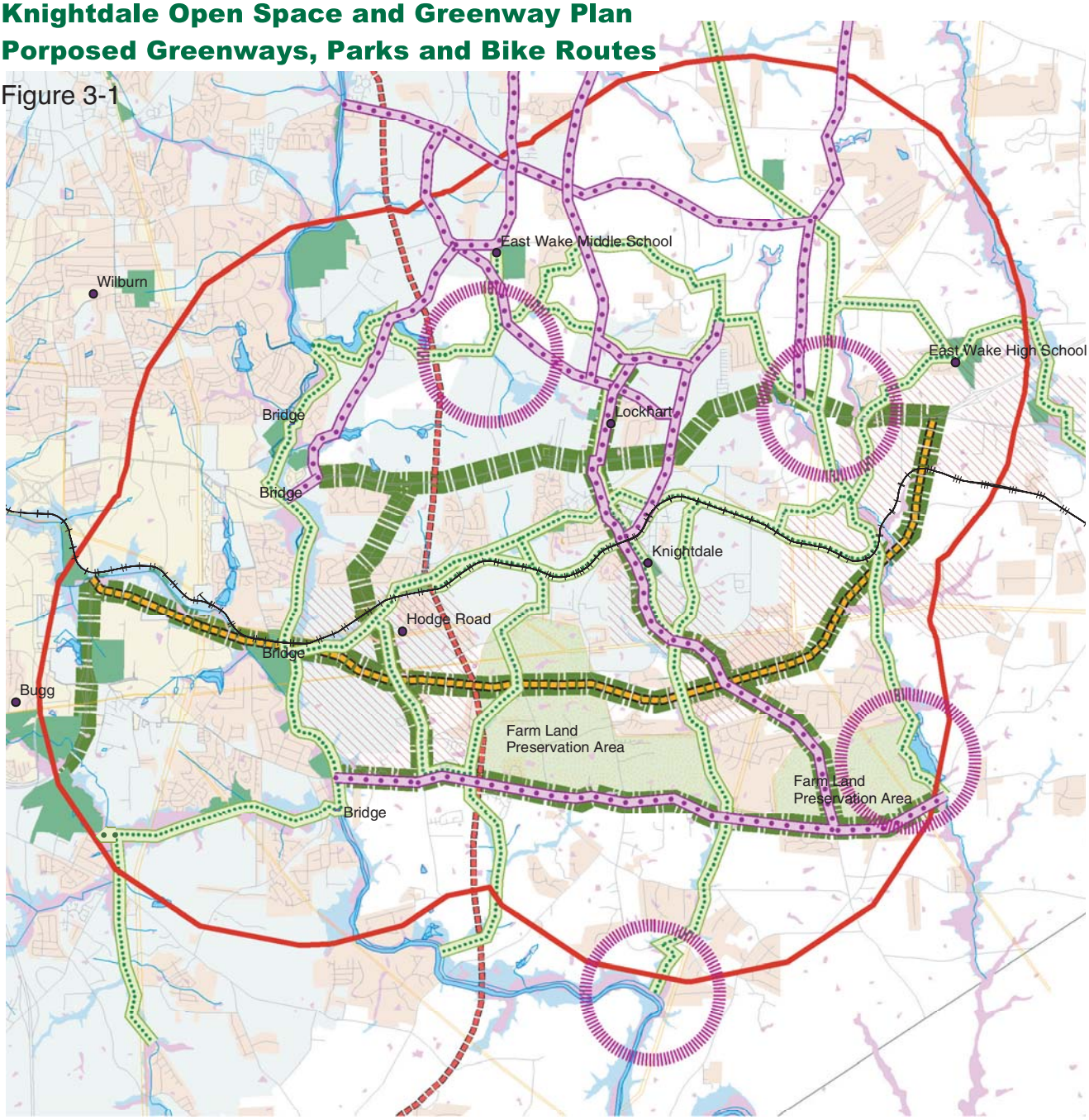
There are several types of greenways that can be used in the following areas. They are explained in depth in Chapter Four. In general, there are five types. Type 1 is reserved for extremely sensitive sites where no access is allowed. An example might be a stream where the water quality is low due to erosion or a site that is an endangered species habitat. Type 2 allows only pedestrian access. Since the surface is usually mulch, dirt or gravel, this cannot be used in a frequently flooded area. Type 3 is an unpaved surface that allows for multi-purpose use. It can be used near a stream, but out of the floodway. Boardwalks can also be incorporated to cross wet areas. Type 3 and 4 are the most preferred types because of scenic and safety reasons. Type 4 is a paved multi-use separate trail. It is not attached to the road, but it can be adjacent to one.

There are five primary greenway corridors that connect Knightdale's neighborhoods, parks, schools, town center and nearby municipalities. Greenways along Smithfield Road, Poole Road, Old Crews Road, Buffaloe Road and Hodge Road will help move people through Knightdale and connect them with surrounding communities.

Smithfield Road and Old Crews Road combine to make the main north-south axis through Knightdale. These roads connect Knightdale with Wake Forest and Johnston County. Both corridors are largely rural, except for the stretch of Smithfield that runs through the town of Knightdale. There are also several neighborhoods that line the southern end of Smithfield Road. A Type 4 multi-purpose, paved trail is proposed from the intersection of Old Crews and Buffaloe Road to the intersection of Old Crews Road and Forestville Road. A Type 5 sidewalk and bike lane are proposed for Smithfield Road from Horton Road through town to its intersection with Poplar Creek. This type is suggested because of the amount of development that is already present here. From the intersection of Smithfield Road and Poplar Creek south to its intersection with Poole Road, a Type

Knightdale Open Space and Greenway Plan
Porposed Greenways, Parks and Bike Routes

Figure 3-1



October 2002

Prepared By:

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

N

1 0.5 0 1 Miles

Legend
- Railroad
- Lakes
- Streets
- Proposed Passive Parks
- Proposed Greenway Alignment
- Proposed Bike Routes
- 64 Bypass
- Farm Land Preservation Area
- Bypass 64 Development Districts
- Jurisdiction
- Corporate Limits
- FEMA
- Wetlands
- Scenic Road

4 multi-purpose, paved trail is proposed. The separated trail is in keeping with the scenic quality of this corridor.

Hodge Road is the other primary north-south connection for Knightdale. Because this road is a major connector to Raleigh and Garner, it has been redesigned as a parkway. While the road is being redesigned and reconstructed, a Type 4 multi-purpose trail or a Type 5 sidewalk and bike lane should be incorporated, depending on which one is more feasible. This would enhance the beauty and functionality of the new parkway. Please see Chapter B, page 41 for ideas on how to incorporate these trail types with the parkway.

The Buffaloe Road corridor creates the main east-west connection to the north of town. It connects Knightdale with Raleigh and Wendell. A Type 5 bike lane is suggested along this route.

The primary east-west connection to the south of town is Poole Road. This connects Knightdale to Raleigh, Garner and Lake Myra. A Type 5 bike lane is also suggested along this corridor. There is good visibility, but shoulders need to be widened for a bike lane in some areas.

There are many secondary greenways that support Knightdale's primary greenway system. Some of these greenways require a Type 5 bike lane. They include Old Milburnie Bike lane, Forestville Road Bike lane, and Rolesville Road Bike lane. These corridors are generally in rural areas that do not have high amounts of traffic. A bike lane would offer an alternative type of transportation, recreational options and connections to other greenways. Since 1st Avenue runs through the old town center, a Type 5 sidewalk and bike lane is suggested. When 1st Avenue crosses Highway 64 and turns into Old Knight Road, a Type 5 bike lane is sufficient. The East Wake High School Loop (including Robertson Pond Road, Rolesville Road, Rolesville Road, Puryear Road and Marks Creek Road) requires a Type 5 sidewalk and bike lane to connect neighborhoods and the school. The visibility on this loop is good and the shoulders are sufficient for a sidewalk.

A Type 4 multipurpose path is proposed for some of the secondary greenways such as Neuse River Greenway, Mingo Creek Greenway and Walnut Creek Greenway. The proposed Mountains to Sea Trail follows the Neuse River. This trail cold be developed in conjunction with Knightdale, Mountains to Sea Trail and Raleigh (a large portion on Raleigh's side is complete). A multi-use path is more suited for its potentially high amount of traffic. There is also a proposed plan for the Mingo Creek Greenway, which connect the adjacent neighborhoods with the Neuse River and several parks. The proposed Walnut Creek multi-use trail will connect the Mountains to Sea Trail with Walnut Creek Park and Garner. The Walnut Creek corridor is currently rather undeveloped, though many subdivisions are planned for this area. To avoid possible conflicts with owners, easements should be secured as a condition of subdivision approval. A Type 4 trail is also suggested for the abandoned rail road through Knightdale.

This trail will connect the Mark's Creek Greenway, the Poplar Creek Greenway and the Smithfield Road Greenway/Bike lane with the Mingo Creek Greenway.

For some of the more sensitive corridors, such as Big Branch Greenway, Cross Creek Greenway, Poplar Creek Greenway and Beaverdam Creek, Type 2 and/or Type 3 trails are proposed. By limiting the access and impervious surface, the health of these streams are protected. Some areas along Big Branch and Cross Creek might be better suited to sidewalks along adjacent roads. Both are narrow waterways with low density housing nearby. Poplar Creek Greenway also runs through low density development and is very narrow. There is a powerline easement that parallels this creek that can be used if there are conflicts along the creek corridor. At grade crossings are necessary for all of these. Boardwalk may be needed in wetland areas, especially along Poplar Creek. Beaverdam Creek Greenway also has a large amount of wetlands that may require boardwalk. This greenway has two branches: one to East Wake Middle School and one to the Smithfield Road/Horton Road/Old Crews Road Greenway. The branch to East Wake Middle School should either be upgraded to a Type 4 multi-purpose trail or a Type 5 sidewalk and bike lane to provide for children who ride their bikes to school. Beaverdam Lake and Neuseoca Lake are also located along this corridor near its intersection with the Neuse River. Closer investigation is needed to determine how to work the trail around these two lakes.

A Type 1 or Type 2 trail is proposed for the Marks Creek Greenway, which is the most sensitive corridor in Knightdale. This creek is the habitat for some rare species, including some freshwater mussels. This trail corridor connects the East Wake High School Loop and the Rail road Greenway to the north with Lake Myra and the Poole Road Greenway to the south. There are many wetland areas along this creek. Therefore, the path must be a Type 1 or 2 trail outside of the flooded area or a Type 3 boardwalk. The corridor is heavily vegetated and at grade crossings are necessary. At the intersection of Marks Creek and Highway 64, the greenway will continue north along the power easement. From this point northward, the greenway will be upgraded to a Type 3 trail.

Chapter 4: Implementation Program

Phasing

Because of the expense, private property issues, and comprehensive nature of this effort a phasing program is required for successful implementation. The Knightdale Open Space and Greenway System can be broken down into four phases of future development in order to be executed in a manageable manner.

Phase One

Phase One focuses on the development of the five primary greenways in Knightdale: Smithfield Road, Poole Road, Old Crews Road, Buffaloe Road and Hodge Road. These greenways will help connect the residents of Knightdale with its commercial area, schools, open space and parks. While these greenways will potentially have recreation destinations, having alternative transportation options is also important to the community. This system of trails would primarily be an on-road system of trails. By installing these five corridors, there will be a greenway on the north and south sides of town, along with the east and west part of town. It will also make the new town center more walkable while connecting it other trails. These corridors are also important to connect Knightdale with its neighboring towns and counties.

Phase Two

Phase Two of the greenway system will focus on some of the trails that are already in the works and that will connect to the primary trails. These include the Neuse River Greenway, the Mingo Creek Greenway and the Mark's Creek Greenway. The Neuse River trail will be part of the Mountains-to-Sea Trail, as previously stated. This particular section (from Durham to Johnston County) is scheduled to be completed in the next five years by the State of North Carolina. The Mingo Creek Master Plan has also been in the works for the past few years. Mark's Creek Greenway is being studied by Triangle J (from Lake Myra to the south) and by Wendell (from Lake Myra to the north). Both are already looking at property along the corridor and would like to partner for a greenway trail. The railroad should also be included in this phase because it is a major east-west corridor that is already cleared and secured that runs through the center of town.

Phase Three

Phase Three includes the preservation of several stream corridors. These include: Big Branch Greenway, Cross Creek Greenway, Poplar Creek Greenway, Beaverdam Creek Greenway and Walnut Creek Greenway. The benefits that these greenways can bring to Knightdale include: stormwater capacity (required with the increased impervious surface of development), community recreation and buffering for adjacent land uses and neighborhoods.

Phase Four

The last phase continues to connect Knightdale with the greenway network using bike lanes and sidewalks. The 1st Avenue sidewalk and bike lane will connect a dense neighborhood area with the greenway system and the rest of town. The East Wake High School Loop will give children and parents access to the school. Old Milburnie Road Bike Land, Forestville Road Bike Lane and Rolesville Road Bike Lane will give access to Knightdale's residents access to the Wake County Greenway System and to other towns. It will also encourage other County residents visit Knightdale.

Greenway Trail Types

Two important issues for the Town to consider while designing greenway facilities are the surface types of trails and the width of trails. These two variables will greatly effect the cost of installing and maintaining this system. When determining the width of greenways the Town should consider the safety of the user groups for which the trail will be built. We recommend a minimum trail width of 10' for any facility intended for bicycle use. This allows enough room for cyclists traveling in opposite directions to pass each other comfortably. An 8' minimum width is recommended for walking/jogging/hiking trails.

There are several different surface types that could be used to build the Knightdale Greenway System. The following descriptions briefly explain some of the trail surface types that can be considered for this greenway system. See Appendix B: Design Guidelines for specifications.

The Knightdale system includes five trail types. The selection of the appropriate type depends on anticipated use, topography, hydrology, existing road access and a host of other factors. The following typology of trails will assist in defining and designing future greenway projects. Construction methods for specific trail types may vary between areas in the region depending on local environmental conditions and user requirements.

Type 1: No Facility Development

This designation applies to corridors containing environmentally sensitive areas, steep slopes, wetlands or other constraints that make trail facilities undesirable or impossible. The corridor will remain primarily in a natural state as human access will be extremely limited. Other functions for these corridors include floodplain management, water quality protection

and conservation of important habitat for wildlife and plants. Preserving connections between wildlife habitat areas is also an important function of such corridors.

Environmentally sensitive areas may be further described as those that contain significant natural resources, remnant landscapes, and those that are unsuitable for development but offer natural resource potential. Sites with steep slopes, mature or virgin natural vegetation, ravines, wetlands and streamsides are typical of such locations in the Knightdale project area. Resource quality is the primary determinant when it comes to selecting a site for preservation. Sites that exhibit unique natural resources or remnant landscapes of the region should be of the highest priority. Outlots and undevelopable/protected lands should be selected on the basis of enhancing the character of the community, protection of stream corridors, and providing linkages with other system components protecting natural systems and processes.

In these areas avoid actual trail development. Hikers are free to use wildlife trails, creeks and other natural features, however, no support facilities, signage or amenities are recommended.

Type 2: Limited Development, Low-impact Uses

This designation applies to corridors containing environmentally sensitive features that limit the extent of greenway facility development. The corridor will remain primarily in a natural state, with gravel, or dirt trails (4 to 6 feet wide) for use by low impact user groups such as hikers or joggers. Trailhead facilities and other amenities (such as signage and picnic tables) will be limited. Boardwalks may be necessary to cross wetlands in these areas.

These areas are valuable to tie park components together to form a cohesive system. They also emphasize harmony with the natural environment while allowing more access than a Type 1 Trail. Type 2 Trails have a great deal in common with Type 1. Both preserve natural resources and mediate between larger habitat areas, open space, and corridors for wildlife. Corridor widths of 200 feet are considered optimal with 50 feet usually considered the minimum.

Type 2 Trails are designed to accommodate pedestrians and are not intended for cyclists or other wheeled users. These paths, often very narrow, sometimes follow strenuous routes and may limit access to all but the most mobile users. Construction of these trails consists of providing positive drainage for the trail tread and should not involve extensive removal of existing vegetation.

Boardwalk or wood surface trails are typically required when crossing wetlands or other poorly drained areas. While boardwalks can be considered multi-use trails, the surface tends to be slippery when wet. They are constructed of wooden planks or recycled material planks that form the top layer of the boardwalk. The recycled material has gained popularity in recent years since it lasts much longer than wood, especially in wet

conditions. A number of low-impact support systems are also available that reduce the disturbance within wetland areas to the greatest extent possible.

Type 3: Multi-Use, Unpaved Trail Development

This designation applies to greenway corridors located outside of areas which experience frequent flooding. Aggregate surface trails (10 feet minimum width) are appropriate for corridors outside the floodplain where anticipated use or the adjacent landscape dictates a more natural trail.

These trails are restricted to pedestrian and bicycle activity. Wheelchair users and persons with strollers can use unpaved trails if they are designed to ADA standards and surfaced with compacted limestone screenings or other hard, permeable surface, crushed stone. Trailhead facilities and other amenities (such as benches, signage and picnic tables) are appropriate with this type trail and will be developed as needed and where desirable.

While less expensive to install, unpaved trails typically require more frequent repairs. Careful consideration should be given to the amount of traffic the specific segment will generate since these surfaces tend to deteriorate with excessive use. Another important design issue is providing for proper drainage of aggregate trails. It is best if water is channeled beside the trail rather than allowing it to cross the surface. Materials that can be used to surface a Type 3 Trail include, soil cement, compacted limestone screenings, and crushed stone.

Type 4: Multi-Use Paved Trail Development

This designation applies to corridors where high use is anticipated, that do not contain environmentally sensitive areas, will most likely be used as transportation routes, and are located within frequently flooded areas. The paved trails can be surfaced with asphalt or concrete (10 feet minimum) for use by several user groups, including bicyclists, joggers, wheelchair users and rollerbladers. Although asphalt is the most common paved surface used for greenway trails, concrete is best for areas experiencing frequent flooding. Trailhead facilities and other amenities will be developed as needed and where appropriate.

Typical pavement design for paved, off-road, multi-use trails should be based on specific loading and soil conditions found on site. They should be designed to accommodate maintenance and emergency vehicles in both width and loading.

Asphalt is a popular trail surface in the region. It is highly flexible, relatively inexpensive to lay and holds-up well over time. One concern with asphalt is the deterioration of trail edges. This condition can be reduced through the installation of geotextile fabric under an aggregate base and the provision of 2-foot shoulders. There are many cases in the metropolitan area, however, where asphalt is installed directly on compacted

subgrade and performance is acceptable. It is important when omitting the aggregate base to pay close attention to subsurface conditions and drainage to insure a stable subgrade prior to paving.

The minimum width for a two-directional trail is 10 feet. Centerline stripes should be considered for paths that generate substantial amounts of traffic. Possible conflicts between user groups must also be considered during the design phase since cyclists often travel at higher speeds than other modes.

Type 5: On-road (Sidewalks and Bikeways)

This trail type has perhaps the most variation of use and construction. This designation applies to corridors in urbanized or urbanizing areas where an off-road option is not possible, corridors function as connections between off-road trails and major origins and destinations and where different users have different needs: i.e. recreational cyclists versus commuter cyclists. This category includes both sidewalks for pedestrian use and bikeways for cyclists. Bikeways can vary from 6-foot wide bicycle lanes (complete with pavement striping and signage) to 4-foot wide paved roadway shoulders to a 14-foot wide curb lane (to be shared by cyclists and motorists). Pedestrian scale lighting, street trees, benches and other amenities can be developed to encourage sidewalk use.

Equestrian Trails

Equestrian trails need to be separated from facilities that are used by pedestrians and cyclists. Equestrian trails tend to prefer longer segments of trails to ride. Knightdale may wish to explore the possibilities of a shared facility with other nearby towns. This would enable the trail to span a greater distance, connect the different towns, and create an opportunity for the towns to share in the investment of a stand-alone equestrian trail or one that parallels a pedestrian and cyclist trail.

Summary Action Plan

The following Action Plan for the Knightdale Open Space and Greenways Plan describes the Plan's overall implementation strategy, identifies five objectives to accomplish that strategy and recommends 37 actions to accomplish those objectives.

Implementation of this plan requires the cooperative effort of a variety of public and private organizations, and involves implementation by landowners and citizens, as well. It is the intent that this plan be fully implemented over the next 10-20 years. However, some of the long-range actions, principally those involving water quality, are complex and may take time to implement. Therefore, an important part of this plan's implementation will be identifying which actions should be initiated immediately and which should be pursued at a later date. The following outline fulfills this need by providing a priority for implementation for each action.

It is important to note, however, that many actions can be pursued simultaneously. The list is intended to provide general direction only, and long-range actions should be implemented if conditions are favorable.

Short-Range Actions

(Initiated within the first five years of plan implementation)

I.) Objective: Establish a greenway corridor and stream buffer zone for all major streams
- A.) Initiate new land acquisitions for greenway preservation and trail development
- B.) Initiate new conservation easements on selected properties
- C.) Initiate acquisition/protection of vacant properties within the greenway boundary
- D.) Increase public education and technical assistance to property owners
- E.) Encourage protection of streamside trees and vegetation

II.) Objective: Develop multi-purpose recreational trails
- A.) Implement land trails along mentioned in Phasing section
- B.) Acquire property for regional trailheads and a water quality demonstration project

III.) Objective: Improve water quality
- A.) Implement buffers along stream corridors
- B.) Acquire and/or protect parcels in water recharge areas

IV.) Objective: Restore natural areas
- A.) Implement restoration and demonstration projects
- B.) Protect streambanks and complete streambank stabilization projects using environmentally friendly bioengineering techniques along creeks in areas which have the greatest erosion

V) Objective: Reduce flood damages
- A.) Remove or relocate repetitively damaged structures from the floodway
- B.) Limit construction in the floodway by increasing buffers along streams

Long-Range Actions

(Initiated and/or completed within 10 years of plan adoption)

I.) Objective: Develop a multi-purpose recreational trail
- A.) Encourage coordination with developers on trail improvements opportunities
- B.) Implement multiple use trailheads

C.) Implement signage program
D.) Install vegetative screening to shield selected land uses

II.) Objective: Improve water quality
A.) Increase water quality public education and technical assistance program
B.) Work to minimize impervious surfaces and to improve infiltration
C.) Acquire, restore and/or construct wetlands
D.) Promote use of native vegetation
E.) Use wetland detention basin designs or retrofit existing basins
F.) Enforce erosion and sediment controls

III.) Objective: Restore natural areas
A.) Actively manage riparian zones and natural areas to control non-native species

IV.) Objective: Reduce flood damages
A.) Provide technical assistance to property owners to minimize impervious surfaces
B.) Conduct annual stream maintenance to maintain stream channel conveyance

A

Appendix A: Summary of Public Involvement

Public Workshops Summary

Two public workshops were conducted for the Knightdale Open Space Plan. The first occured on October 4, 2001, and was held in conjunction with a Knightdale Chamber of Commerce event and the opening of the Knightdale Environmental Park. The second meeting occurred on December 12, 2001 and was held at the Knightdale Town Hall. During these workshop, citiznes of Knightale were invited and encouraged to make notations directly on open space maps produced by Greenways Incorporated for the workshops. Public opinion comment forms were also available for people to fill out, and consultants and staff were on hand to answer questions about the open space plan.

Most of the attention focused on the stream corridors, the Marks Creek co-oridor in particular. Participants were also interested in improving access to outdoor areas close to where they live, and making a connection between open space preservation and environmental education.

Mayor Joe Bryan cuts a ribbon to officially dedicate and open for public use the Knightdale Environmental Park. Throughout the ceremony, the public was invited to review and comment on the proposed Open Space Plan for Knightdale.

Public Information & Newsletter

Greenways Incorporated also produced two community newsletters to inform citizens about the Open Space Plan and to invite them to attend public meetings. These newsletters were distributed to town staff and made available at Town Hall. Additionally, an announcement of the public meetings was provided to each Town resident through the water billing system.

Knightdale Open Space

The Newsletter for the Knightdale Open Space Plan.

You're Invited!
Come help shape the vision of Knightdale at a Public Workshop!
Wednesday, December 12, 2001
6:30pm - 8:30pm at Town Hall

The Open Space Plan will focus on evaluating the opportunity to preserve and protect the valued natural, historic and cultural landscapes of Knightdale

Issue #1 · September '01

Plan for Open Space Underway

Knightdale an energetic community that is poised to take advantage of land development opportunities that will occur in the next ten years. In the coming decade, new houses, office parks and shopping centers will be constructed to accommodate new residents. The land use of the community will continue to change. Now is the time for residents of the community to identify which lands should be preserved, before development occurs, in order to maintain a high quality of life, clean water and healthy environment.

Knightdale has begun a year long study to identify valuable landscapes that need to be protected. The study will evaluate the natural, historic and cultural landscapes of the community to determine those resources that are in need of protection and preservation. The study will conclude with recommendations for protecting and preserving selected landscapes, provide guidelines for establishing an integrated community greenway system and determine the sources of funding for implementing the program.

The Consultant hired to complete the Study (see back) will conduct a thorough process to identify priority landscapes throughout the community to be protected based on ecological, historical and water quality considerations. Recommended recreational uses for these lands will also be determined. Public meetings will then be held to gather input from Knightdale residents on the Study recommendations. The location and dates of these meetings will be available in the next edition of this newsletter.

If you have any questions about the Study, please contact Mike Ciriello, Department of Planning, at 217-2242.

Benefits of Open Space

Preserving open space will benefit everyone who lives, works, learns and plays in Knightdale by:

- **Improving Water Quality**–Natural areas (especially those adjacent to waterways) act as filters for rainwater, removing sediment and pollutants before water reaches our streams, rivers, lakes, groundwater and water supply reservoirs.
- **Providing Opportunities for Outdoor Recreation**–Public open space can be used for many types of outdoor recreation, including hiking, biking, horseback riding, dog walking, boating, fishing and birdwatching. Additionally, these close-to-home recreation opportunities in the Triangle will encourage residents to spend recreation dollars in their own community.
- **Reducing Flooding Losses**–Natural, vegetated land stores rainwater better than impervious surfaces (rooftops, parking

What is Open Space?

Open Space has been defined for the purposes of this study to include:
• Landscapes not Converted to Residential, Commercial or Industrial Uses;
• Parks, Greenways, Wetlands, Meadows, Forests, Lakes and Streams;
• Ecologically or Historically Significant Areas.

en Space

The Newsletter for the Knightdale Open Space Plan.

velocity of rainwater, help-
he loss of property associ-
pace has been proven to
use residents place a pre-
enways and natural areas.

vation of naturally and historically significant landscapes will improve quality of life for residents and encourage businesses and individuals to remain in the Triangle region.

- **Protecting Wildlife**–Protecting natural areas also preserves habitat for wildlife, migration corridors for plant and animal species, and genetic diversity in rare ecosystems.

Issue #1 · September '01

A Word About Property Rights...

The Open Space Plan to be completed will in no way infringe upon the rights of property owners. The Plan will stress the voluntary participation of landowners, appropriate compensation for property (or an interest in property) when there is a willing seller, and appropriate management strategies for public lands. The Plan will also help inform landowners about the benefits of preserving open space, including income tax benefits and increased property values.

Protecting open space will improve the quality of waterways for drinking water, as well as aquatic habitat, boating, fishing, hiking and swimming.

Consultant Selected to Complete Study

Knightdale has selected a nationally-recognized firm to complete the Open Space Plan. Greenways Incorporated, a Durham-based firm that specializes in the planning, design, development and management of greenways and open space, will complete the plan for the community. This nationally respected firm has provided services to more than 100 communities and 27 states across the country, including the completion of open space plans for Wake County, Durham and High Point, NC. Greenways Incorporated has also completed comprehensive greenway plans for more than a dozen North Carolina communities.

For more information please contact Mike Ciriello , Planning Department, at 217-2242

Town of Knightdale
950 Steeple Square Court
PO Box 640
Knightdale, NC 27545
phone: 919.217.2241
fax: 919.217.2249
Web: www.ci.knightdale.nc.us

B

Design Guidelines

Description

The design development guidelines featured in this Appendix have been tailored to meet the specific facility development needs of the Knightdale Open Space and Greenway System. The purpose of these guidelines is to assist the County and its municipalities and partnering organizations in developing open space and greenway facilities.

These guidelines provide a variety of trail facility and ecological system restoration concepts and ideas. These guidelines are not a substitute for a more thorough examination and detailed landscape architectural and engineering evaluation of each project segment. These guidelines serve as minimum standards for greenway facility development. Knightdale disclaims any liability for the use, appropriateness and accuracy of these guidelines as they apply to a specific project. They are not to be used for construction.

The following resource materials have been used in the preparation of these guidelines:

- Adherence to national design standards for off-road trails and green way facilities, as defined by the American Association of State Highway Transportation Officials (AASHTO), the Americans with Disabilities Act, Designing Sidewalks and Trails for Access: Part 2 and the Manual on Uniform Traffic Control Devices.

Resources

For more in-depth information and design development standards, the following publications should be consulted:

<u>Greenways: A Guide to Planning, Design and Development</u>
Published by Island Press, 1993
Authors: Charles A. Flink and Robert Searns
For more information visit www.greenways.com

<u>Trails for the Twenty-First Century</u>
Published by Island Press, 2001
Authors: Charles A. Flink, Robert Searns and Kristine Olka
For more information visit www.greenways.com

Additional Resources

Guide to the Development of Bicycle Facilities
Updated in 2000 by the American Association of State Highway Transportation Officials (AASHTO). Available from FHWA or AASHTO. www.aashto.org/bookstore/abs.html

Manual on Uniform Traffic Control Devices (MUTCD)
Published by the U. S. Department of Transportation, Washington, DC

Universal Access to Outdoor Recreation: A Design Guide
Published by PLAE, Inc., Berkeley, CA, 1993

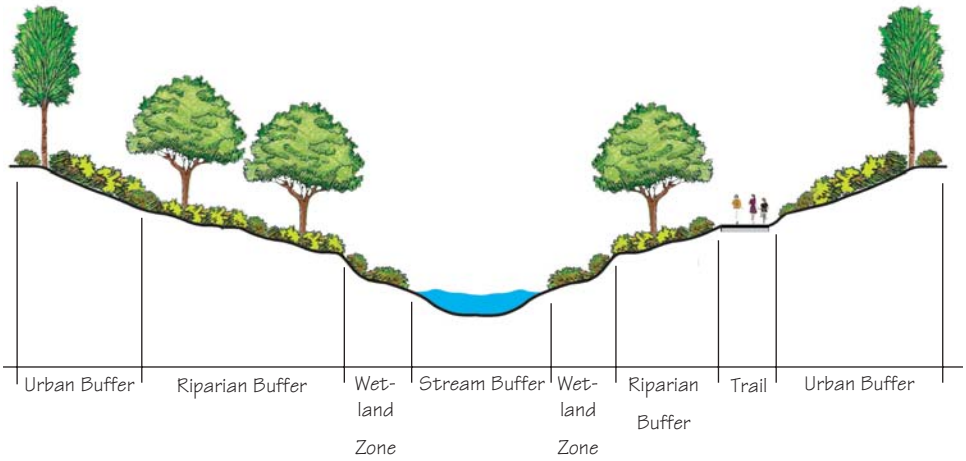
Designing Sidewalks and Trails for Access: Part Two - Best Practices Design Guide
Published by U.S. Department of Transportation, Washington, DC, 2001

In all cases, the recommended guidelines in this report meet or exceed national standards. Should these national standards be revised in the future and result in discrepancies with this chapter, the national standards should prevail for all design decisions.

Other useful web sites for information include:

Rails-to-Trails Conservancy - www.railtrails.org
National Park Service - www.nps.org
U.S. Department of Transportation - www.walkinginfo.org and www.bicyclinginfo.org
Trails and Greenways Clearinghouse - www.trailsandgreenways.org
National Bicycle and Pedestrian Clearinghouse - www.bikefed.org/clear.htm
Greenways Incorporated - www.greenways.com

Stream Corridor Buffer



Riparian buffers serve many functions. They filter stormwater pollutants, help moderate stream flow, stabilize streambanks, moderate stream temperature, and provide aquatic and terrestrial habitat. The Neuse Nutrient Sensitive Waters (NSW) rules require that new developments maintain an existing 50-foot vegetated buffer on both sides of all intermittent and perennial streams, lakes and ponds within the Neuse River Basin. Approximately 85 percent of Knightdale lies within the Neuse River Basin. For the purpose of the rules, a waterbody exists if the feature is present on either the most recent version of the soil map or 7.5 minute quadrangle topographic map prepared by USGS. The required buffers consist of two zones: a 30-foot undisturbed zone adjacent to each side of the waterbody, and a vegetated zone that extends from the outer edge of the 30 foot zone for a distance of at least 20-feet.

Buffers are required in water supply watersheds throughout the state as part of the Water Supply Watershed Management Program. The Division of Water Quality manages the program through oversight of local ordinances and monitoring of land use activities. Local water supply watershed programs must be approved by the NC Environmental Management Commission (EMC). The program requires local governments to adopt land use controls that include buffer protection. For low-density development, 30-foot buffers are required along perennial streams, and 100-foot buffers are required for high-density development. There are five major water supply watersheds within Wake County: Falls Lake, Jordan Lake, Wake Forest Reservoir, Swift Creek, and Little River. In addition, a small portion of the County near Fuquay-Varina drains to the Cape Fear River, which is used as a water supply by Lillington.

Stream buffers within Knightdale should be established to protect water quality and animal habitat. For the purpose of greenway facility development, a minimum of 50-feet wide buffer (150-feet preferred) as measured from the top of streambank is required in order to mitigate the damaging effects of flooding from storms, filter pollutants from overland flow and develop appropriately sized greenway trail facilities.

Knightdale has applied the Neuse River Basin 50-foot buffer throughout the county. (Please see the attached Neuse River Buffer Rules.) Some of the municipalities within the county (Garner, Apex, Cary and Morrisville) have placed additional buffers up to 100-feet on their streams, according to their order.

Instead of using this conventional method of prescriptive buffers, stream buffers should be a varied width according to ecological features of the watershed. Each buffer width will be site specific, depending on the following characteristics of the stream, riparian buffer and watershed:

- Slope
- Soil
- Hydrology
- Vegetation
- Water Quality
- Impervious Surface

The appropriate width for a variety of characteristic combinations will be discussed more in depth in the Knightdale-wide Open Space and Greenways Plan.

Corridor Planting

Some basic guides for planting in corridors is as follows:

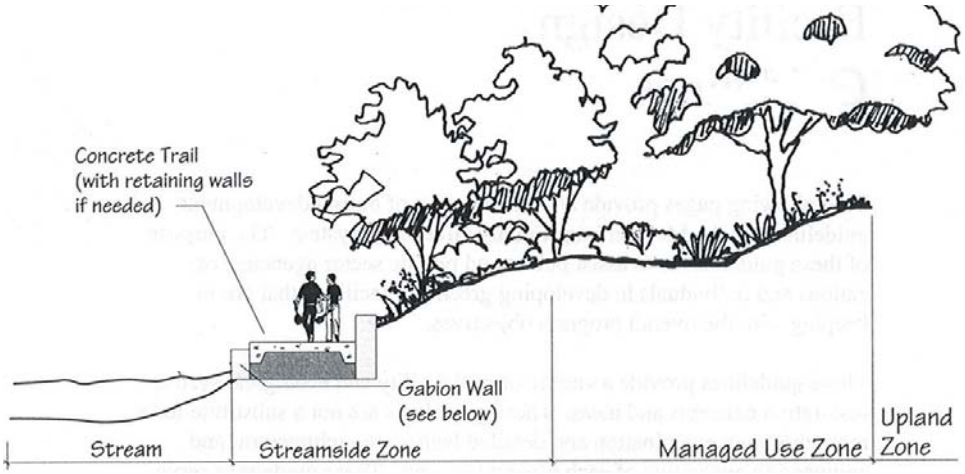
- Efforts should be made to eliminate non-native invasive species, such as privet, from corridors.
- Native overstory and understory trees/shrubs should be re planted where vegetation is removed or harmed due to construc tion of parks, trails, etc. in greenway corridors or open space.
- Fallen trees should not be removed unless they obstruct trails or present danger. Otherwise, they should be left to decay natu rally.
- Evergreens, conifers (pines) and deciduous trees should all be used proportionally.
- Mast producing trees and shrubs with berries should be utilized for wildlife food whenever possible.
- Flowering trees and shrubs can be used to draw attention to important intersections and entrances.
- Evergreen shade trees are needed near seating areas and picnic tables.
- Evergreen shrubs, such as wax myrtle, can help separate public areas from private residences.

Types of Trail Treads

One of the following types of trail treads should be used when designing greenway trails and sidewalks. The appropriate trail type will depend on the specific site conditions of the trail segment. Some of the characteristics of the trail corridor to consider are soil type, vegetation cover, flooding, slope and wildlife habitat sensitivity, among others.

Creekside Trail Tread

Creekside trails are located only in urban areas, where right-of-way constraints and channelized streams restrict trail development to the floodway. Creekside trails are designed to accommodate walkers, bicyclists, rollerbladers, and joggers. These multi-use trails are typically positioned directly adjacent to the stream channel and are therefore subject to frequent flooding. These trails require hard-paved surfaces of concrete to withstand high-velocity stream flows. Retaining walls or other structural elements may also be required for stable construction and to protect the trail from erosion and flood damage.



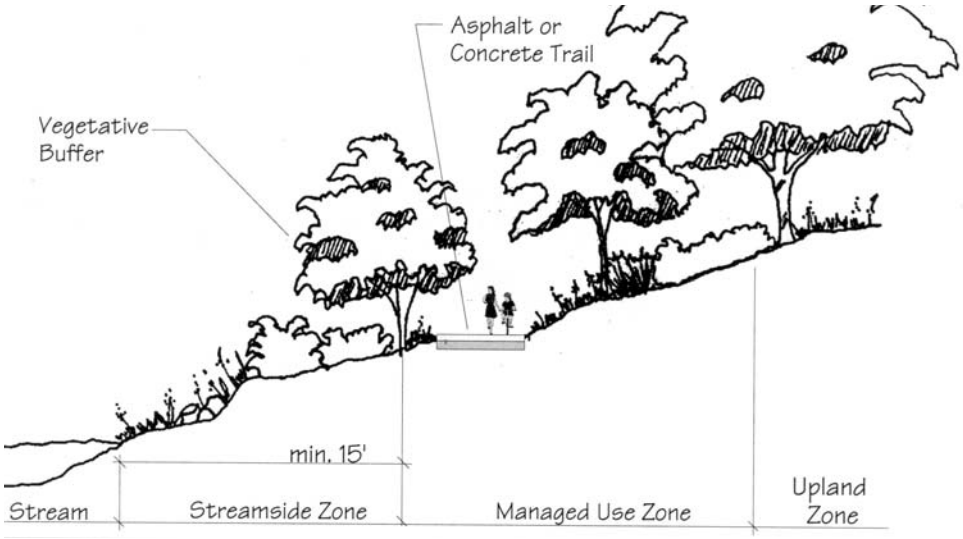
Typical Multi-Use Creekside Trail Cross Section

Creekside trails should be a minimum of 10'-wide for multi-use trails. The installation of railings, benches, signage, and trash receptacles that could obstruct flow during storm events, should be carefully considered. Creekside trails must be designed and installed in a manner that minimizes their effect on flood waters and protects the amenities from flood damage. The use of retaining walls as seat walls is one way in which non-obtrusive amenities can be included on this type of trail facility. Special consideration should be paid to mitigating the impacts of trail construction on the natural environment.

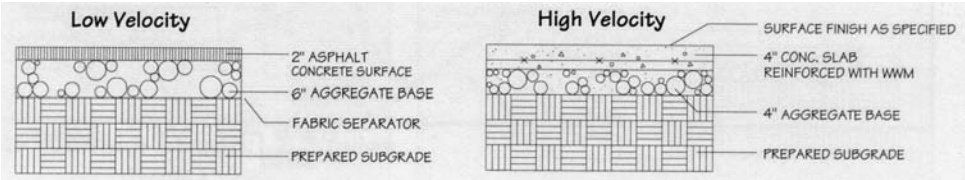
Floodway Trail Tread

Multi-use trails within the floodway are designed to accommodate a variety of users including walkers, joggers, cyclists, and rollerbladers. These multi-use trails are typically positioned within the floodway but not directly adjacent to streams. Some vegetative buffer between the stream and trail should be left intact. Like the streamside trails, trails within the floodway are subject to periodic flooding, however, not as frequently. These trails require paved surfaces of either asphalt or concrete depending on frequency of flooding and expected velocity of flow. A proper trail foundation is important and will increase the longevity of the trail. No soft shoulder should be constructed due to flood considerations. Special consideration should be given to the mitigation of negative impacts from trail development on the natural stream environment.

Multi-use trails within the floodway should be built with a minimum width of 10 feet. All elements of the trail including the trail tread, railings, benches, and trash receptacles will be periodically flooded. The design and materials for these trails should be carefully selected accordingly.



Typical Multi-Use Trail Cross Section (Within the Floodway)



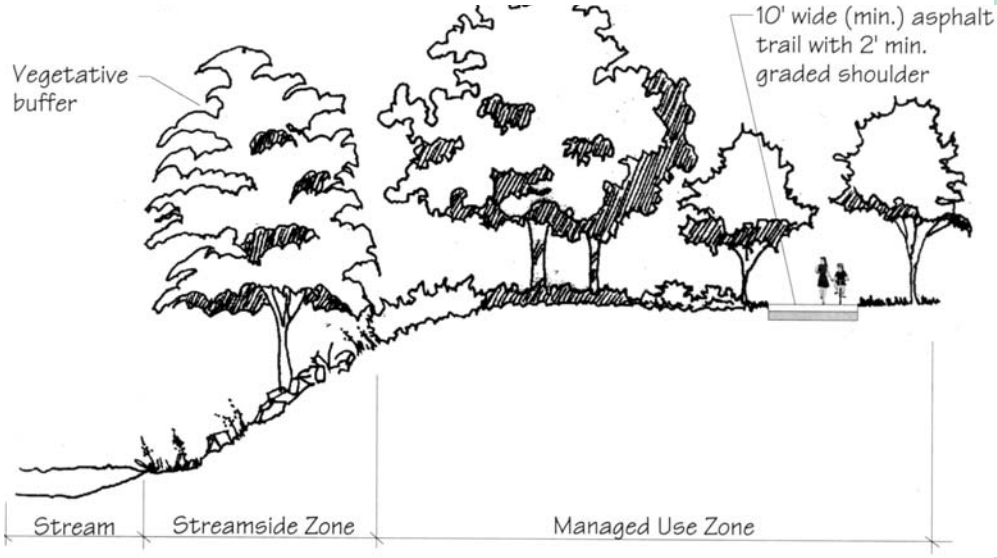
Asphalt Paving on Aggregate Base Concrete Paving on Aggregate Base

Paving Cross Section

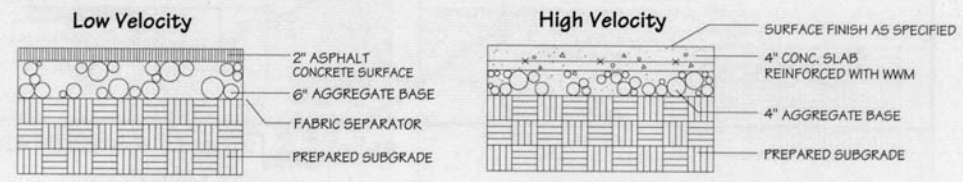
Floodplain Trail Tread

Multi-use trails within the floodplain are designed to accommodate a variety of users including walkers, joggers, cyclists, and in-line skaters. These multi-use trails are typically positioned outside the floodway but within the floodplain. Significant vegetative buffers between the stream and trail should be left in tact. Multi-use trails within the floodplain are subject to occasional flooding during large storm events. It is recommended that these trails be built with paved asphalt, however an aggregate stone surface may be adequate in some locations.

Multi-use trails within the floodplain should be built to a minimum width of 10', although12' to 14' is preferred. The graphics below illustrate two suitable pavement cross sections that can be used to build multi-use trails within the floodplain.



Typical Multi-Use Trail Cross Section (Within the Floodplain)

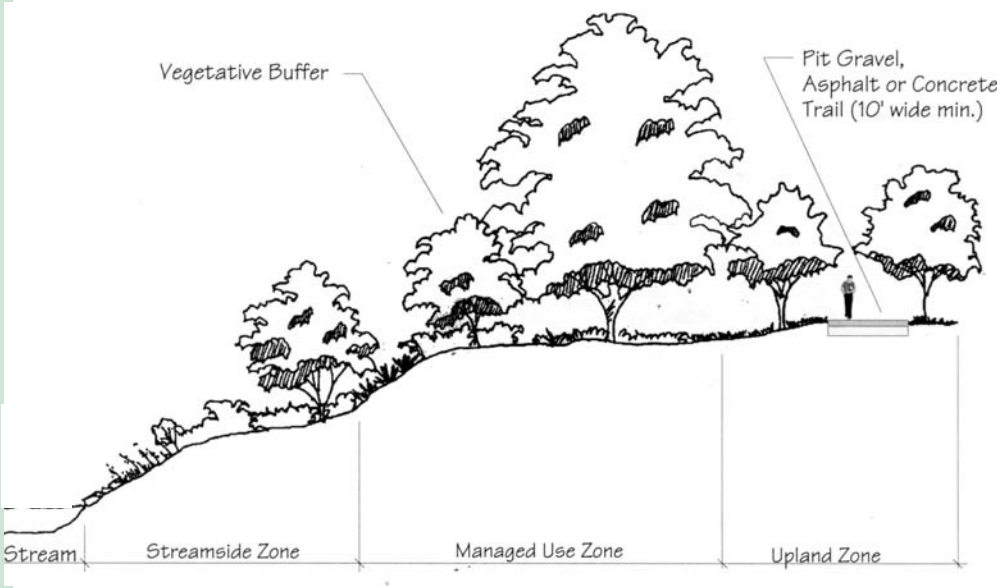


Asphalt Paving on Aggregate Base Gravel Paving on Aggregate Base

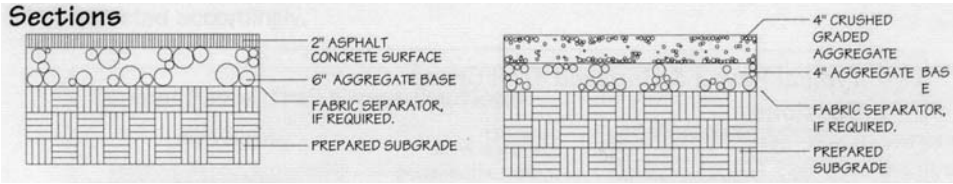
Paving Cross Section

Upland Trail Tread

Upland multi-use trails are designed to accommodate a variety of users including walkers, joggers, cyclists and in-line skaters. These upland multi-use trails are typically positioned completely outside designated floodplains. Significant vegetative buffer between any streams and the trail should be left in tact. It is recommended that these trails be built with paved asphalt or aggregate stone, depending on the preference of local user groups. Upland multi-use trails should be built to a minimum width of 10', though 12' is preferred.



Upland Trail Cross Section

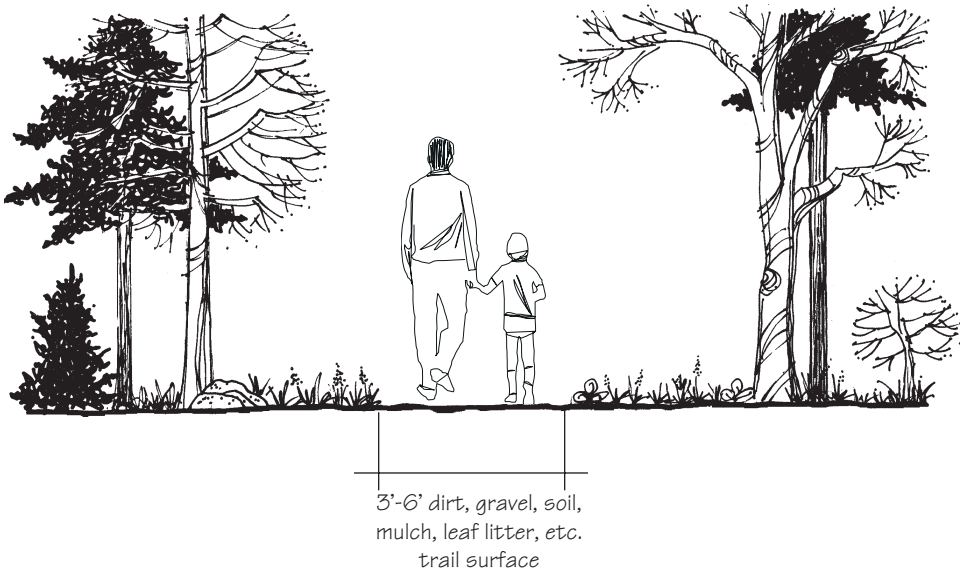


Asphalt Paving on Aggregate Base Gravel Paving on Aggregate Base

Paving Cross Section

Footpath/Hiking Trail

Footpaths or hiking trails are designed to accommodate pedestrians and are not intended for cyclists or other wheeled users. These natural surface trails typically make use of dirt, rock, soil, forest litter, pine mulch and other native materials for the trail surface. Preparation varies from machine-worked surfaces to those worn only by usage. This is the most appropriate surface for ecologically sensitive areas.

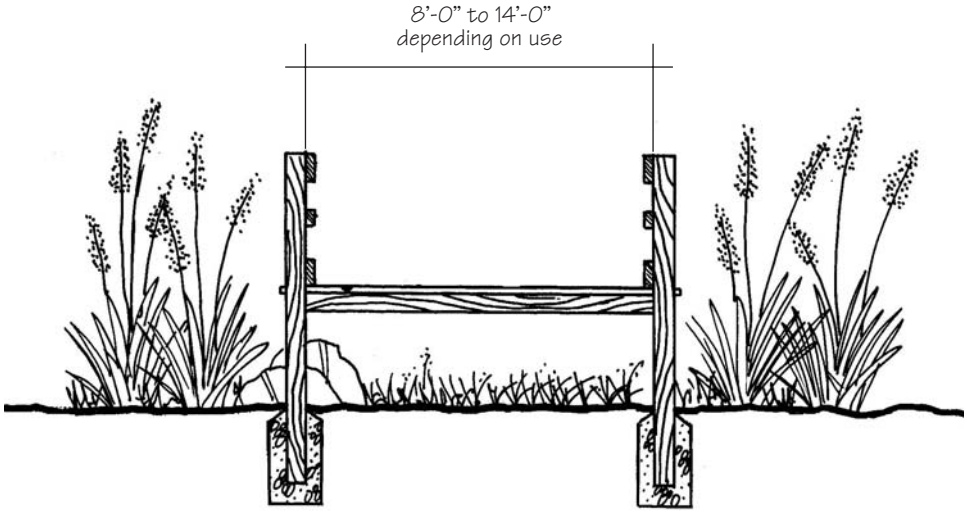


Footpath Cross Section

These pathways, often very narrow, sometimes follow strenuous routes and may limit access to all but skilled users. Construction of these trails mainly consists of providing positive drainage for the trail tread and should not involve extensive removal of existing vegetation. Timbers may be used for steps along steep slopes. These trails vary in width from 3 feet to 6 feet and vertical clearance should be maintained at 9 feet. These trails are most commonly found within the streamside zone.

Boardwalk Trail Tread

Boardwalks, or wood surface trails, are typically required when crossing wetlands or poorly-drained areas. While boardwalks can be considered multi-use trails, the surface tends to be slippery when wet and not best suited for wheeled users. Boardwalks intended for use by bikes, pedestrians, in-line skaters and others should be a minimum of 14 feet wide. However, boardwalk trails limited to pedestrian use can be as narrow as 8 feet. If maintenance vehicles use the boardwalk for maintenance access, it should be a minimum of 14 feet.



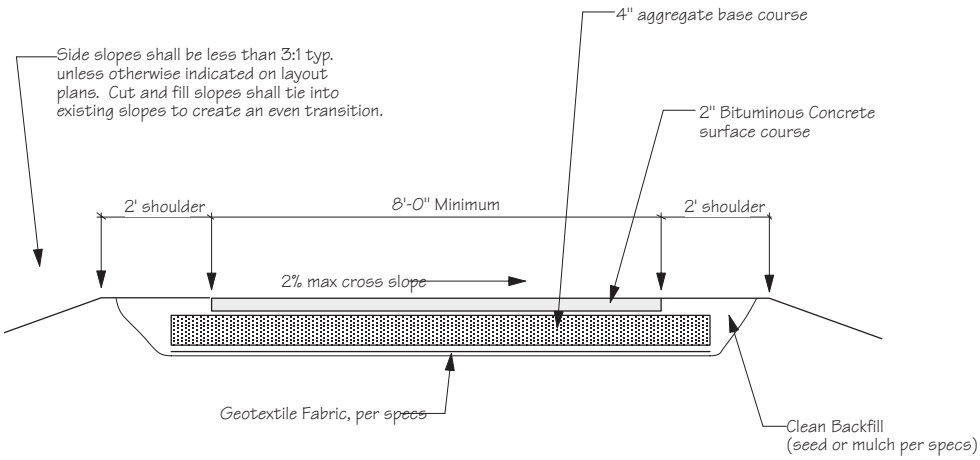
Boardwalk Cross Section

Wood surfaced trails are usually composed of sawn wooden planks or lumber that forms the top layer of a bridge, boardwalk or deck. The most commonly used woods for trail surfacing are exposure- and decay- resistant species such as pine, redwood, fir, larch, cedar, hemlock and spruce. Wood is a preferred surface type for special applications because of its strength and comparative weight, its aesthetic appeal and its versatility. Synthetic wood, manufactured from recycled plastics, is now available for use as a substitute in conventional outdoor wood construction. While these products are more expensive than wood lumber, recycled plastic lumber lasts much longer, does not splinter or warp and will not discolor.

Paved Multi-Use Trail

Typical pavement design for paved, off-road, multi-use trails should be based upon the specific loading and soil conditions for each project. These trails, typically composed of asphalt or concrete, should be designed to withstand the loading requirements of occasional maintenance and emergency vehicles. In areas prone to frequent flooding, it is recommended that concrete be used because of its excellent durability.

One important concern for asphalt, multi-use trails is the deterioration of trail edges. Installation of a geotextile fabric beneath a layer of aggregate base course (ABC) can help to maintain the edge of a trail. It is important to provide a 2'- wide graded shoulder to prevent trail edges from crumbling.



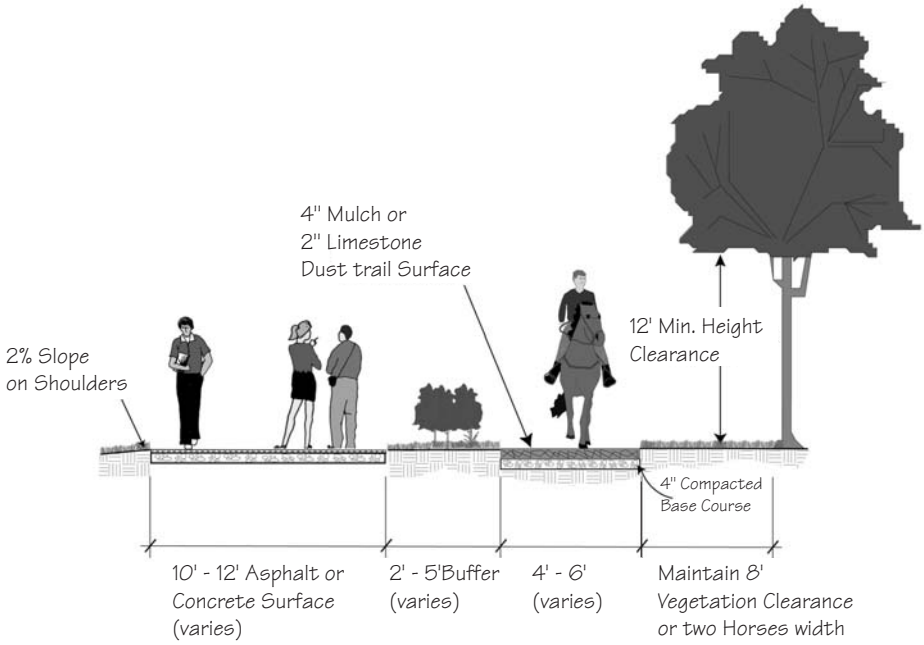
Multi-Use Trail Cross Section

The minimum width for two-directional trails is 10', however 12'-14' widths are preferred where heavy traffic is expected. Centerline stripes should be considered for paths that generate substantial amounts of pedestrian traffic. Possible conflicts between user groups must be considered during the design phase, as cyclists often travel at a faster speed than other users. Radii minimums should also be considered depending on the different user groups.

Asphalt is a hard surface material that is popular for a variety of rural, suburban and urban trails. It is composed of asphalt cement and graded aggregate stone. It is a flexible pavement and can be installed on virtually any slope.

Concrete surfaces are capable of withstanding the most powerful environmental forces. They hold up well against the erosive action of water, root intrusion and subgrade deficiencies such as soft soils. Most often, concrete is used for intensive urban applications. Of all surface types, it is the strongest and has the lowest maintenance requirement, if it is properly installed.

Dual Trail Tread



Typical Equestrian and Pedestrian Trail Cross Section

Dual tread trails are suggested on multi-use trail systems where different users travel at different speeds, such as equestrians and walkers. If hard surfacing is being used on the multi-use trail, a softer, 5-foot-wide tread for horses should be considered. Mulch, dirt, stabilized dirt or limestone dust can be used. Hard surfaces, such as concrete and asphalt are undesirable for equestrians because they can injure horses' hooves. Granular stone may also present problems because it can get stuck in horse hooves.

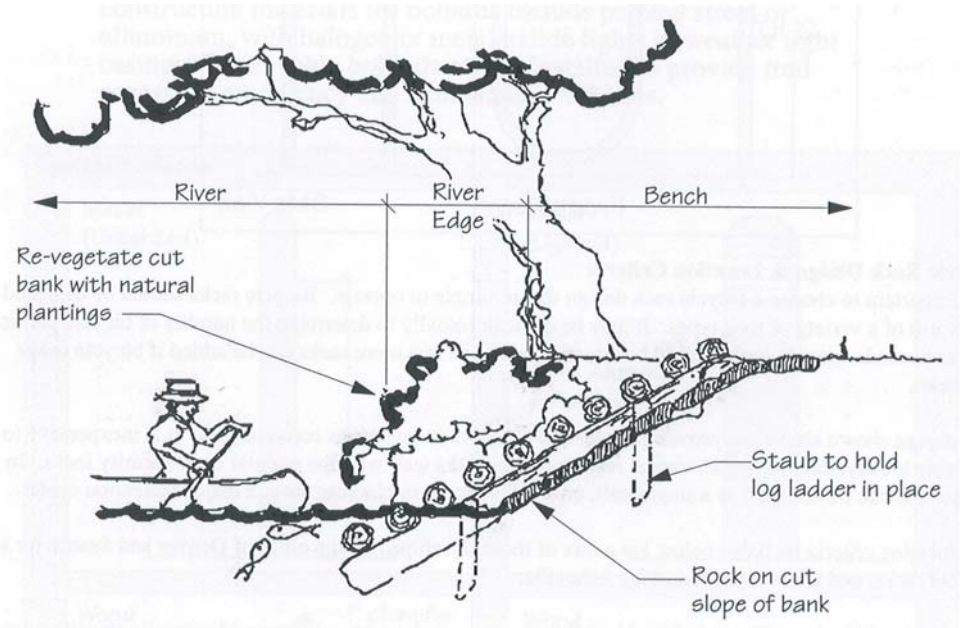
Vertical clearance for equestrians should be at least 12 feet, with a horizontal clearance of at least 5 feet. Low-hanging tree limbs should be cut flush with the trunk. Leaves, branches and other protrusions that could injure the horse, rider or gear should be removed. Within the tread, stumps, large rocks and other debris should be cleared. Sight distances for equestrians, who usually travel between 4 and 6 miles per hour, should be at lest 100'.

Dual treads may also be required for mountain biking trails.

Water Based Trail

This designation applies to those rivers and streams that can successfully accommodate and/or which are designated to support canoeing, kayaking and boating. Water based trails can be designated with features and facilities that make this activity more enjoyable for residents, including signage systems, improved rapids, safety systems, and access points. Rental outfits could be established at put in/take out points.

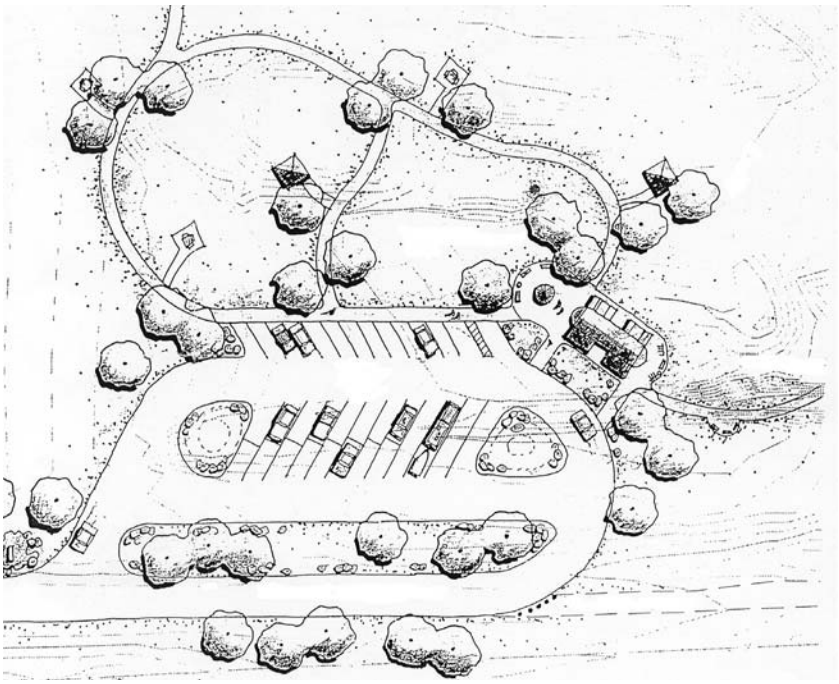
Example of a Water Based Trail in Use



Small Boat Access

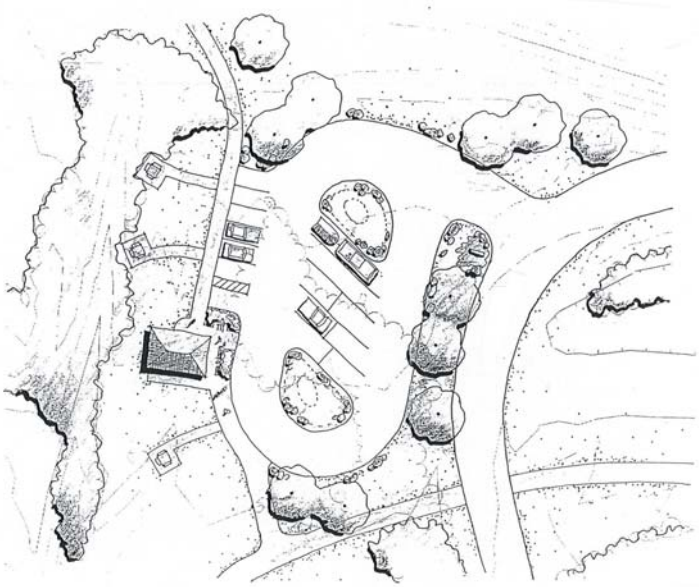
Trailheads

Major and Minor Trailheads



Typical Major Trailhead Plan View

Trail heads should be installed throughout the greenway system to give the public access. A “trail head” is a point of formal public entry into the greenway system that may provide certain related public facilities such as parking, restrooms, drinking fountains, trail signage, etc. Major trail heads and minor trail heads are suggested. Major trail heads should be located in significant areas. An exhibition building or an interpretive exhibit may be incorporated, along with restrooms, water fountains, picnic tables, parking, signage, etc. Minor trail heads can be used to connect a smaller number of people to surrounding trails, open space, parks, etc.



Typical Minor Trailhead Plan View

Restrooms

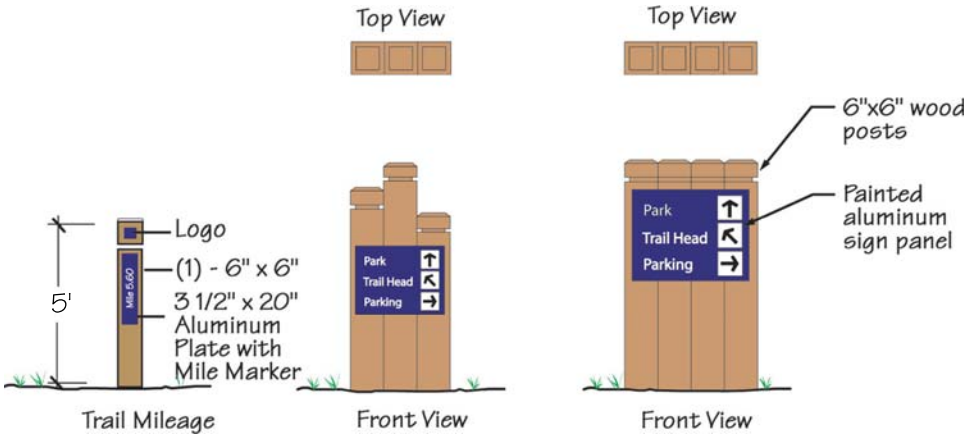
Public amenities, such as phones, restrooms, etc., shall be located and concentrated at the confluence of vehicular and pedestrian traffic. ADA accessible restrooms should be placed at major trail access points in order to accommodate trail users. Where possible, other uses should be incorporated into the structure, such as storage for maintenance equipment. These structures should be located adjacent to thoroughfares for security, maintenance and access to utility hookups. They should also make use of natural light and ventilation as much as possible.

Typical Restrooms

Waterless Restroom Option

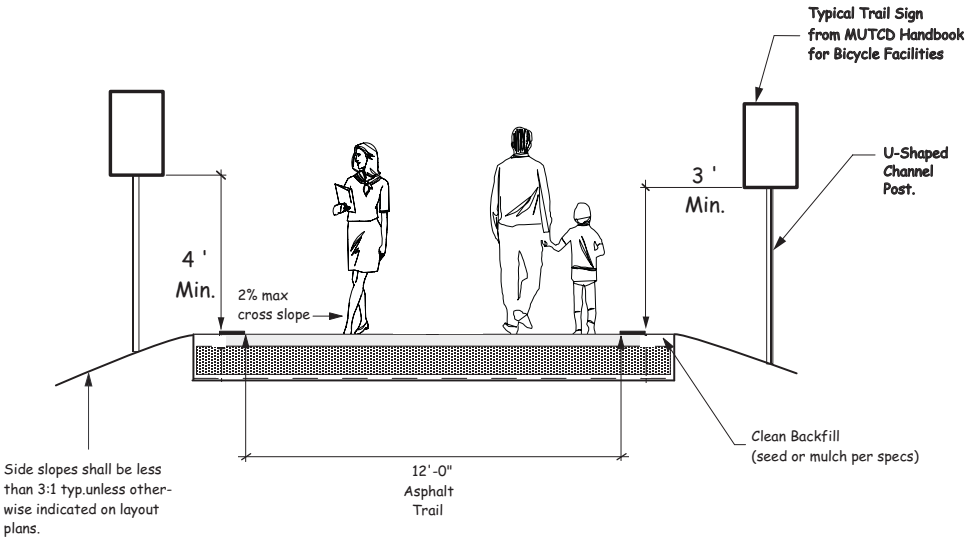
Signage Details

Directional Signage



Signage Examples

Typical Trail Signage Location

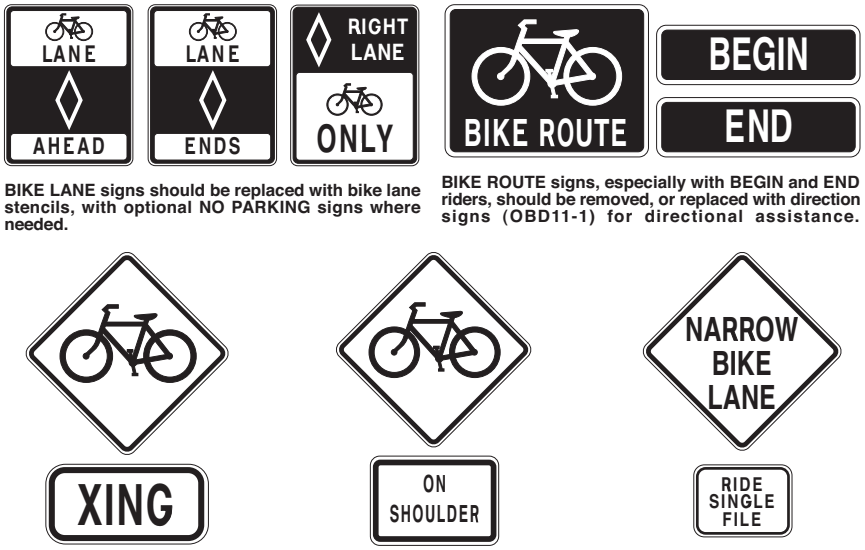


Typical Signage Location

DOT Bike Signage

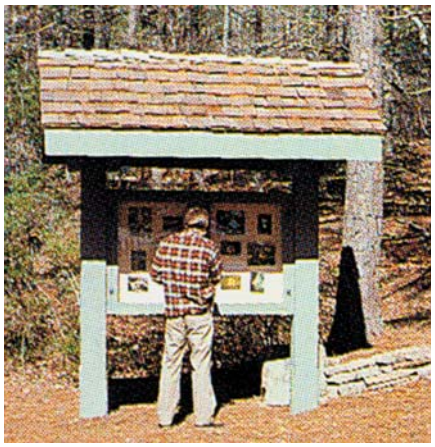
The MUTCD specifies standard signage for bicycle lanes. According to section 9B-8, the R3-16 sign should be used in advance of the beginning of a designated bicycle lane to call attention to the lane and to the possible presence of bicycles. The MCTUD requires that the diamond lane symbol be used with both the R3-16 and R3-17 signs.

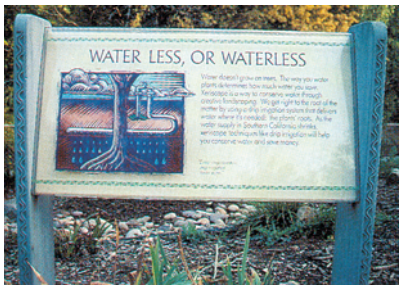
According to Section 9B-ll of the MUTCD, the R7-9 R7-9a signs can be used along streets where motorists are likely to park or frequently pull into the bike lane.



Signage Examples

Interpretive Signage

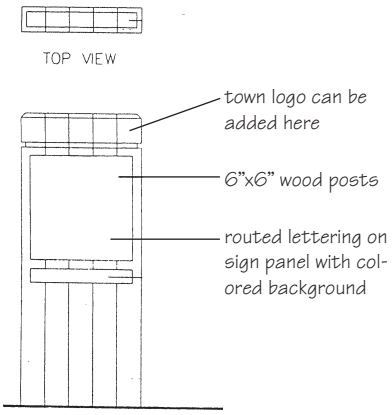


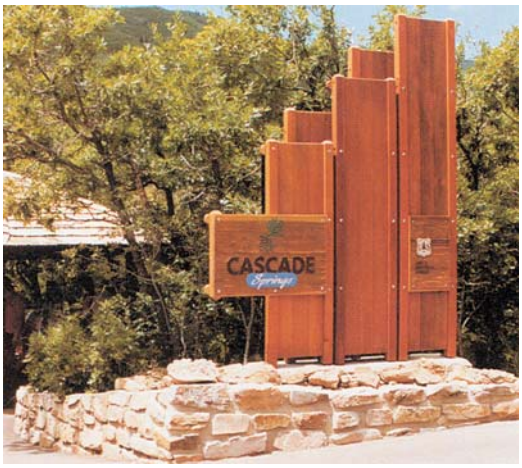


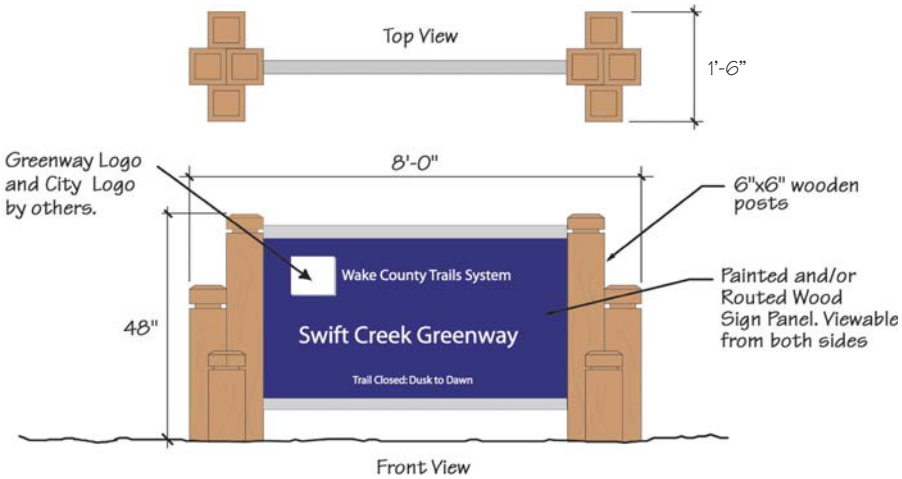
Signage Examples

Entry Signage

Proper trail identification at trail terminal point and major intersections is important in the development of a comprehensive trail network. A system of signage is important throughout Knightdale to ensure that information is provided to trail users regarding the safe and appropriate use of all facilities. Greenway entry signage may also include mileage to provide users with a reference as to how far he or she has traveled, and the remaining distance to specific destinations.



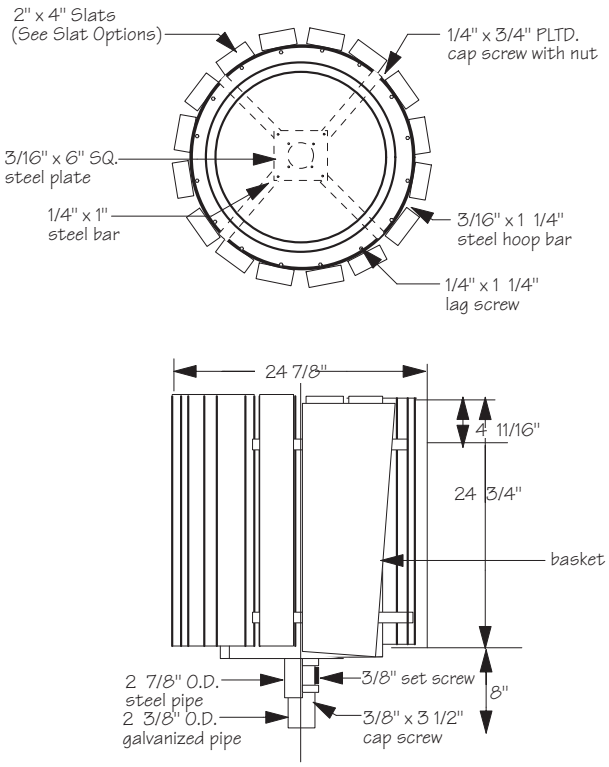




Entry Signage Examples

Trash Receptacles

Trash containers are necessary along all trails. They can be attractive as well as functional and should be selected based on the amount of trash expected, overall maintenance program of the trail, and types of users. Trash cans need to be accessible to both trail users and maintenance personnel. At a minimum, 22-gallon or 32-gallon containers should be located at each entranceway and at each bench seating area. They should be set back three feet from the edge of the trail. The location of additional trash cans will depend upon the location of concessions, facilities adjacent to the trail and areas where trail users tend to congregate.

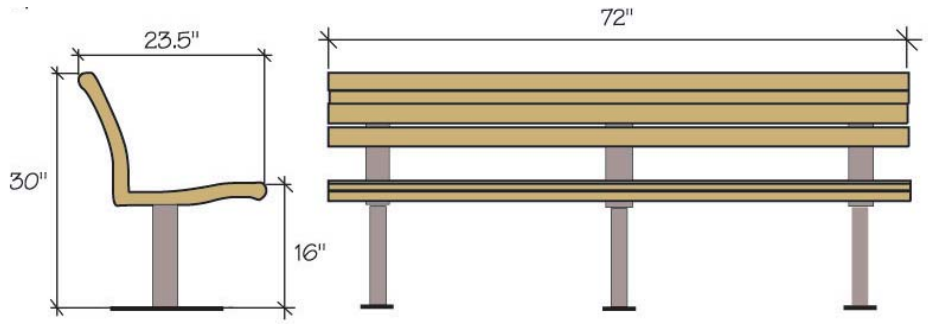


Typical Trash Receptacle Detail

Benches

Benches along trails allow users to rest, congregate or contemplate. Trail benches should comfortably accommodate the average adult. They should be located at the primary and secondary entrances to the trail and at regular intervals, and should be set back three feet from the trail edge.

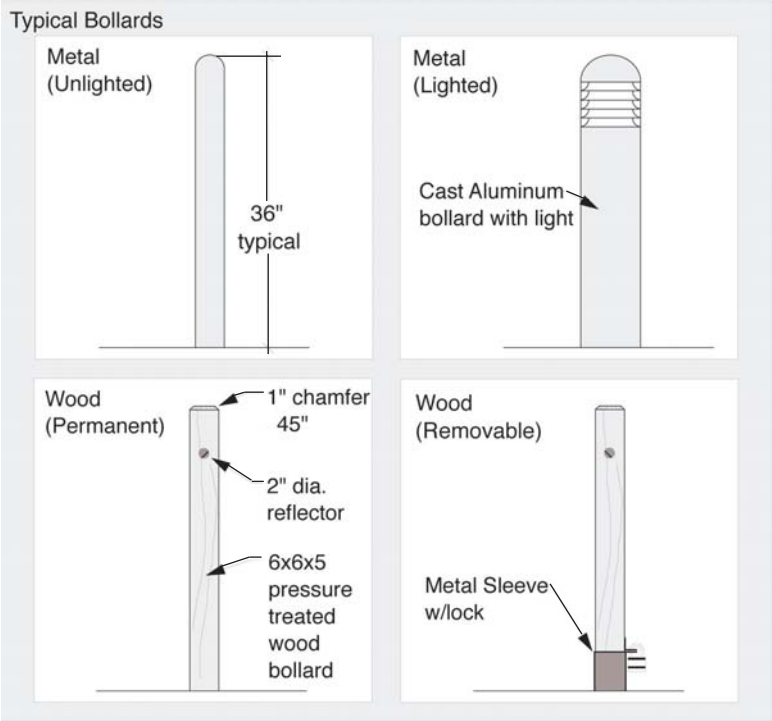
The graphics below illustrate a bench that can be manufactured using recycled plastic lumber or conventional treated wood lumber. The prefabricated plastic lumber units cost more initially but last longer and require little or no maintenance.



Typical Bench Detail

Bollards

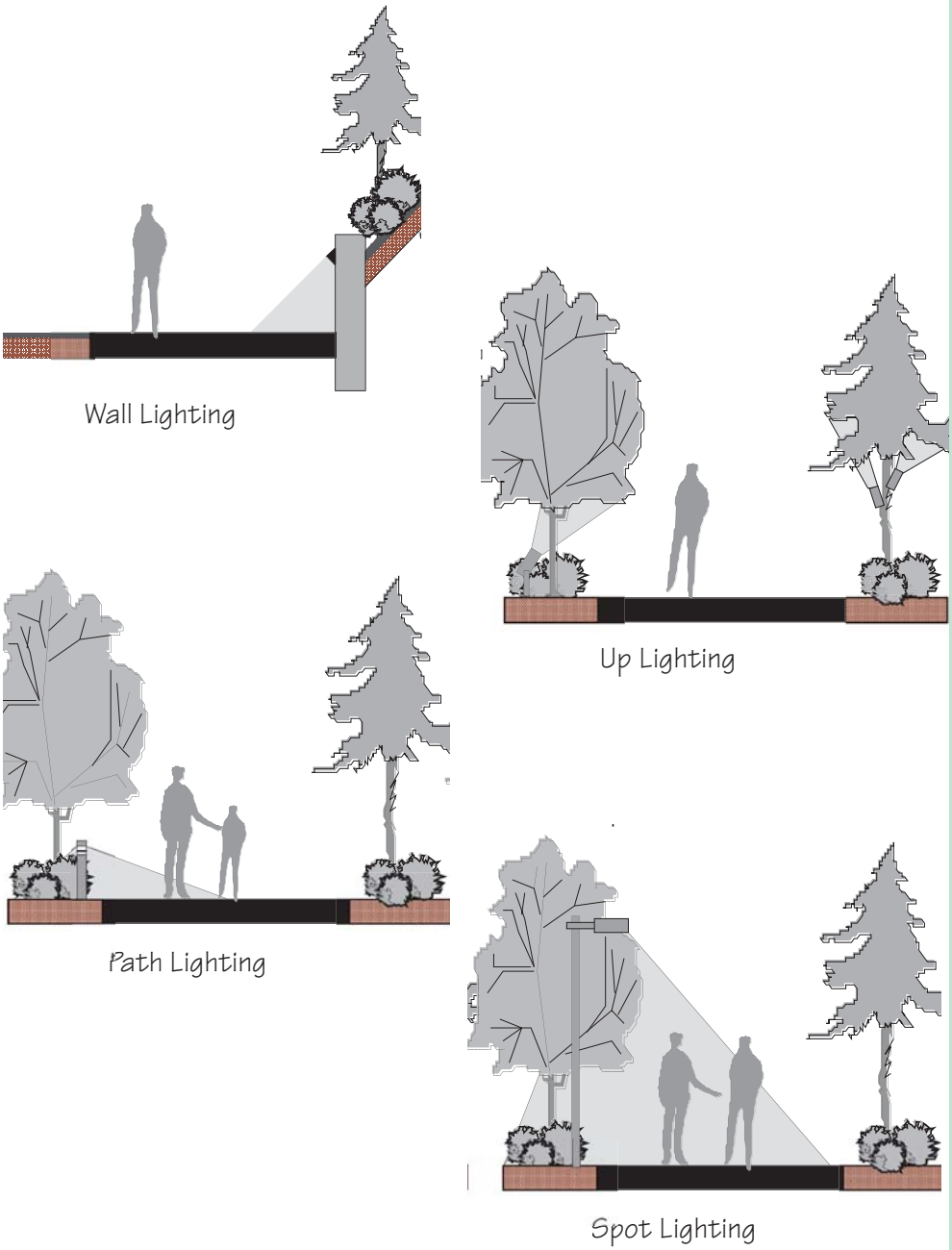
Bollards are intended to provide separation between vehicles and trail users. They are available in a variety of shapes, sizes, and colors and come with a variety of features. Lighted bollards are intended to provide visitors with minimum levels of safety and security along trails which are open after dark. Bollards should be chosen according to the specific needs of the site and should be similar in style to the surrounding elements. Typical construction materials for bollards include painted steel or aluminum, with halogen or metal halide lights in weather tight casings. Removable bollards can be installed to provide trail access for emergency and maintenance vehicles. The graphic below illustrates several typical bollard examples.



Typical Bollard Details

Trail Lighting

Particularly during winter months when trips to and from work are made in the dark, adequate lighting can make the difference in a person's choice to bicycle or walk. However, due to liability and security concerns, many off-road bicycle paths are closed at night, and therefore unlit.Lighting for multi-use trails should be considered on a case-by-case basis in areas where 24-hour activity is expected (such as college campuses or downtown areas), with full consideration of the maintenance commitment lighting requires.

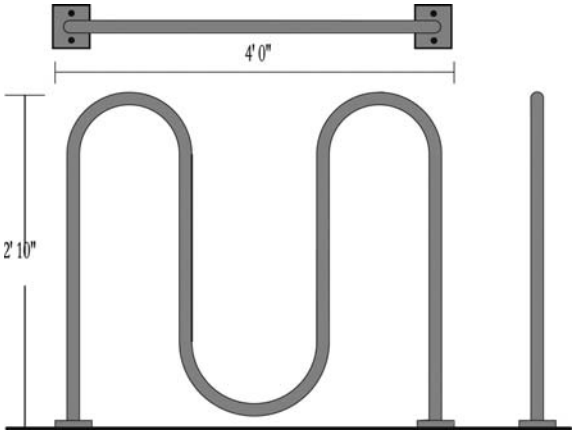


Various Lighting Types

Bike Rack

It is important to choose a bicycle rack design that is simple for cyclists to operate. Bicycle racks should be designed to allow use of a variety of lock types. It may be difficult initially to determine the number of bicycle parking spaces needed. Therefore, bike racks should be situated on-site so that more can be added if bicycle usage increases.

The design shown below has proven popular and effective in numerous communities. It is inexpensive to fabricate locally, easy to install, vandal resistant and works well with popular high-security locks. In addition, it can be installed as a single unit, on a sidewalk, or in quantity, at major recreation nodes.



Typical Bike Rack

Location Criteria:

- Racks should be located within 50' of building entrances (where bicyclists would naturally transition into pedestrian mode).

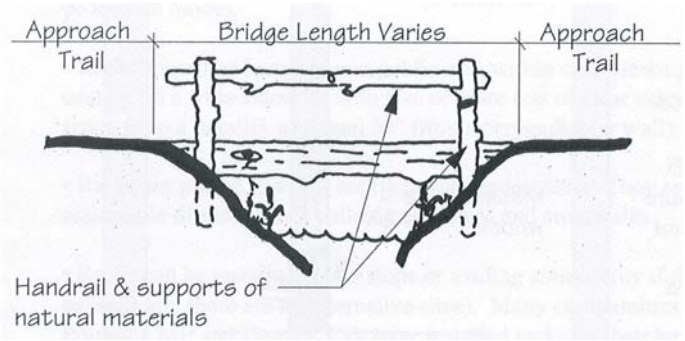
- Racks should be installed in a public area within easy viewing distance from a main pedestrian walkway, usually on a wide sidewalk with five or more feet of clear sidewalk space remaining (a minimum of 24" clear space from a parallel wall and 30" from a perpendicular wall).

- Racks are placed to avoid conflicts with pedestrians. They are usually installed near the curb and at a reasonable distance from the building entrances and crosswalks.

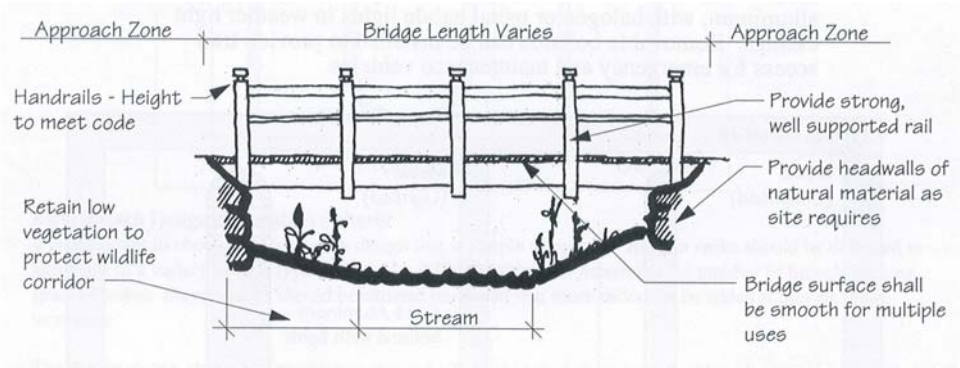
- Racks can be installed at bus stops or at loading zones (only if they do not interfere with boarding or loading patterns and there are no alternatives). Bike racks on busses also facilitate bike-on-transit travel.

Bridges

Bridges are an important element of almost any trail project. The type and size of bridges can vary widely depending on the trail type and specific site requirements. Some bridges often used for multi-use trails include suspension bridges, prefabricated span bridges and simple log bridges. When determining a bridge design for multi-use trails, it is important to consider emergency and maintenance vehicle access. Bridges intended for occasional vehicular use must be designed to handle up to 10,000 pound loads safely and at least 14'-wide to allow for vehicle passage.



Foot Bridge



Urban Trail Bridge

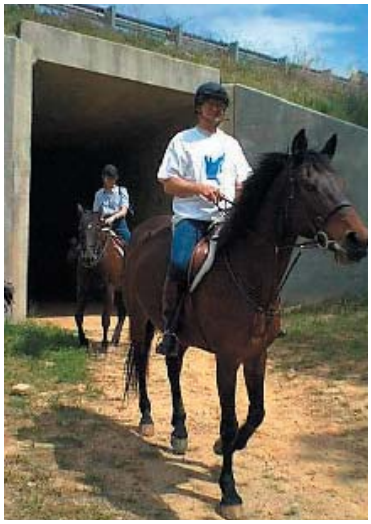
Span Bridge

Note: Prefabricated span bridges are ordered directly from the manufacturer. Approximate cost is $100/foot. For examples and quotes, see www.steadfastbridge.com.

Underpass

Trail underpasses and overpasses can be used to avoid undesirable at-grade intersections of trails and freeways or high volume arterial highways . Neither should be used frequently in suburban, fringe or rural areas. Underpasses typically utilize existing overhead roadway bridges adjacent to a stream or culverts under the roadway that are large enough to accommodate trail users. There are several key issues that must be addressed in the design of the roadway underpass:

1. The vertical clearance of the underpass must be at least 10 feet
2. The width of the underpass must be at least 12 feet
3. Proper drainage must be established to avoid pooling of stormwater inside the underpass
4. It is recommended that underpasses be lighted for safety



Roadway underpasses that utilize box culverts can sometimes be installed as part of a roadway improvement or construction project at a greatly reduced cost.

Overpass

Trail overpasses can be used in high traffic volume areas where underpasses are not possible. Overpass options include sidewalks on bridges, freestanding pedestrian/bike bridges or lanes attached to an existing bridge. AASHTO requires that bridges be a minimum of 36 inches, but prefers that they are at least as wide as the trail. Fourty-two inch high railing is also required. A fenced cover, as shown below, provides a safer environment over highways and busy streets. The NCDOT should be referenced for height requirements, which vary depending on the type of road. ADA should also be referenced for ramp requirements.

It is important to remember that pedestrians and cyclists will opt not to use an overpass or an underpass if it takes more than twice the time as crossing the street at-grade. For this reason, at-grade fencing should be considered in some instances .

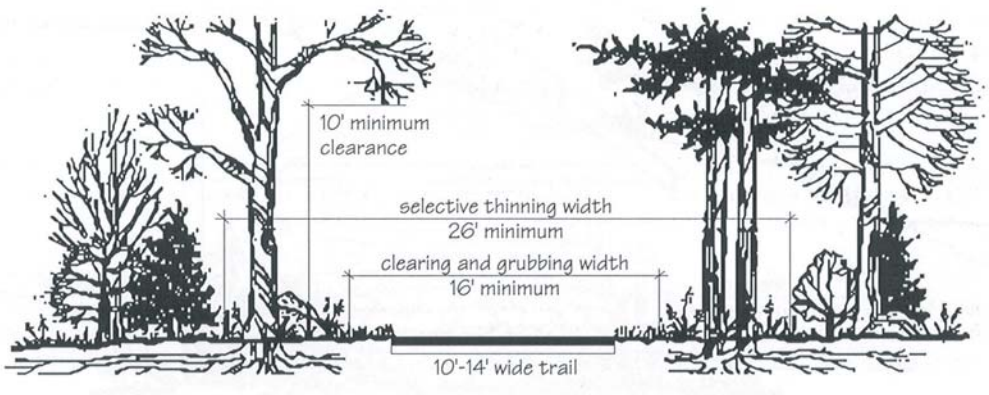
Typical Roadway Bridge with Sidewalk

Miscellaneous Trail Details

Vegetative Clearing

Vegetative clearing refers to the amount of vegetation removal that is required for various levels of trail development. The amount of vegetative clearing required for any one trail will depend on the type of trail being developed. While footpaths or hiking trails require little or no vegetation removal, paved pathways may require significantly more.

Single-tread, multi-use trails are the most common trail type in the nation. These trails vary in width, can accommodate a wide variety of users and are especially popular in urban areas. While the vegetative clearing needed for these trails varies with the width of the trail, the graphic below outlines typical requirements.

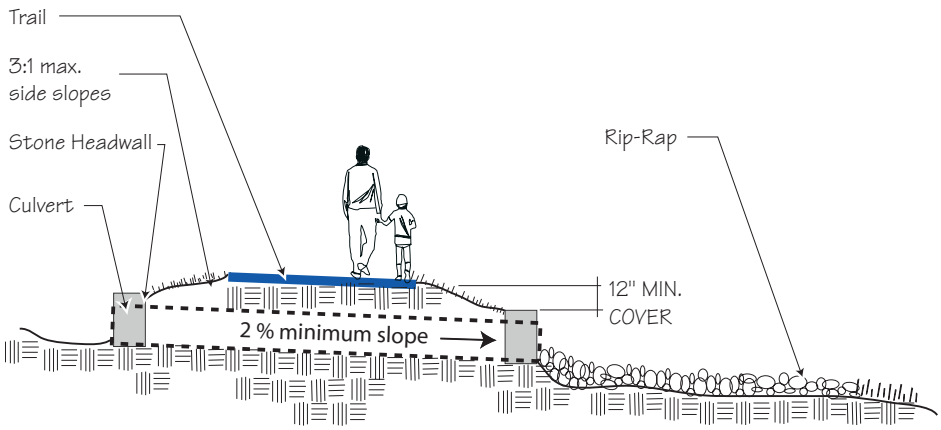


Typical Tree Trimming Distances

Clearing and grubbing consists of tree, shrub and stump removal. The minimum width for clearing and grubbing of a 14'-wide trail is 16 feet (2'-wide shoulders). Selective thinning includes removal of underbrush and limbs to create open pockets within a forest canopy. Selective thinning increases sight lines and distances and enhances the safety of the trail user. Selective thinning does not include the removal of the forest canopy.

Trail Culvert

Proper installation of trail culverts is important to ensure proper stormwater runoff drainage, trail user safety and longevity of the trail surface. Pipe length, diameter and material specifications will vary depending on specific site needs. Two materials typically used for trail culverts are reinforced concrete pipe (typically required when the trail is within NCDOT Right of Way), and High Density Polyethylene (HDPE) recycled plastic pipe. Plastic pipes are typically less expensive on a per foot basis. Outlet protection varies per site needs and in some cases a flow spreader may be required at the outlet location. Rock check dams can be placed after the outlet to slow and filter drainage. The graphic below outlines proper installation parameters for greenway trail culverts.

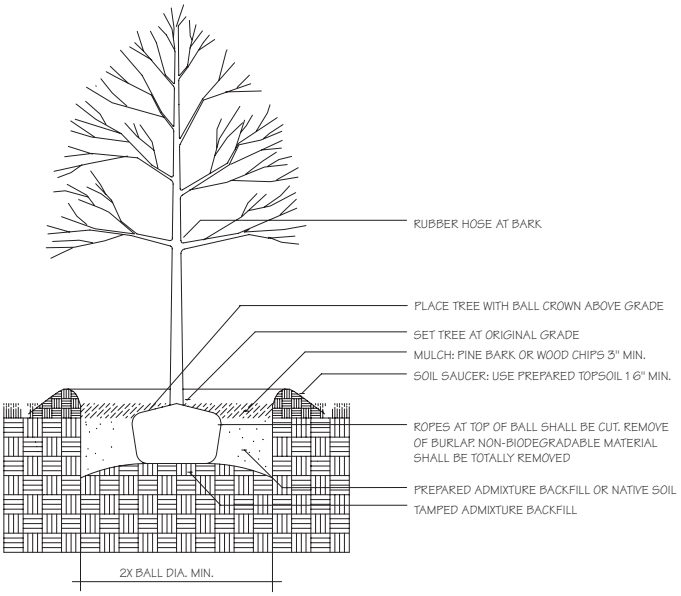


Culvert Placement Cross Section

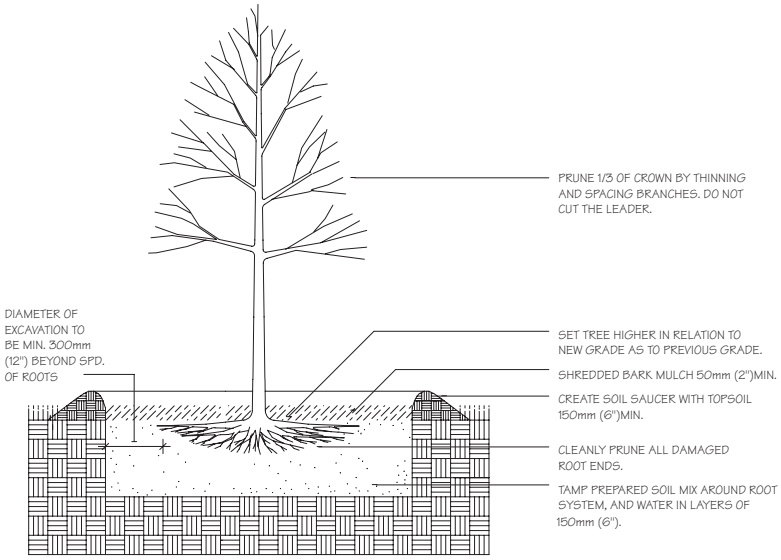
Planting Details

Tree Plantings

Trees are important to greenways and trails for both aesthetic and environmental reasons. Not only do they contribute to the appearance of a trail, their shade cools the environment for trail users and provides habitat for birds and wildlife. Trees also help keep streams healthy by providing shade (which regulates the temperature), filtering pollutants in storm runoff and adding leaf litter to feed small insects and fish. When choosing trees and shrubs for greenway corridors, it is recommended that indigenous and well-adapted species be used. This will reduce the need for chemical and water applications as a part of long term maintenance. The following graphics represent common installation practices used for several different types of plant material.



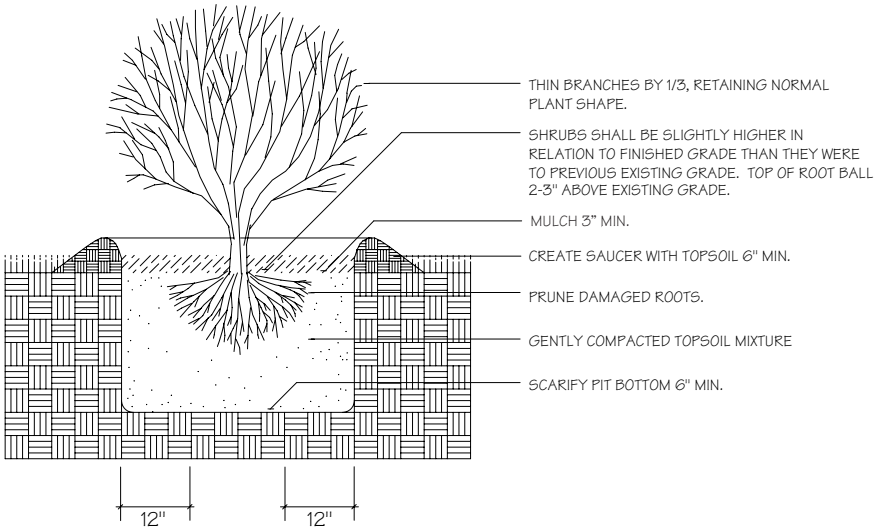
Ball and Burlap Tree Planting Detail



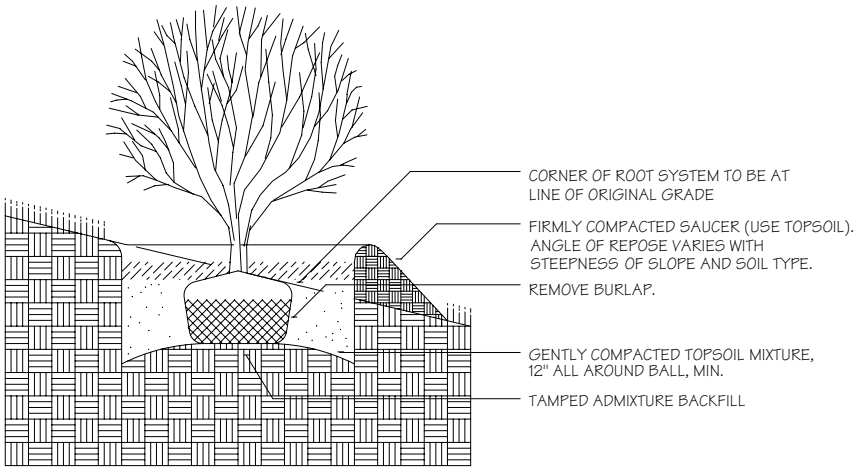
Bare Root Tree Planting Detail

Shrub Plantings

The amount of planting needed will vary depending on the project. While some projects will require little or no planting, other projects may require it for vegetative screening, habitat restoration, erosion control or aesthetics. The graphics below illustrate planting techniques for two types of shrub material (ball & burlap and bare root) which can be used.



Shrub Planting Detail



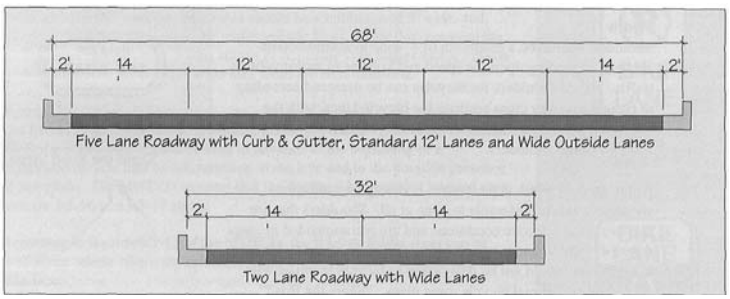
Ball and Burlap Shrub Planting Detail

Bike Considerations - Wide Curb Lanes

There are three types of on-road bicycle facilities: wide curb lanes, bike lanes and paved shoulders. Wide curb lanes, or outside lanes, are wider than the standard 12' travel lane and can provide more space for cyclists and easier passing for motorists. Under most conditions, automobiles and bicycles can coexist in a 14' wide curb lane, without the need for the motorist to move into the next adjacent lane.

Location and Width

Wide curb lanes best accommodate advanced cyclists, as these riders are more comfortable operating directly in traffic. The wide curb lane is always the furthest right-hand lane, and should optimally be 14'-16' wide, not including the gutter pan (curb lanes that are wider than 16' are not recommended). Wide curb lanes are not required to have curb and gutter. In order to achieve the extra space needed for a 14' wide outside lane, the roadway may either be physically widened or restriped to reduce the lane width of inner lanes and increase the width of outer lanes. Restriping proposals should be reviewed by a transportation engineer to ensure adequate safety for the motorists as well as bicyclists.



Signage

There is no special "wide curb lane" sign, however, on high volume urban arterials, the designer may choose to install "Share the Road" warning signs (standard bicycle warning plate with a subplate stating SHARE THE ROAD).

Intersection Design

When the curb lanes approach intersections with turning lanes, the 14' wide lane should continue through the intersection as the outside through-lane.

Design Issues

Acceptance: Bicycle programs in numerous communities have found that less experienced bicyclists seldom see a difference when wide curb lanes are provided. Therefore, if the desired outcome is greater numbers of bicyclists or a visible "pro bicycle" statement, this option will not satisfy the need.

Traffic: Wider curb travel lanes may tend to increase motorist speeds. Whether a marginal increase in speeds is important in a particular situation should be a subject for analysis.

Bike Considerations - Bike Lanes

Bicycle lanes in Knightdale should conform to the standards in AASHTO's Guide for the Development of Bicycle Facilities (2000). Bicycle lanes are an on-road type of facility. They should not be separated from other motor vehicle lanes by curbs, parking lanes, or other obstructions. General standards for width, striping, and intersections are provided below.

Location and Use

Bicycle lanes serve the needs of experienced and inexperienced bicyclists in urban and suburban areas, providing them with their own travel lane. Bicycle lanes are always located on both sides of the road (except when they are constructed on one-way streets). By this design, cyclists are encouraged to follow the rules of the road, which require them to travel in the same direction as adjacent motor vehicle traffic.

Width

The minimum width of bike lanes should be 4', exclusive of the gutter pan. On roads with parallel parking, bike lanes should be a minimum of 5' wide, and should be installed adjacent to the motor vehicle lanes, rather than between the parking lane and the curb. Along streets in Knightdale with higher motor vehicle speeds and traffic volumes, 6' wide bike lanes are recommended.

Signage

The MUTCD specifies standard signage for bicycle lanes. According to section 9B-8, the R3-16 sign should be used in advance of the beginning of a designated bicycle lane to call attention to the lane and to the possible presence of bicyclists. The MUTCD requires that the diamond lane symbol be used with both the R3-16 and R3-17 signs. (See page xx for signage examples.)

According to Section 9B-11 of the MUTCD, the R7-9 or R7-9a signs can be used along streets where motorists are likely to park or frequently pull into the bike lane.

Striping

Bicycle lane stripes should be solid, 6"-wide white lines. Care should be taken to use pavement striping that is skid resistant. Bicycle-shaped pavement symbols and directional arrows should be placed in the bicycle lane to clarify its use. avement letters that spell "ONLY BIKE" are also highly recommended. Symbols should be installed at regular intervals, immediately after intersections, and at areas where bicycle lanes begin.

Bike lane striping at intersections is challenging. Traffic has a tendency to mix at intersections: motorists who are turning right must cross paths with cyclists who wish to continue straight, and cyclists who wish to turn left must cross into left-hand turn lanes. Several intersection striping patterns are provided by AASHTO's Guide for the Development of Bicycle Facilities (2000) and the MUTCD.

Bike Route

A bicycle route is a “suggested way” for a cyclist to get from a point of origin to a destination. Bike routes do not necessarily require physical improvements in order to accommodate bicyclists, given that they meet minimum safety criteria in their present condition (see below). Bike routes can be preferable for a number of reasons including directness, scenery, less congestion and lower speed limits.

Location and Use

Bicycle routes may be used by all types of cyclists. In urban areas bike routes are most often designated on residential streets with low traffic volumes, and are typically used to direct cyclists to a destination within the community, or to provide a through-route for bicyclists. In rural areas, bike routes are most often designated on roadways that are popular touring routes for recreational cyclists, or long-distance commuting routes for advanced cyclists.

Safety Criteria

A street does not necessary have to be physically widened in order to be designated as a bicycle route. A road with standard 12' wide lanes can be designated as a bike route with the appropriate signage, given that each condition below is met:

- In its present state (or with planned improvements), the roadway sufficiently accommodates cyclists. The evaluation should take into account roadway width and traffic volumes. Candidate bike routes should have good sight distances and adequate pavement conditions. In addition, traffic should not regularly exceed posted speed limits.

- All bicycle hazards have been removed from the roadway or otherwise remedied, including unsafe drainage grates and angled railroad crossings.

- The bicycle route is designated as one segment within an interconnected system of bicycle facilities.

Bicycle route signage should be used according to the standards in the MUTCD, which provides several choices in styles. Bicycle route signs should be placed at all areas where new traffic enters the roadway. The distance between signs should not be greater than two miles. In urban areas, it is helpful to include directional arrows and captions that indicate nearby destinations, particularly at intersections.

Bike Pavement

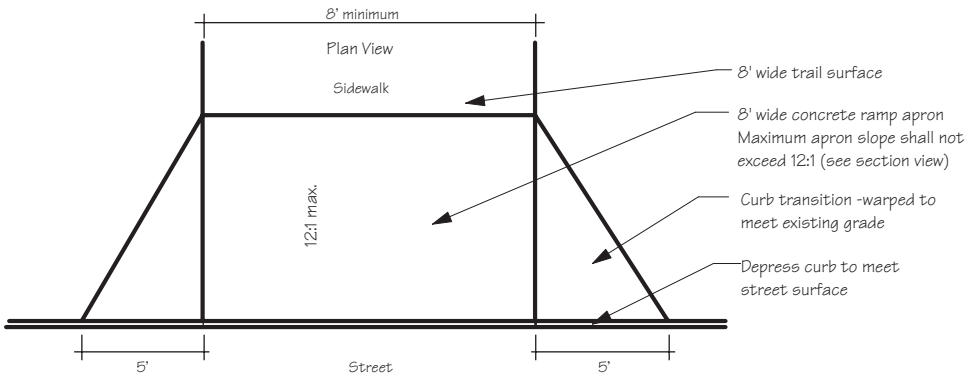
Bike lane pavement and sub-base should always have the same depth and quality as the adjacent roadway. Bike lanes are not required to have a curb and gutter.

Every effort should be made to provide a smooth and even surface for bicycles, particularly for designated bicycle routes and lanes. Bicycles are much more vulnerable to surface irregularities than motor vehicles, because they rely on very narrow, highly pressurized wheel with no suspension. A simple pothole that might cause a slight jarring to the passengers of a car can cause a serious crash for a cyclist.

Potholes aren't the only surface hazard for cyclist. Bumps, corrugations, seams, rumble strips, unraveled pavement and bridge expansion joints can cause bicyclists to lose their balance. In addition, temporary roadway construction zones often include surface hazards such as milled pavements and sudden pavement changes. Temporary signage can be used to warn bicyclist of upcoming irregularities.

When paved shoulders or bicycle lanes are added to the edge of the existing roadway, a resulting seam between the two can be hazardous to bicyclists. One solution is to install 10' wide strips of asphalt, partially overlapping the existing motor vehicles lanes.

Pavement with large aggregates can also put additional stress on the mechanical parts of road bikes, especially for distance riders. Smooth pavement is preferred to avoid accidents due to the loss and/or looseness of bike parts.

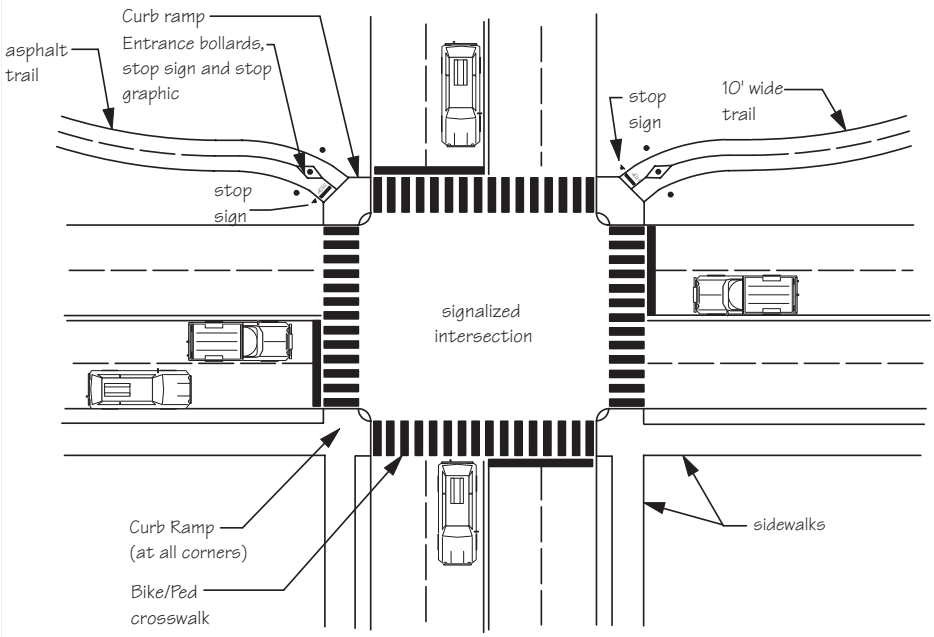


Bike Curb Ramp Plan View

Bike Intersections

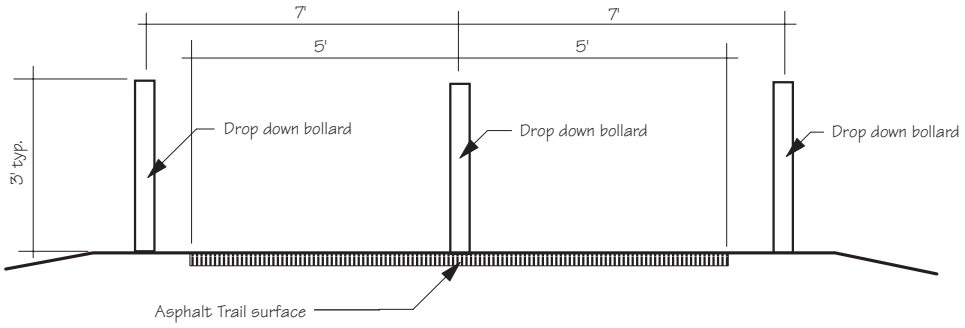
Trail/Roadway intersections can become dangerous conflict areas if not carefully designed. For at-grade intersections, there are usually several design objectives:

1. Site the crossing area at a logical and visible location.
2. Warn motorists of the upcoming crossing.
3. Maintain visibility between trail users and motorists.
4. Inform trail users of the upcoming intersection.



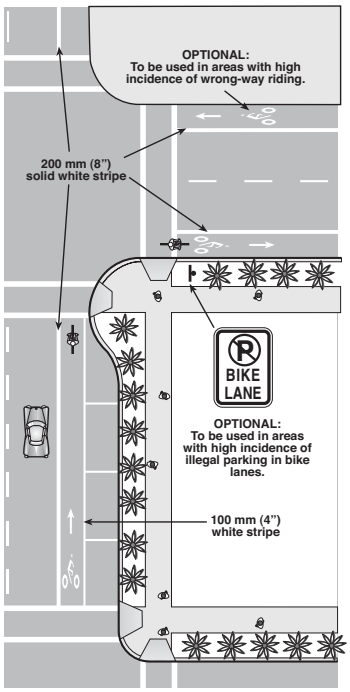
Typical Signalized Intersection Plan View

Intersections and approaches should be on relatively flat grades. In particular, the bicyclist should not be required to stop at the bottom of the hill. If the intersection is more than 75 feet from the curb to curb, it is preferable to provide a center median refuge area, per ADA (Americans with Disabilities Act) or ANSI (American National Standards Institute) standards. If crossing traffic is expected to be heavy, it may be necessary to provide a traffic signal that responds to bicycles and/or can be pedestrian activated.

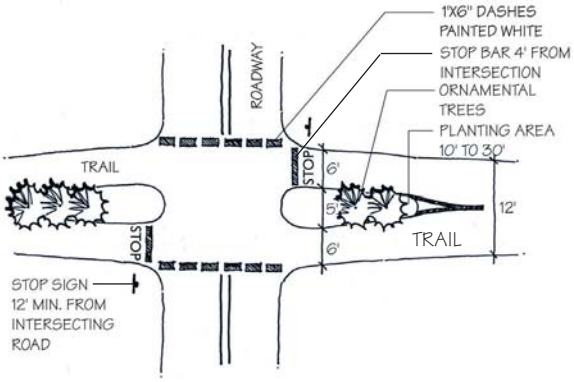


Typical Bollard Placement

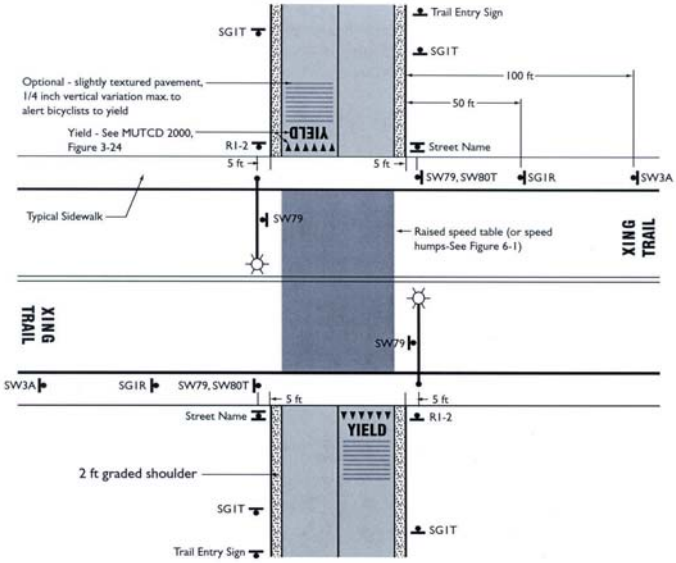
Bike Intersections



Typical Intersection Signage Layout Plan View



Typical Perpendicular Trail and Road Intersection



Typical Trail Crossing at Local Street
(from Contra Costa County Trail Design Guidelines)

Sidewalk Considerations

Sidewalks are a critical component of this Open Space and Greenways Plan. They not only encourage walking, but they also improve the safety of pedestrians. An individual's decision to walk is as much a factor of convenience as it is the perceived quality of the experience. Pedestrian facilities should be designed with the following factors in mind:

Sufficient width
Sidewalks should accommodate anticipated volumes based on adjacent land uses, and should at a minimum allow for two adults to walk abreast (min. 5 feet, prefer 6 feet).

Protection from traffic
High volume and/or high speed (greater than 35 mph) motor vehicle traffic creates dangerous and uncomfortable conditions for pedestrians. Physical (and perceptual) separation can be achieved through a combination of methods: a grassy planting strip with trees, a raised planter, bicycle lanes, on-street parallel parking, etc.

Street trees
Street trees are an essential element in a high quality pedestrian environment. Not only do they provide shade, they also give a sense of enclosure to the sidewalk environment which enhances the pedestrian's sense of a protected environment.

Pedestrian-scaled design
Large highway-scale signage reinforces the general notion that pedestrians are out of place. Signage should be designed to be seen by the pedestrian. Street lighting should likewise be scaled to the level of the pedestrian (14 feet tall), rather than providing light poles that are more appropriate on high-speed freeways.

Continuity
Pedestrian facilities are often discontinuous, particularly when private developers are not encouraged to link on-site pedestrian facilities to adjacent developments and nearby sidewalks or street corners. New development should be designed to encourage pedestrian access from nearby streets. Existing gaps in the system should be placed on a prioritized list for new sidewalk construction.

Clearances
Vertical clearance above sidewalks for landscaping, trees, signs and similar obstructions should be at least 10 feet. In commercial areas and the downtown, the vertical clearance for awnings should be 10 feet. The vertical clearance for building overhangs which cover the majority of the sidewalk should be 12 feet.

Conformance with national standards
Sidewalk design should be consistent with Americans with Disabilities Act requirements and/or ANSI requirements. Specific guidance is provided by the Architectural and Transportation Barriers Compliance Board's American's with Disabilities Act Accessibility Guidelines.

Sidewalk Obstacles
Street furniture and utility poles create obstacles to pedestrian travel when located directly on the sidewalk. At a minimum, there should be 36 inches of sidewalk width to allow wheelchairs to pass. Where possible, utilities should be relocated so as not to block the sidewalk. Benches should not be sited directly on the sidewalk, but set back at least 3 feet. The design of new intersections or re-design of existing intersections presents an opportunity to improve pedestrian circulation. Street furniture located near intersections can block sight lines. In general, the designer should consider the impact on sight distance for all features located in the vicinity of roadway intersections.

Sidewalk pavement design
Sidewalks and roadside pathways should be constructed of a solid, debris-free surface. Regardless of the type of surface chosen, it must be designed to withstand adequate load requirements. Pavement depth should reflect site specific soil conditions but never be less than 4.5 inches. Brick and concrete pavers are popular materials for more decorative sidewalks. The use of stylized surfaces is encouraged, however they must be installed properly or they will deteriorate more rapidly.

Sidewalk width and setback guidelines
It is important to note that there are some areas that warrant wider sidewalks . For example, sidewalks in and around local universities and colleges must accommodate a much higher volume of pedestrians and, therefore, warrant additional width. The recommendations below are based upon standards used by other pedestrian-friendly communities in the U.S. Following the recommenations below ensures that basic needs of pedestrians are addressed in developing areas. In existing residential and commercial areas that lack sidewalks, new sidewalk construction (independent of new development) should occur first in locations that demonstrate the most need.

Sidewalks on local streets in residential areas:
Five-foot wide sidewalks are recommended on at least one side of the street, with a 5 feet wide planting strip. The planting strip may need to be slightly wider to accommodate the roots of street trees, if they are included in the design. Sidewalks are not necessary on cul-de-sacs that are less than 500 feet in length.

Sidewalks on collector streets in residential and commercial areas:
Five-foot wide sidewalks are recommended on both sides of the street. However, one option may be to install a 6 feet wide sidewalk on the side

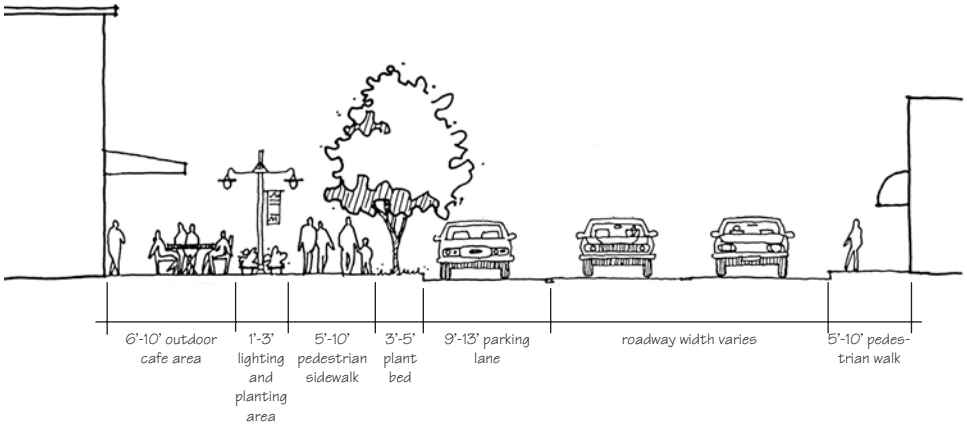
of the street that generates the most activity. A 7 foot wide planting strip is recommended.

Sidewalks on arterial streets in residential and commercial areas:
Six foot sidewalks are recommended on both sides of the street, with an 8' wide planting strip.

Sidewalks on streets within 2000' of schools:
Width and setback should be based on the specific roadway type as described above. For all roadway types, however, sidewalks should be installed on both sides of the road, and should include well-marked crosswalks and school crossing signs.

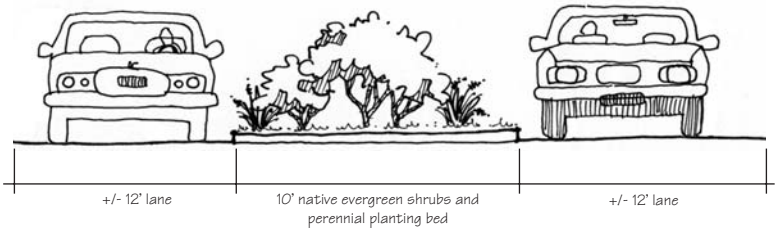
Sidewalks on streets with no curb and gutter
Sidewalks located immediately adjacent to "ribbon pavement" (pavement with no curb and gutter) are not recommended. However, if no other solution is possible, sidewalks adjacent to ribbon pavement have a much greater setback requirement, depending on roadway conditions. Engineers should consult the AASHTO Policy on Geometric Design of Highways and Streets for more specific guidelines.

Sidewalks in rural areas
In most rural areas, the low volume of pedestrians does not warrant sidewalk construction. In most cases, 4'-6' wide paved shoulders can provide an adequate area for pedestrians to walk on rural roadways, while also serving the needs of bicyclists. Exceptions should be made in areas where isolated developments such as schools, ballparks or housing communities create more pedestrian use. For example, motorists might regularly park along a rural road to access a nearby ballpark. A sidewalk may be warranted in this circumstance so that the pedestrians can walk separately from traffic. Sidewalks in rural areas should be provided at a width based on anticipated or real volume of pedestrians, with 5' being the minimum width.

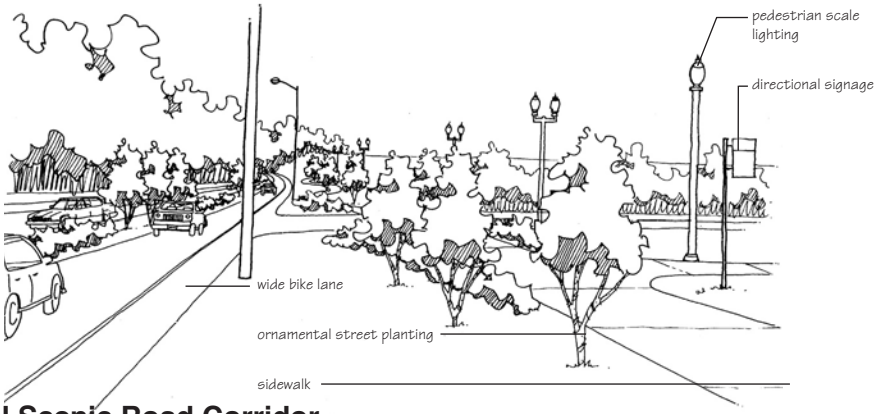


Typical Street Section

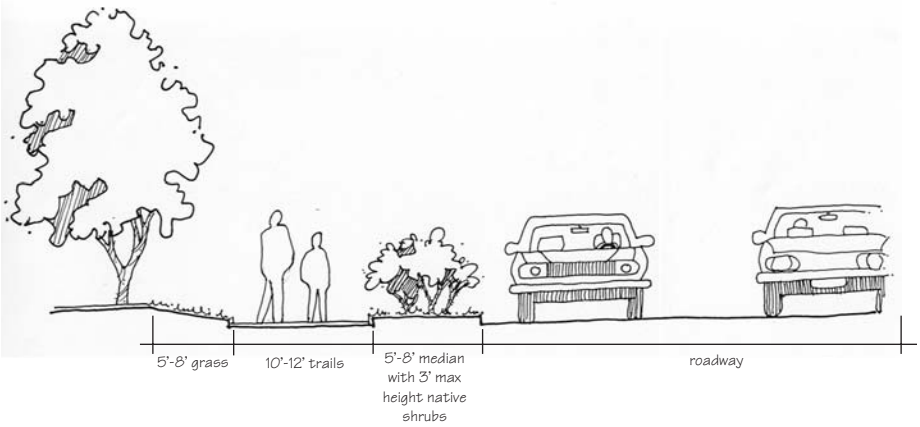
Roadside Treatments



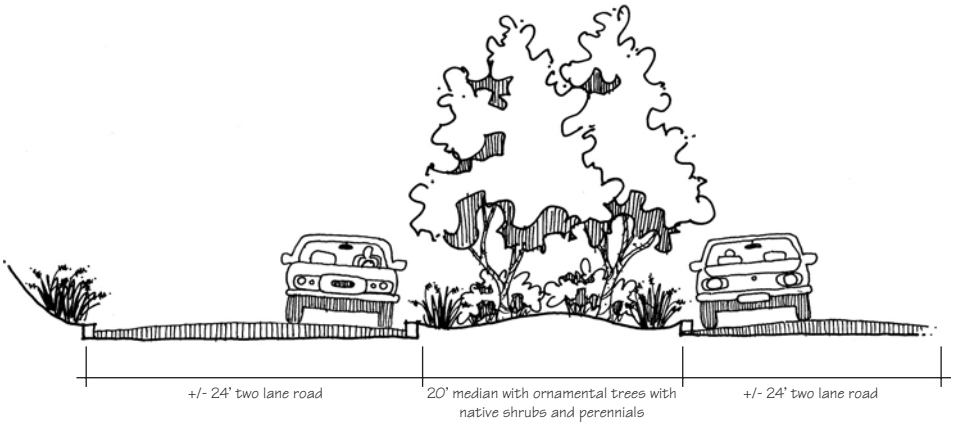
Typical Median Shrub Planting



Typical Scenic Road Corridor



Typical Road with Adjacent Sidewalk



Typical Median Planting

Appendix C: Estimated Costs

Cost Estimates

Itemized below are some rough cost estimates that could be associated with trail development for the Knightdale greenway system. These costs are divided into major elements of the project. These prices are based on North Carolina greenway averages for similar projects currently in operation throughout the state and assume that the Town will employ professional contractors appropriate to build the project. Greenways Incorporated offers these estimates as a guide to future decision making and cannot guarantee their accuracy.

Because the greenways can be built using a variety of different trail widths, materials, and surfaces, the costs for installation can vary widely . Volunteer labor and donations of materials can help to significantly lower the price of trail installation. A representative sample of costs (in 2001 dollars) associated with trail types follows.

Greenways with No Facility Development (Type 1):

Vegetation	**Unit cost**	
Trees (3" caliper)	$ 350	each
Shrubs (3 gallon)	$ 25	each

*Costs include plant and installation.

Streambank Stabilization (Bioengineering)

	$ 25 - 75 / lin. foot
	$ 45 - 60 / lin. foot (ave.)

Greenways with Limited Facility Development (Type 2):

Trail Treads	**Unit cost**	
4-foot Bare Earth Hiking/Mtn. Bike Trail	$ 2	/ lin. foot
10-foot Wood Deck/Boardwalk Trail	$ 150	/ lin. foot

*Costs include site preparation, clearing, grading, and mobilization.

Signage		
Information Signs	$ 250	each
Direction Signs	$ 250	each
Warning Signs	$ 250	each
Mile Markers	$ 50	each

Greenways with Multi-Use Unpaved Trail Facility Development (Type 3):

Trail Treads		**Unit cost**	
10-foot Aggregate/Stone Trail	$	12	/ lin. foot
10-foot Wood Deck/Boardwalk Trail	$	150	/ lin. foot
Signage			
Information Signs	$	250	each
Direction Signs	$	250	each
Warning Signs	$	250	each
Mile Markers	$	50	each
Furniture/Furnishings			
Benches	$	600	each
Trash Receptacles	$	200	each
Security Bollards	$	250	each
Bicycle Racks	$	550	each
Fencing (Board-on-Board)	$	20	/ lin. foot
Gates	$	750	each
911 Emergency Phones (w/ infrastructure)	$	800	each
911 Emergency Phones (w/o infrastructure)	$	3,500	each
Pre-fabricated Steel Bridges	$	1,000	/ lin. foot

Greenways with Multi-Use Paved Trail Facility Development (Type 4):

Trail Treads		**Unit cost**	
10-foot Asphalt Multi-Purpose Trail	$	50	/ lin. foot
10-foot Concrete Multi-Purpose Trail	$	75	/ lin. foot
10-foot Wood Deck/Boardwalk Trail	$	150	/ lin. foot
Signage			
Information Signs	$	250	each
Direction Signs	$	250	each
Warning Signs	$	250	each
Mile Markers	$	50	each
Furniture/Furnishings			
Benches	$	600	each
Trash Receptacles	$	200	each
Security Bollards	$	250	each
Bicycle Racks	$	550	each
Fencing (Board-on-Board)	$	20	/ lin. foot
Gates	$	750	each
911 Emergency Phones (w/ infrastructure)	$	800	each
911 Emergency Phones (w/o infrastructure)	$	3,500	each
Pre-fabricated Steel Bridges	$	1,000	/ lin. foot

The following estimate for developing the Knightdale Greenway trail system has been prepared based on the itemized costs above.

On-road trail construction estimates consist of establishing sidewalks in the Knightdale business district and as connectors between off-road trails.

Phase I (as delineated on the Knightdale Vision Map) trails are estimated to take 2-3 years to complete. These include approximately 1000 feet of off-road trail, 7.70 miles of on-road bike routes, and 2.77 miles of on-road trail. It is estimated that two-thirds of the off-road trail will require an asphalt or concrete surface.

• Paved asphalt trail (1000 linear ft. @ $50.00 per /ft.)	$5,000
• On-road trail (14,665 linear ft. @ $25.00 per /ft.)	$293,300
• Signage allowance (1 sign per 1,000 linear ft. @ $250 each)	$3750
• Furniture allowance ($2,000 per mile of trail - off-road only)	$2000
• Design fees and Construction Documentation (@15% of Total Cost)	$45,607
• Total Cost	$349,657

Cost options for phase I bike routes:

Option 1: Share the road signage (6 signs per route @ $250 each sign)	$6,000
Option 2: Restriping ($7200 per mile)	$55,440
Option 3: Rural Bike Lanes (4' wide, both sides $110,000 per mile)	$847,000

Phase II trails are estimated to take 1-5 years to complete. These include approximately 9.07 miles of off-road trail. It is estimated that two-thirds of the off-road trail will require an asphalt or concrete surface.

• Natural surface trail (15,975 linear ft. @ $12.00 per /ft.)	$191,700
• Paved asphalt trail (31,950 linear ft. @ $50.00 per /ft.)	$1,597,500
• Signage allowance (1 sign per 1,000 linear ft. @ $250 each)	$11,750
• Furniture allowance ($2,000 per mile of trail)	$18,000
• Design fees and Construction Documentation (@15% of Total Cost)	$272,842
• Total Cost	$2,091,792

Phase III trails are estimated to take 5-10 years to complete. These include approximately 10.20 miles of off-road trail and 1.06 miles of on-road trail. It is estimated that two-thirds of the off-road trail will require an asphalt or concrete surface.

• Natural surface trail (17,943 linear ft. @ $12.00 per /ft.)	$215,316
• Paved asphalt trail (35,886 linear ft. @ $50.00 per /ft.)	$1,794,300
• On-road trail (5,611 linear ft. @ $25.00 per /ft.)	$112,220
• Signage allowance (1 sign per 1,000 linear ft. @ $250 each)	$14,750
• Furniture allowance ($2,000 per mile of trail)	$20,400
• Design fees and Construction Documentation (@15% of Total Cost)	$323,547
• Total Cost	$2,480,533

Facility Mainenance Costs

The following maintenance costs are provided as a guide to establishing a budget for the operation, maintenance and management of each trail segment within the greenway system. These costs are derived from national industry averages and have not been adjusted to reflect unique labor, material and cost issues specific to Knightdale.

It may be possible to lower the cost of maintaining one mile of paved trail through the development of an Adopt-a-Greenway Program. Volunteers have been proven effective in performing some of the routine maintenance activities that are listed below. Savings of 50% of the estimated cost per mile defined below are possible through a coordinated and well-run Adopt-a-Greenway Program, and some of these costs are already being covered along highways, roads and parks and other areas.

Typical Maintenance Costs (for a 1-mile paved trail)

Drainage and storm channel maintenance (4 x / year)	$ 500
Sweeping/blowing debris off trail tread (20 x / year)	$ 1,200
Pick-up and removal of trash (20 x./ year)	$ 1,200
Weed control and vegetation management (10 x / year)	$ 1,000
Mowing of 3-ft grass safe zone along trail (20 x / year)	$ 1,200
Minor repairs to trail furniture / safety features	$ 500
Maintenance supplies for work crews	$ 300
Equipment fuel and repairs	$ 600
Total Maintenance Costs per Mile of Paved Trail	$ 6,500
Re-surfacing of paved trail tread (20-year cycle)	$ 50 / lin. foot

Appendix D: Funding Sources

Federal Government Funding Sources

Some Federal programs offer financial aid for projects that aim to improve community infrastructure, transportation, housing and recreation. Some of the Federal programs that could be used to support the development of Knightdale open space and greenways include:

The Intermodal Surface Transportation Efficiency Act (ISTEA)

The primary source of federal funding for greenways is through the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). This money is targeted at greenway projects that serve a transportation purpose, and is administered through the state Department of Transportation. All funded projects must meet certain design standards set forth by the state, which may add to the cost of the project. Therefore, this funding source should be investigated carefully before an application is completed. There are many sections of the Act that support the development of bicycle and pedestrian transportation corridors. Those sections that may be of particular interest to Knightdale include:

•Section 1302: Symms National Recreational Trails Fund Act (NRTFA)

A component of ISTEA, the NRTFA is a funding source that assists with the development of non-motorized and motorized trails. The Act uses Highway Trust Fund fees from non-highway recreation fuel used by off-road vehicles and camping equipment. States can grant funds to private and public sector organizations. NRTFA projects are 80 percent federally funded, grant recipients must provide a 20 percent match. Projects funded must be consistent with the Statewide Comprehensive Outdoor Recreation Plan.

Surface Transportation Program (STP) Funds

These funds can be used for bicycle and pedestrian facility construction or non-construction projects such as brochures, public service announcements, and route maps related to bicycle safety. The projects must involve bicycle and pedestrian transportation and must be part of the Long Range Transportation Plan.

•STP Transportation Enhancements Program

Ten percent of North Carolina's annual STP funds are available for transportation enhancements, which include projects such as scenic byways, historic transportation preservation, landscaping and the development of bicycle and pedestrian facilities. These funds are available to all cities and counties in the state. There are several key requirements that projects must meet in order to receive these funds. Contact the State Bicycle and Pedestrian Coordinator for more information.

Community Development Block Grant Program

The U.S. Department of Housing and Urban Development (HUD) offers financial grants to communities for neighborhood revitalization, economic development, and improvements to community facilities and services, especially in low and moderate-income areas. Several communities have used HUD funds to develop greenways, including the Boscobel Heights' "Safe Walk" Greenway in Nashville, TN.

Land and Water Conservation Fund (LWCF) Grants

This Federal funding source was established in 1965 to provide "close-to-home" parks and recreation opportunities to residents throughout the United States. Money for the fund comes from the sale or lease of nonrenewable resources, primarily federal offshore oil and gas leases along with surplus federal land sales. LWCF grants can be used by communities to build a variety of park and recreation facilities, including trails and greenways.

LWCF funds are distributed by the National Park Service to the states annually. Communities must match LWCF grants with 50 percent of the local project costs through in-kind services or cash. All projects funded by LWCF grants must be used exclusively for recreation purposes, in perpetuity.

Watershed Protection and Flood Prevention (Small Watersheds) Grants

The USDA Natural Resource Conservation Service (NRCS) provides funding to state and local agencies or nonprofit organizations authorized to carry out, maintain and operate watershed improvements involving less than 250,000 acres. The NRCS provides financial and technical assistance to eligible projects to improve watershed protection, flood prevention, sedimentation control, public water-based fish and wildlife enhancements and recreation planning. The NRCS requires a 50 percent local match for public recreation, and fish and wildlife projects.

Urban and Community Forestry Assistance Program

The USDA provides small grants of up to $10,000 to communities for the purchase of trees to plant along city streets, greenways and parks. To qualify for this program, a community must pledge to develop a street-tree inventory; a municipal tree ordinance; a tree commission, committee or

department; and an urban forestry-management plan.

Small Business Tree Planting Program

The Small Business Administration provides small grants of up to $10,000 to purchase trees for planting along streets and within parks or greenways. Grants are used to develop contracts with local businesses for the planting.

Design Arts Program

The National Endowment for the Arts provides grants to states and local agencies, individuals and nonprofit organizations for projects that incorporate urban design, historic preservation, planning, architecture, landscape architecture and other community improvement activities, including greenway development. Grants to organizations and agencies must be matched by a 50 percent local contribution. Agencies can receive up to $50,000.

State Funding Sources

North Carolina Department of Transportation (NCDOT)

NCDOT is the state agency that administers federal funding from the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. Along with the federal requirements for this money, NCDOT has application policies and procedures. Contact the state Bicycle and Pedestrian Coordinator for more details.

North Carolina Division of Parks and Recreation

The state Division of Parks and Recreation currently offers limited funding for greenway projects. The Adopt-a-Trail program provides funding (approximately $135,000 annually) to trail projects, with priority given to volunteer groups. There is also a state trails program that offers technical assistance in the planning, design and maintenance of trails.

North Carolina Wildlife Resources Commission

The Commission, through small grants, annually funds projects that increase wildlife habitat or improve public access and education related to wildlife. This money can be used for interpretive signage on local wildlife habitat along greenways.

North Carolina Department of Corrections

Low security prison labor can be used to construct and maintain greenways. Amenities such as picnic tables, signs and benches can be constructed using prison labor. An example of where this has been successful is in Guilford County, where prisoners regularly maintain the Bicentennial Greenway.

North Carolina Division of Water Resources

Greenway projects involving stream restoration or recreation can receive money from the Water Resources Development Grant Program, administered by the Division of Water Resources.

Local Funding Sources

• PL 566—Watershed Protection and Flood Prevention Act

Local communities can receive funding for greenway projects that incorporate flood prevention and watershed protection through this Act.

Local Private-Sector Funding

Local industries and private businesses may agree to provide support for development of Knightdale open space and greenways through:

- donations of cash to a specific greenway segment or open space parcel;
- donations of services by large corporations to reduce the cost of greenway implementation, including equipment and labor to construct and install elements of greenways;
- reductions in the cost of materials purchased from local businesses which support open space preservation/ greenway implementation and can supply essential prod ucts for facility development.

One example of a successful endeavor of this type is the Swift Creek Recycled Greenway in Cary, NC. A total of $40,000 in donated construction materials and labor made this trail an award-winning demonstration project. This method of raising funds requires a great deal of staff coordination. (Note: Some materials used in the “recycled trail” were considered waste materials by local industries!)

Greenway Sponsors

A sponsorship program for greenway amenities allows for smaller donations to be received both from individuals and businesses. The program must be well planned and organized, with design standards and associated costs established for each amenity. Project elements which may be funded can include wayside exhibits, benches, trash receptacles, entry signage, and picnic areas.

Volunteer Work

Community volunteers may help construct open space or greenway facilities, as well as conduct fund-raisers. Individual volunteers can be recruited, as well as those from local organizations such as church groups, civic groups, scout troops, and environmental groups.

A case in point is Cheyenne, Wyoming’s volunteer greenway program. The Greater Cheyenne Greenway has motivated an impressive amount of community support and volunteer work. The program had to insist that volunteers wait to begin landscaping the trail until construction is completed. A manual for greenway volunteers was developed in 1994 to guide and regulate volunteer work. The manual includes a description of appropriate volunteer efforts, request forms, waiver and release forms, and a

completion form (that asks volunteers to summarize their accomplishments). Written guidelines are also provided for volunteer work in 100-year floodplains.

To better organize volunteer activity, Cheyenne developed an "Adopt-a-Spot" program. Participants who adopt a segment of trail are responsible for periodic trash pickup, but can also install landscaping, prune trail-side vegetation, develop wildlife enhancement projects, and install site amenities. All improvements must be consistent with the Greenway Development Plan and must be approved by the local Greenway Coordinator. Adopt-a-Spot volunteers are allowed to display their names on a small sign along the adopted section of greenway.

"Buy-a-Foot" Programs

"Buy-a-Foot" programs have been successful in raising funds and awareness for trail and greenway projects within North Carolina. Under local initiatives, citizens are encouraged to purchase one linear foot of the greenway by donating the cost of construction. An excellent example of a successful endeavor is the High Point Greenway "Buy-a-Foot" campaign, in which linear greenway "feet" were sold at a cost of $25/foot. Those who donated were given a greenway T-shirt and a certificate. This project provided over $5,000 in funds.

Private Foundations and Corporations

Many communities have solicited funding from a variety of private foundations and other conservation-minded benefactors.

Walking Magazine Trail Restoration Fund

Walking Magazine, hoping to encourage more volunteer efforts among trail users, established this fund for the restoration of urban, suburban or rural walking trails. The magazine provides small grants, generally from $200 to $500, to help walking clubs and other groups purchase trail maintenance equipment or supplies.

Coors Pure Water 2000 Grants

Coors Brewing Company and its affiliated distributors provide funding and in-kind services to grassroots organizations that are working to solve local, regional and national water-related problems. Coors provides grants, ranging from a few hundred dollars to $50,000, for projects such as river cleanups, aquatic habitat improvements, water quality monitoring, wetlands protection, pollution prevention, water education efforts, groundwater protection, water conservation and fisheries.

World Wildlife Fund Innovative Grants Program

This organization awards small grants to local, regional and statewide nonprofit organizations to help implement innovative strategies for the conservation of natural resources. Grants are offered to support projects which:

1. Conserve wetlands;
2. Protect endangered species;
3. Preserve migratory birds;
4. Conserve coastal resources; and
5. Establish and sustain protected natural areas.

Innovation grants can help pay for the administrative costs for projects including planning, technical assistance, legal and other costs to facilitate the acquisition of critical lands; retaining consultants and other experts; and preparing visual presentations and brochures or other conservation activities. The maximum award for a single grant is $10,000.

E

Appendix E: Operations, Maintenance and Management

Overview

Operating, maintaining and managing a system of open space and greenways in Knightdale will require a coordinated effort among all Town departments, private sector organizations and individuals. The following text defines key aspects of Open Space and Greenway System management, beginning with a discussion of a governance structure for the system, followed by definition of operational policies, facility management, land management, safety and security, trail user rules and regulations, an emergency response plan, and risk management program.

Governance Structure

For a successful Open Space and Greenway System to be developed it is critical for the players to understand their role in supporting and managing the system.

Role of Knightdale

The Knightdale Open Space and Greenway System will be developed and managed by the Town and its departments. Listed below and on the following pages are the key departments and organizations that will play a role in this implementation.

Role of Department of Parks and Recreation

As the primary developer of greenways, the Parks and Recreation Department is the most prominent participant in the Open Space and Greenway Plan. The Department will be responsible for the design, management and maintenance of the greenway system. The Parks and Recreation Department will need to work closely with the planning Department in the siting of greenways.

Role of the Planning Department

The Planning Department should provide support for the Open Space and Greenway Plan and assistance with future implementation of the system. This can be accomplished by defining future greenways within related planning efforts; utilizing the rezoning process to encourage dedication of lands, including sidewalks and bicycle facilities for the Open Space and Greenway System; and planning transportation improvements in coordination with greenways.

Role of Department of Public Utilities

The Department of Public Utilities is an important player in the implementation strategy for the Open Space and Greenway System. The Department manages the system of sanitary and stormwater sewers which offers enormous potential for shared use with greenway development objectives. For the expansion and development of new sanitary sewer lines, the Department should consider the use of a joint-use easement document during right-of-way negotiations to acquire subsurface and surface rights from willing sellers. The Department could function as a greenway developer in partnership with the Parks and Recreation Department. Additionally, stormwater management objectives can be enhanced through the development of the Open Space and Greenway System through the use of funds obtained from federal and state grants.

Role of Department of Police Services

The Department of Police Services should assist the Parks and Recreation Department with patrolling and law enforcement for Open Space and Greenway System lands and facilities.

Role of Private Sector

The private sector throughout Knightdale is the primary beneficiary of the Knightdale Open Space and Greenway System. As such, private organizations, businesses and individuals can and should play an important role in the development and management of the system. Private sector groups and businesses can sponsor implementation projects for open space and greenways as a partner of the Town. These groups can also help to maintain open space and greenway lands through cooperative management agreements with the Town.

Role of Local Businesses and Corporations

Knightdale businesses and corporations might choose to sponsor a segment of greenway for development or maintenance. Businesses and corporations can work with the Parks and Recreation Department to give money, materials, products and labor toward the development of a greenway facility. Businesses can also consider installing facilities, such as bike racks or lockers, benches, and signage that links their operations to the Open Space and Greenway System.

Role of Civic Organizations

Local civic groups and organizations, including the Junior League, Boy Scouts and Girl Scouts, garden clubs, YMCA, Kiwanis and Rotary Clubs, to name a few, can be participants in the Knightdale Open Space and Greenway System. These organizations can play a vital role in building sections of greenway trails, maintaining and managing greenway lands and facilities, and co-hosting events that raise money for the Open Space

and Greenway System. There are many ways in which civic organizations can participate in the development of the Open Space and Greenway System. The most appropriate involvement can be determined by matching the goals and objectives of each organization to the needs of the greenway program.

Role of Individual Citizens

Local residents who are interested in the development of Knightdale's Open Space Greenway System can participate by agreeing to donate their time, labor, and expertise to the Parks and Recreation Department. Residents might choose to partner with a friend or form a local neighborhood group that adopts a section of greenway for maintenance and management purposes. As an adopt-a-greenway organization, individuals might help pick-up trash, plant flowers and trees, care for newly planted vegetation and serve as additional "eyes and ears" for safety and security on open space and greenway lands. All volunteer efforts would be recognized by the Parks and Recreation Department through a community-wide program.

Open Space and Greenways Operations

Over the course of time, Knightdale will encounter a variety of issues that are important to the successful management and operation of the Open Space and Greenway System. The following operational policies are defined to assist the Town in responding to typical greenway implementation issues. More specific problems and issues may arise during the long-term development of the system that result in additional policies being considered and adopted.

Land Acquisition Procedures

The protection of stream corridors from urban encroachment is essential in order to permit stream channels and their floodplains to perform natural infrastructure functions. Stream corridors are best protected by first delineating the landscape boundaries of the 100-year (regulatory) floodplain and then by encouraging landowners to engage in land stewardship practices that limit encroachment and preserve the native landscape.

This section of the Plan defines land acquisition procedures that can be used to conserve, protect, and preserve the stream corridors of Knightdale. This Plan recommends a voluntary land acquisition program for protecting the streams and floodplains of the Town. The text in this section offers a menu of tools that landowners, land conservation organizations and local government can use to establish the physical boundaries of the Open Space and Greenway System. In the event that certain parcels of land within the floodplain are considered vital to the overall efforts of the Open Space and Greenway System, mechanisms defined herein enable Knightdale to purchase or negotitate for the dedication of certain property rights. Dedication should be negotiated in a manner that is consistent with local, state and Federal laws that permit and govern such action.

Management is a method of conserving the resources of a specific greenway parcel through either an established set of policies called Management Plans, or through negotiated agreements or easements with private property owners.

Methods for Acquisition of Land Through Management

Management Plans

Management plans are prepared for Town-owned greenway lands. Management plans should identify valuable resources; determine compatible uses for the parcel; determine administrative needs of the parcel, such as maintenance, security and funding requirements; and recommend short-term and long-term action plans for the treatment and protection of the resources.

Land management agreements in which Knightdale receives less than full interest in a parcel of land in order to protect a valuable resource. The purpose of these agreements is to establish legally binding contracts or a mutual understanding of the specific use, treatment and protection that these greenway lands will receive. Property owners who grant easements retain all rights to the property except those which have been granted by the easement. The property owner is responsible for all taxes associated with the property, less the value of the easement granted. Easements are generally restricted to certain portions of property, although in certain cases an easement can be applied to an entire parcel of land. Easements are transferable through title transactions, thus the easement remains in effect in perpetuity. Three types of greenway easements are:

Easements

Conservation Easements

This type of easement generally establishes permanent limits on the use and development of land to protect the natural resources of that land. Dedicated conservation easements can qualify for both federal income tax deductions and state tax credits. Tax deductions are allowed by the Federal government for donations of certain conservation easements. The donations may reduce the donor's taxable income.

Preservation Easements

This type of easement is intended to protect the historical integrity of a structure or important elements of the landscape by sound management practices. Preservation easements may qualify for the same federal income tax deductions and state tax credits as conservation easements.

Public Access Easements

Right of public access easements provide the general public with the right to access and use a specific parcel of property. Both conservation easements and preservation easements may contain clauses for the right of public access and still be eligible for tax incentives.

Methods for Acquisition of Greenways Through Regulation

The second method of protecting stream corridor/greenways is through government regulation. Regulation is defined as the government's ability to control the use and development of land through legislative powers. The following types of development ordinances are regulatory tools that can meet the challenges of projected suburban growth and development and, at the same time, conserve and protect greenway resources.

Dedication/Density Transfers

Also known as incentive zoning, this mechanism allows greenways to be dedicated for density transfers on the development of a property. The potential for improving or subdividing part or all of a parcel of real property, as permitted under land use development laws, can be expressed in dwelling unit equivalents or other measures of development density or intensity. Known as density transfers, these dwelling unit equivalents may be relocated to other portions of the same parcel or to contiguous land that is part of a common development plan. Dedicated density transfers can also be conveyed to subsequent holders if properly noted in transfer deeds.

Negotiated Dedications

The Town may ask a landowner to enter into negotiations for certain parcels of land that are deemed beneficial to the protection and preservation of specific stream corridors. The Town may ask for the dedication of land for greenways when landowners subdivide property (a minimum size would be determined). Such dedications would be proportionate to the relationship between the impact of the subdivision on community services and the percentage of land required for dedication - as defined by the US Supreme Court in Dolan v Tigard.

Fee-in-Lieu

To complement negotiated dedications, a fee-in-lieu program may be necessary to serve as a funding source for other land acquisition pursuits of the Greenway Program. Based on the density of development, this program allows a developer the alternative of paying money for the development/protection of greenways in lieu of dedicating land for greenways. This money is then used to implement greenway management programs or acquire additional greenway lands.

Reservation of Land

A reservation of land does not involve any transfer of property rights but simply constitutes an obligation to keep property free from development for a stated period of time. Reservations are normally subject to a specified period of time, such as 6 or 12 months. At the end of this period, if an agreement has not already been reached to transfer certain property rights, the reservation expires.

Buffer/Transition Zones

This mechanism recognizes the problem of reconciling different, potentially incompatible land uses by preserving greenways that function as buffers or transition zones between uses. Care must be taken to ensure that use of this mechanism is reasonable and will not destroy the value of a property.

Overlay Zones

An overlay zone and its regulations are established in addition to the zoning classification and regulations already in place.

Subdivision Exactions

An exaction is a condition of development approval that requires a developer to provide or contribute to the financing of public facilities at their own expense. For example, a developer may be required to build a greenway on-site as a condition of developing a certain number of units because the development will create need for new parks or will harm existing parks due to overuse. The mechanism can be used to protect or preserve a greenway which is then dedicated to the Town. Consideration should be given to including greenway development in future exaction programs.

Methods for Protection of Greenways through Acquisition

The third method of protecting stream corridor/greenways is through the acquisition of property. A variety of methods can be used to acquire property for greenway purposes.

Donation/Tax Incentives

A government body, public agency or qualified conservation organization agrees to receive full title or a conservation easement to a parcel of land at no cost or at a “bargain sale” rate. The donor is eligible to receive a federal tax deduction of up to 30 to 50 percent of their adjusted gross income. Additionally, North Carolina offers a tax credit up to 25 percent of the property’s fair market value (up to $5000). Any portion of the fair market value not used for tax credits may be deducted as a charitable contribution. Also, property owners may be able to avoid inheritance taxes, capital gains taxes and recurring property taxes.

Fee Simple Purchase

This is a common method of acquisition where a local government agency or private greenway manager purchases property outright. Fee simple ownership conveys full title to the land and the entire “bundle” of property rights including the right to possess land, to exclude others, to use land and to alienate or sell land.

Easement Purchase

This mechanism is the fee simple purchase of an easement. Full title to the land is not purchased, only those rights granted in the easement agreement. Therefore the easement purchase price is less than full title value.

Purchase/Lease Back

A local government agency or private greenway organization can purchase a piece of land and then lease it back to the seller for a specified period of time. The lease may contain restrictions regarding the use and development of the property.

Bargain Sale

A property owner can sell property at a price less than the appraised fair market value of the land. Sometimes the seller can derive the same benefits as if the property were donated. Bargain Sale is attractive to sellers when the seller wants cash for the property, the seller paid a low cash price and thus is not liable for high capital gains tax, and/or the seller has a fairly high current income and could benefit from a donation of the property as an income tax deduction.

Option/First Right of Refusal

A local government agency or private organization establishes an agreement with a public agency or private property owner to provide the right of first refusal on a parcel of land that is scheduled to be sold. This form of agreement can be used in conjunction with other techniques, such as an easement, to protect the land in the short term. An option would provide the agency with sufficient time to obtain capital to purchase the property or successfully negotiate some other means of conserving the greenway resource.

Purchase of Development Rights

A voluntary Purchase of Development Rights (PDR) involves purchasing the development rights from a private property owner at a fair market value. The landowner retains all ownership rights under current use, but exchanges the rights to develop the property for cash payment.

Condemnation

The practice of condemning private land for use as greenways is viewed as a last resort policy. Using condemnation to acquire property or property rights can be avoided if private and public support for the Greenway Program is present. Condemnation is seldom used for the purpose of dealing with an unwilling property owner. In most cases, condemnation for greenway purposes has been exercised when there has been absentee property ownership, when title to the property is not clear, or when it becomes apparent that obtaining the consent for purchase will be difficult

because there are numerous heirs located in other parts of the United States, or in different countries. The community must exercise caution in using Eminent Domain.

It is recommended that the right of eminent domain for a specific property be exercised by the community only if all of the following conditions exist:

a) that the property is valued by the community as an environ mentally sensitive parcel of land, significant natural resource, or critical parcel of land, and as such has been defined by the community as irreplaceable property;
b) that written scientific justification for the community's claim that the property possesses such value should be prepared and offered to the property owner;
c) that all efforts to negotiate with the property owner for the management, regulation and acquisition of the property have been exhausted and that the property owner has been given reasonable and fair offers for compensation and has rejected all offers;
d) that due to the ownership of the property, the timeframe for negotiating the acquisition of the property will be unreason able, and in the interest of pursuing a cost effective method for acquiring the property, the community has deemed it necessary to exercise the right of eminent domain.

Right of Public Access and Use of Trail Lands

The general public should have access to and use of those greenway lands that support public use (i.e. trail development), and that are owned by Knightdale or on land that the Town has secured the right of public access and use. All access and use is governed by existing Town policies and should also be governed by a Greenway Trail Ordinance. The use of all trails is limited to non-motorized uses, including hiking, bicycling, running, jogging, wheelchair use, skateboarding, in-line skating (rollerblading), equestrian use, mountain biking, and other uses that are determined to be compatible with the Town's greenway trails.

Naming of Greenways

Greenways are named for the significant natural features that are found within the corridor. Greenways can also be named after an individual or individuals if these persons are truly distinguished within the community, or if these persons have contributed a gift equal to more than 50% of the value of greenway development within that corridor segment.

Fencing and Vegetative Screening

Knightdale should work with each landowner on an individual basis to determine if fencing and screening is required and appropriate. The Town may agree to fund the installation of a fence or vegetative screen; however, it should be the responsibility of the adjacent property owner to maintain the fence or vegetative screen in perpetuity, including the full replacement of such fence or screen in the event of failure or deterioration due to any circumstances.

Adopt-a-Greenway Program

An Adopt-a-Greenway Program should be established by Knightdale to encourage community groups, families, businesses, school groups, civic clubs and other organizations to join in managing the Open Space and Greenway System. Knightdale should implement this program for every greenway corridor in the system, and work closely with local organizations to ensure that these groups manage and maintain trails in a manner that is consistent with Town objectives. The Town should develop written agreements for each Adopt-a-Greenway entity and keep a current record of this agreement on file. Adopt-a-Greenway entities will be assigned a specific section of the Open Space and Greenway System, defined by location or milepost. The activities of each organization should be monitored by the Town or its designee. Agreements for management can be amended or terminated at any time by either party, giving 30 days written notice.

Management Agreements

Management Agreements will be established between Knightdale and specific public or private organizations wishing to assist with the management of designated segments of the Open Space and Greenway System. The objective of these agreements is to define areas of maintenance and management that are compatible with existing land management activities, especially where greenways intersects with public or private properties and/or rights-of-way. Management agreements spell out specific duties, responsibilities and activities of Knightdale and public or private organization that wishes to assist with management activities. They can be amended or terminated at any time by either party, giving 30 days written notice.

Cross Access Agreements

Knightdale can use cross access agreements to permit private landowners that have property on both sides of a greenway corridor access to and use of a greenway corridor to facilitate operation and land use activities.

Cross access agreements are based on case law of the United States and specific experiences from other greenway trail systems throughout the United States. Adjacent landowners generally have the right to use the access at any time. However, access cannot block the right-of-way for trail users, other than for temporary measures such as permitting livestock to cross, or transporting equipment. Adjacent landowners are responsible for acts or omissions that would cause injury to a third party using the trail. If a landowner must move products, materials, livestock or equipment across the trail on a regular basis, appropriate signage should be installed to warn users of the trail to yield for such activities.

Crossing of abandoned or active rail lines, utility corridors and/or roads and highways will require the execution of agreements with companies, local, state or federal agencies and organizations that own the rights-of-way. These crossings must provide clearly controlled, recognized, and

defined intersections in which the user will be warned of the location. In accordance with the American Association of State Highway Transportation Officials (AASHTO) and the Manual on Uniform Traffic Control Devices (MUTCD), the crossing will be signed with appropriate regulatory, warning and information signs.

Greenway Facility Management

Greenway facilities shall be maintained in a manner that promotes safe use. All trail facilities should be managed by Knightdale or its designee. Trail maintenance should include the removal of debris, trash, litter, obnoxious and unsafe man-made structures, and other foreign matter so as to be safe for public use. Trailheads, points of public access, rest areas and other activity areas should be maintained in a clean and usable condition at all times. The primary concern regarding maintenance should always be public safety.

All trail surfaces should be maintained in a safe and usable manner at all times. Rough edges, severe bumps or depressions, cracked or uneven pavement, gullies, rills and washed out treads should be repaired immediately. Volunteer vegetation occurring in the tread of the trail should be removed in such a manner so that the trail surface is maintained as a continuous, even and clean surface.

Land Management

Property owned or used by Knightdale for the Open Space and Greenway System shall be maintained in a condition that promotes safety and security for greenway users and adjacent property owners. To the extent possible, the property shall also be maintained in a manner that enables the corridor to fulfill multiple functions (i.e. passive recreation, alternative transportation, stormwater management and habitat for wildlife). Property that is owned or managed by other entities should be managed and maintained in accordance with the policies of that public body responsible for the affected parcel.

Private lands and neighborhood groups wanting to connect to the Knightdale system will need to seek permission from the Knightdale Parks and Recreation Department. Efforts to connect to the system will require the approval of the Department and will be decided on a case-by-case basis. Development expenses will not be covered by the Knightdale Parks and Recreation Department. Connecting to the Knightdale municipal system does not relieve neighborhood greenways management bodies of their responsibilities of safety, security, and/or maintenance.

Vegetation adjacent to trails shall be managed as necessary to maintain clear and open lines of sight along the edge of the trail, and eliminate potential hazards that could occur due to natural growth, severe weather or other unacceptable conditions. To promote safe use of any greenway trail, all vegetation should be clear cut to a minimum distance of three (3) feet from each edge of a trail. Selective clearing of vegetation should be conducted within a zone that is defined as being between three (3) to ten (10) feet from each edge of a trail. At any point along a trail, a user

should have a clear, unobstructed view, along the centerline of a trail, 300 feet ahead and behind his/her position. The only exception to this policy should be where terrain or curves in a trail serve as the limiting factor.

Knightdale or their designated agent should be responsible for the cutting and removal of vegetation. Removal of vegetation by an individual or entity other than the Town of Knightdale or its designee shall be deemed unlawful and subject to fines and/or prosecution.

It may also be necessary for Knightdale to conduct wildlife management programs on lands that are publicly owned. This shall be accomplished in a manner that is in keeping with accepted laws, professional practices and/or recommended strategies that are provided to Knightdale by wildlife management experts.

Safety and Security

In order to provide a standard of care that offers reasonable and ordinary safety measures, Knightdale shall cooperatively develop and implement a Safety and Security Program for the Open Space and Greenway System. This program will consist of well-defined safety and security policies; the identification of trail management, law enforcement, emergency and fire protection agencies; the proper posting, notification and education of the trail user policies; and a system that offers timely response to the public for issue or problems that are related to safety and security. The safety and security of the Open Space and Greenway System will need to be coordinated with local law enforcement officials, local neighborhood watch associations, and Adopt-a-Greenway organizations.

Important components of the safety and security program include the following. Knightdale should:

1) Work with law enforcement agencies to establish a Greenway Safety and Security Committee that can meet periodically to discuss management of the Open Space and Greenway Sys tem.
2) Prepare a Greenway Safety Manual and distribute this to man agement agencies and post it at all major trailheads.
3) Post User Rules and Regulations at all public access points to greenway trails.
4) Work with the management agencies to develop Trail Emer gency Procedures.
5) Prepare a Safety Checklist for the Open Space and Greenway System, and utilize it monthly during field inspection of greenway facilities.
6) Prepare a Greenway User Response Form for complaints and complements and provide copies at all trailheads.
7) Work with management agencies to develop a system for accident reporting analysis.
8) Conduct a regular Maintenance and Inspection Program, and share the results of these investigations with all management agencies.

9) Coordinate other Public Information Programs that provide information about greenway events and activities that Town residents can participate in.
10) Have an ongoing evaluation of greenway program objectives.

User Rules and Regulations

Trails within greenway corridors shall be operated like all other parks within Knightdale open for public use from sunrise to sunset, 365 days a year, except as specifically designated. Individuals who are found to be using unlighted facilities after dusk and before dawn should be deemed in violation of these hours of operation and treated as trespassers. Where trails are lighted for nighttime use, the rules established within the Trail Ordinance should govern permitted uses and activities.

Knightdale shall enforce trespassing laws as defined under North Carolina General Statutes for publicly owned lands and facilities.

Knightdale should always discourage the general public from using any segment of a greenway trail that is under construction. Trail segments should not be considered officially opened for public use until such time as a formal dedication ceremony and official opening has been completed. Individuals who use greenway segments that are under construction, without written permission from the Town should be deemed in violation of this access and use policy and treated as a trespasser.

Trail Ordinance

Multi-use conflict is a national problem for community and regional Open Space and Greenway Systems. Typically, conflicts are caused by overuse of a greenway trail, however, other factors may be problematic including poorly designed and engineered trail alignments, inappropriate user behavior, or inadequate facility capacity. The most effective conflict resolution plan is a well-conceived safety program that provides the individual user with a Code of Conduct for the greenway trail, sometimes called a Trail Ordinance. Several communities across the United States have adopted progressive trail ordinances to govern public use and keep trails safe for all users. The following Rules and Regulations are recommended for the Knightdale Greenway System. These rules should be displayed both on brochures and information signs throughout the Open Space and Greenway System.

1) Be Courteous: All Trail users, including bicyclists, joggers, walkers, wheelchairs, skateboarders and skaters, should be respectful of other users regardless of their mode of travel, speed, or level of skill. Never spook animals; this can be dangerous for you and other users. Respect the privacy of adjacent landowners! No trespassing allowed from trails, remain on trails at all times.
2) Keep Right: Always stay to the right as you use the Trail, or stay in the lane that has been designated for your user group. The exception to this rule occurs when you need to pass

another user.

3) Pass on the Left: Pass others going in your direction on their left. Look ahead and behind to make sure that your lane is clear before you pull out an around the other user. Pass with ample separation. Do not move back to the right until you have safely gained distance and speed on the other user. Faster traffic should always yield to slower oncoming traffic.
4) Give Audible Signal When Passing: All users should give a clear warning signal before passing. This signal may be produced by voice, bell or soft horn. Voice signals might include "Passing on your left!" or "Cyclist on your left!" Always be courteous when providing the audible signal - profanity is unwarranted and unappreciated.
5) Be Predictable: Travel in a consistent and predictable manner. Always look behind before changing position on the Trail, regardless of your mode of travel.
6) Control Your Bicycle: Lack of attention, even for a second, can cause disaster - always stay alert! Maintain a safe and legal speed at all times.
7) Do not Block the Trail: When in a group, including your pets, use no more than half the trail, so as not to block the flow of other users. If your group is approached by users from both directions, form a single line or stop and move to the far right edge of the Trail to allow safe passage by these users.
8) Yield when Entering or Crossing Trails: When entering or crossing the Trail at an uncontrolled intersection, yield to traffic already using the other trail.
9) Do not Use this Trail Under the Influence of Alcohol or Drugs: It is illegal to use this Trail if you have consumed alcohol in excess of the statutory limits, or if you have consumed illegal drugs. Persons who use a prescribed medication should check with their doctor or pharmacist to ensure that it will not impair their ability to safely operate a bicycle or other wheeled vehicle.
10) Clean-up Your Litter: Please keep this Trail clean and neat for other users to enjoy. Do not leave glass, paper, cans or any other debris on or near the Trail. Please clean up after your pets. Pack out what you bring in - and remember to always recycle your trash.
11) Keep Pets on Leashes: All pets must be kept on secure and tethered leashes. Keep pets off of adjacent private property. Failure to do so will result in a fine.
12) Prohibition on Camp Fires: Fires, for any purpose, are prohibited within the Trails System. Any person caught lighting a fire for any purpose will be prosecuted to the fullest extent of the law.

In order to effectively patrol the Open Space and Greenway System and respond to the potential for fire, flash floods and other natural or human-

Emergency Response Plan

caused disasters, Knightdale shall adopt a greenway emergency response plan. This plan defines a cooperative law enforcement strategy for greenways based on services required and those that are typically provided by police, sheriff, fire and EMS agencies. Specifically, all trails should be provided with an address system that denotes specific locations along the length of a trail corridor. A site plan that illustrates points of access to each trail corridor should be produced and kept on file and provided to each agency. Trails in flash flood areas shall be appropriately signed to warn users. Each trail should be designed to permit access for law enforcement, fire and EMS agencies and vehicles that are not in excess of 6.5 tons gross vehicle weight. Typically, inter-governmental agreements are executed for this. A system of cellular-type emergency phone should be located in remote sections of the system, providing users with access to the area 911 Emergency System. All emergency phone should be placed above the flood elevation to ensure long term usage.

The emergency response plan should also define the agencies that should respond to 911 calls, and provide easy to understand routing plans and access points for emergency vehicles. For long distance trails, access points for emergency and maintenance vehicles should be located at reasonable distances from trailheads (approximately every 2-3 miles). Local hospitals should be notified of these routes so that they may also be familiar with the size and scope of the project. The entire Open Space and Greenway System should be designed and develop to support a minimum gross vehicle weight of 6.5 tons.

Risk Management Plan

The purpose of a Risk Management Plan is to increase safety for the users of the Knightdale Open Space and Greenway System and reduce the potential for accidents to occur within the system or on lands adjacent to the system. While it is impossible to guarantee that all risk will be eliminated by a Risk Management Plan, implementation of a plan is in fact a critical step to reduce liability and improve safety. A Risk Management Plan establishes a methodology for greenway management that is based on current tort liability and case law in the United States related to the development, operation and management of public use greenway lands and facilities.

The ultimate responsibility for managing the Open Space and Greenway System, as defined within this Plan, rests with Knightdale. The Risk Management Plan has as its major goals:

1) Risk Identification: determining where risk (threat to safety or potential loss) exists within the corridor.
2) Risk Evaluation: conducting appropriate examination of areas defined as a risk and determining the factors that contribute to risk.
3) Risk Treatment: defining and implementing an appropriate solution to the area of risk in accordance with one of the four

options:

a) Risk avoidance: prohibiting use of a risk area.
b) Risk reduction: limit use of area and repair risk area immediately.
c) Risk retention: obtain waivers from all potential users of the risk area.
d) Risk transfer: transfer risk area (property) to an agency better suited to manage the area.

The following sixteen step plan should be implemented by Knightdale to establish a Risk Management Plan for the Knightdale Open Space and Greenway System.

1) Develop a policy statement about risk management.
2) Conduct a needs assessment for the greenway program.
3) Determine goals and objectives for risk management - what are acceptable and not acceptable management levels.
4) Develop specifications for site and facility development.
5) Establish a clear and concise program for risk management.
6) Define supervision and responsibility for risk management.
7) Define appropriate rules and regulations that govern the use of the trail system.
8) Conduct routine/systematic inspections and investigations of the trail system.
9) Develop an accident reporting and analysis system.
10) Establish procedures for handling emergencies.
11) Develop appropriate releases, waivers and agreements for use and management.
12) Identify best methods for insuring against risk.
13) Develop a comprehensive in-service training program for employees of the Town.
14) Implement a public relations program that can effectively describe the risk management program and activities.
15) Conduct periodic reviews of the Risk Management Plan by outside agents to ensure that the Plan is up to date.
16) Maintain good legal and insurance representation.

Liability

The design, development, management, and operation of the Knightdale Open Space and Greenway System must be carefully and accurately executed in order to provide a resource that protects the health and welfare of the public. Liability may occur when a facility has been under-designed to handle its intended volume of use; when management of the facility is poor; or when unexpected accidents occur because the trail manager failed to recognize the possibilities of a potentially hazardous situation. To reduce the possibility and exposure to liability, the Town should have in operation the following measures prior to opening the first segment of greenway:

1) a thorough Maintenance Program that provides the appropriate duty or level of care to greenway users;

2) a Risk Management Plan that appropriately covers all aspects of the Open Space and Greenway System, and as necessary adjacent landowners;
3) a comprehensive working knowledge of public use laws and recent case history applicable in North Carolina.

Knightdale's existing program may be adequate to protect the Town government from financial loss that might occur through the development and operation of the Open Space and Greenway System. Trails are no greater liability to the Town than park and recreation, sidewalk or urban open space resources. The Town should review its current policy and check coverages to be certain that all aspects of its policies are up to date.

Knightdale should exercise reasonable care in the design and construction of all greenway facilities to reduce hazardous, public nuisance and life threatening situations. In fact, it is very difficult to find any case law in the United States where an adjacent property owner has been sued because a trail user strayed onto the adjacent private property and fell victim to an accident that was caused by the adjacent landowner. Some landowners have claimed that their insurance rates will go up because of the presence of a trail abutting their property. Once again, there is no case history among insurance companies to support this claim — provided the landowner has not gone out of their way to create an attractive nuisance and lure trail users onto their property.

It is also important that a fee not be charged to use any portion of the Open Space and Greenway System, because typically this may impact the way in which the recreational use statutes in North Carolina apply to the use of the system. A voluntary donation applied to the Open Space and Greenway System will generally not affect the recreational use statute.

CHAPTER 8

TRANSPORTATION
MASTER PLAN

I. INTRODUCTION

The Knightdale Transportation Master Plan addresses mobility needs throughout the Town of Knightdale's planning jurisdiction and urban service area. The Plan seeks to encourage the development of a network of interconnected streets that work to disperse traffic while connecting and integrating neighborhoods within the existing urban fabric of the Town.

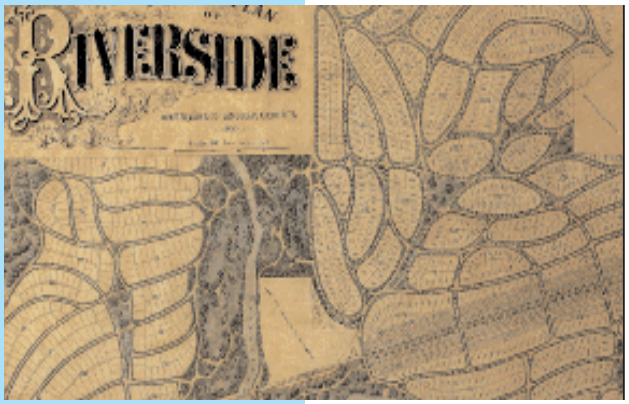
Equally as important the Transportation Master Plan encourages the development of a network of sidewalks, bicycle lanes, and mass transit options to provide an attractive and safe mode of travel for cyclists and pedestrians. In addition to dispersing traffic, interconnected street networks encourage alternate modes of transportation to the automobile, enhance transit service opportunities, and potentially reduce vehicle miles traveled within the street network. The overall network function, and the comfort and safety of multi-modal or shared streets to disperse traffic are primary to the system's efficiency.

One of the biggest challenges facing Knightdale during the next twenty-years is planning for a safe and efficient transportation system. As the population of Knightdale and the region continues to increase so will traffic demand. The result without proper planning is congestion and unsafe conditions.

The goal of the Plan is to address regional as well as local issues. While the plan focuses on mobility, it is also designed to preserve the local character and heighten community design. In achieving this goal, the plan recommends street design guidelines that serve the traffic needs, while encouraging type and density of development suitable to the area.

Finally, the plan is intended to function cooperatively with the long-range plans of agencies such as the Triangle Transit Authority (TTA), Capital Area Metropolitan Planning Organization (CAMPO), the North Carolina Department of Transportation (NCDOT), other neighboring municipalities (Raleigh, Wendell and Zebulon) and Wake County government.

The intent of the Transportation Master Plan is to plan a transportation network that enhances quality community design. The purpose of evaluating the transportation system is the understanding of which improvements are needed now and which improvements are needed in the future.



Original Plan for Riverside (IL), Riverside Historic Society

The Six Major Parts of the Transportation Plan:

1. Transportation System Plan

Serves as a basis for the coordinated implementation of roadway improvements to protect the integrity and safety of the street network and provide an acceptable level of mobility to the citizens of Knightdale.
The system plan includes:

- History of Transportation Planning in Knightdale
- Existing Conditions

2. Street System Classifications

Provide guidelines regarding ultimate cross sections for all street classification types.

3. Transportation Map

Includes the thoroughfare plan and the collector street plan.

4. Street Design Principles

Provide guidelines regarding the design of Town streets (1) to promote a safe and pedestrian friendly street system and (2) an interconnected pattern of streets throughout Town.

5. Transportation Objectives and Action Items

Outlines the Town's main transportation objectives and tasks to be completed to achieve these objectives.

6. Greenway Corridor Map

Shows proposed locations of the Town's Greenway System. This map, though part of the transportation plan, is found in the Open Space and Greenway System chapter of the 2027 Comprehensive Plan.

II. TRANSPORTATION SYSTEM PLAN

The plan contains recommendations for maintaining and improving the Town's street network. Road design details are only generalized in this plan; specific cross section construction details and dimensions can be found in the Town of Knightdale Standard Specifications and Construction Details and the Town's Unified Development Ordinance after rewrites of these documents are completed by Year 2004.

A. History of Transportation Planning In Knightdale

I. Creation of the 1993 Knightdale Thoroughfare Plan

On May 19, 1993, the Town of Knightdale adopted its first Thoroughfare Plan. The original Thoroughfare Plan was a cooperative effort between the Town of Knightdale

and the North Carolina Department of Transportation (NCDOT) and was created to meet the following objectives:

- Guide the development of the urban street system to meet changing traffic demands
- Develop an adequate major street system as land development occurs
- Reduce travel and transportation costs
- Reduce the cost of major street improvements to the public by coordinating the street system with community development
- Enable citizens to make plans and improvements with full knowledge of public intent
- Minimize disruption and displacement of people and businesses through long-range planning for major street improvements
- Reduce air and noise pollution that may be created by traffic
- Increase travel safety
- Mitigate urban sprawl on U.S. 64
- Reduce Knightdale's dependency on U.S. 64 for vehicular trips internal to Knightdale

The plan objectives are still in place. However, in 2002, the NCDOT initiated a new program for transportation planning as required by the North Carolina General Assembly. The Thoroughfare Plan, as approved in 1993, will be replaced by a new NCDOT Transportation Plan. The NCDOT Thoroughfare Plan is being replaced to:

- Provide opportunities for multi-model transportation options, which are not addressed on the current plan
- Provide a series of maps outlining multi-model options rather than the provision of one thoroughfare plan map
- Provide a larger hierarchy of streets rather than limiting the map to thoroughfares only
- Break down each category of street type into three levels: "existing, proposed and needs improvement".

Though the new NCDOT Transportation Plan is not yet approved, the ultimate goal is to have this plan in place within the next two years. This will cause the 1993 Knightdale Thoroughfare Plan to be out of date and no longer useful. Also note that the Capital Area Metropolitan Planning Organization has approved a Long Range Transportation Plan.

The new Knightdale Transportation Plan has been organized to align with the basic guidelines of NCDOT's new Transportation Plan by:

1. Encouraging similar street terminology,
2. Providing multi-model transportation options
3. Providing a series of maps and guidelines to show the various options of the transportation system.

II. Creation of the Functional Classification Map

On August 7, 1995, the Town of Knightdale adopted its first Unified Development Ordinance. The Unified Development Ordinance merged the zoning and subdivision regulations into one comprehensive document. The Street Ordinance section of the UDO outlines standards for the street hierarchy system and provides street cross section requirements. The Functional Classification Map adopted as part of the UDO outlines requirements for street cross sections throughout the Knightdale planning jurisdiction and urban service area.

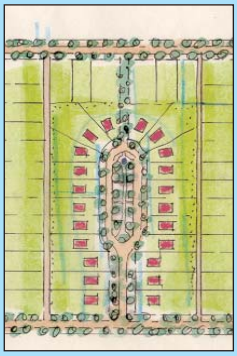
The Functional Classification Map will be used until the Town completes a major rewriting of the Unified Development Ordinance. The UDO rewrite will update the Functional Classification Map in accordance with the guidelines provided from 2027 Comprehensive Plan's Transportation Master Plan. Expected completion date of the Unified Development Ordinance is July 2004. The functional classification will also be based on the Federal Functional Classification designation provided by FHWA. There is a process for changing the classification as spelled out in the guidelines provided by FHWA.

B. Existing Conditions

U.S. HIGHWAY 64

U.S. Highway 64 is not only the gateway into Knightdale, but also one of the Town's most important transportation and economic corridors. Because of the importance of U.S 64, the Town has dedicated much attention to its appearance and function. The Town adopted a Special Thoroughfare Overlay District, the U.S 64 Corridor Plan, and established the Planning and Appearance Board. Knightdale also continues to request and receive enhancement funding for median landscaping on US 64 at several locations.

Because this is an important facility, the Town should continue to plan for traffic improvements and aesthetic enhancements. Planning includes the implementation of Village Park Drive as a parallel collector street system. The parallel collector street



Close, sketch by Ciriello

allows traffic to access the commercial property adjacent to U.S. 64 without having to travel on U.S. 64. The commercial areas created by this marginal access street is, and should continue to be, pedestrian friendly. It is designed to promote slower travel speeds and is required to have sidewalks on both sides of the street.

The Town has programs and projects in place to improve the appearance of U.S. 64 and to help ensure quality development. The Town should continue to plan and implement projects that enhance the appearance, efficiency, and safety of the U.S. 64 corridor. The corridor width and high volume of traffic presents a barrier to cyclists and pedestrians. The Town should coordinate an effort with NCDOT to explore techniques that allow for the safe crossing of U.S. 64 for non-motorized transportation.

One important issue for U.S. 64 is the construction of the U.S. 64 Bypass. The US 64 Bypass will initially remove a tremendous volume of thru traffic from U.S. 64. This will allow US 64 to function focus more on local service. Greater emphasis should be placed on designing U.S. 64 as one of Knightdale's main streets rather than as a regional highway.

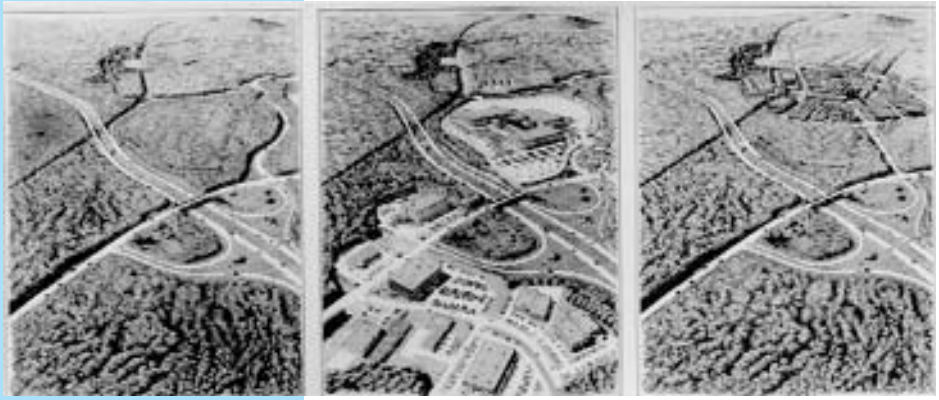
U.S.HIGHWAY 64 BYPASS AND EASTERN WAKE EXPRESSWAY (INTERSTATE-540)

As part of the NCDOT highway system, two major limited access freeways are being constructed through the Town of Knightdale's planning area: The US 64 Bypass and the Eastern Wake Expressway. These two freeways are prompting a tremendous amount of inquiries from citizens and the development community. Both roads will have an incredible impact upon the development of Knightdale. These roads, and especially the interchanges associated with these roads, should be carefully planned well before completion.

THE US 64 BYPASS

The US 64 Bypass is a 10.2-mile, 6-lane freeway with 7 interchanges serving Raleigh, Knightdale and Wendell. It connects the US 64 with the Raleigh I-440 Beltline. Upon completion it will provide 125 miles of controlled access from Williamston in eastern North Carolina to the Town of Cary.

The US 64 Bypass was the number one priority on the CAMPO Transportation Improvement Program priority list. Due to incredible traffic congestion at peak hours along the existing highway, the Bypass was determined to be the best solution to ease traffic congestion. The project is estimated to cost $188 million dollars, including right-of-way acquisition and construction.



Existing 64 carries between 43,000 and 62,000 vehicles daily (NCDOT 1998 ADT counts). Projections for the Bypass are between 53,800 to 59,800 vehicles daily by 2018 (CAMPO Transportation Plan 2025). The six-lane highway will be constructed within a 350-foot right-of-way with a 60-foot median. The Bypass's completion was expedited in July 2001 when the construction method was changed to a design-build schedule to start in 2002 and to be completed by November of 2004; three years earlier than originally scheduled.

The purpose of the US 64 Bypass Interchange Final Report is to ensure that local municipalities and future highway users get the maximum benefit from the Bypass project by preserving mobility, addressing citizen concerns, increasing public safety, ensuring economic viability, and facilitating regional cooperation in planning efforts. To fulfill these goals, the corridor study provides land use and transportation recommendations in the areas along the Bypass corridor and near the proposed interchanges.

The Town of Knightdale has adopted the U.S. Highway 64 Bypass Interchange Final Report, a land use plan for the interchanges of the freeway. This Final Report also serves as a Focus Area Plan, and is contained in the 2027 Comprehensive Plan. Recommendations from the US 64 Knightdale Bypass Interchange Final Report should be implemented as development occurs.

THE EASTERN WAKE EXPRESSWAY (I-540)

The Eastern Wake Expressway (I-540) will run perpendicular to the Bypass with two interchanges in Knightdale's planning jurisdiction. The Eastern Wake Expressway is part of I-540 (commonly called the 'Raleigh Outer Loop') and will provide access to areas west of Knightdale, including Durham and Research Triangle Park. This easier regional access is making Knightdale most attractive to developers seeking land for commercial, residential and industrial projects. The I-540 section through Knightdale is expected to be completed by late 2006.

As previously stated, careful consideration should be given to the effects of these freeways on traffic flow and land use, especially in the areas surrounding the interchanges associated with both facilities.

LOCAL ROADS

In Knightdale, Smithfield Road, Bethlehem Church Road, Robertson Street, and Old Knight Road function as streets radial to downtown Knightdale. If all radial streets met in a central area, an intolerable congestion problem could result. To avoid this problem, it is important to have a system of cross-town streets that create a loop

around the central area. This cross-town street system allows traffic moving from one side of the central area to the other to follow the area's border and then enter the area near a given destination. A good cross-town system frees the central area of cross-town traffic. This permits the central area to function as a Town Center mixed use, higher density area. Forestville Road and Old Faison Road function as cross town streets.

Loop system streets move traffic between suburban areas of the town. Although a loop may completely encircle the town, a typical trip may be from one place in the outskirts of town to another place in the outskirts of town. Loop streets do not necessarily carry heavy volumes of traffic, but relieve central areas. There may be one or more loops, depending on the size of the area, and they are generally spaced one-half mile to one mile apart, depending on the intensity of land use. Currently, Knightdale does not have a loop system. A loop system is planned as part of the Transportation Plan. The proposed loop will connect Old Faison and Forestville Road.

The function of the local street system is to provide direct access to property. To provide for a safe local street system, facilities should be designed in such a way as to reduce travel speeds. Traffic calming techniques such as entryway landscaping, traffic throttles, speed humps, bulb outs, textured treatments, and pavement markings should be utilized. Careful selection of traffic calming techniques is recommended so as not to interfere with emergency services.

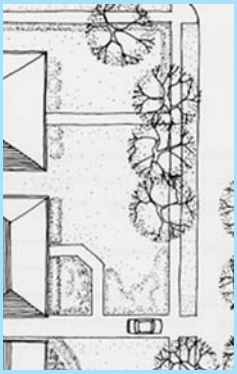
In addition, local street planning should favor a modified grid system, rather than long dead-end or long cul-de-sac streets. The use of the grid allows traffic to disperse over several routes, rather than relying on a single street. It also allows for better access by emergency vehicles.

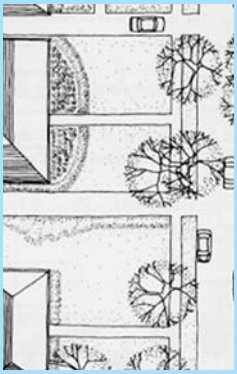
TOWN CENTER STREET PLAN

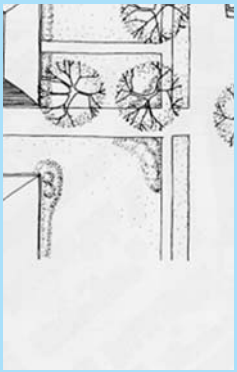
As development, and redevelopment, of the downtown area continues, the current grid system of streets should be maintained. The Town initiated a Town Center revitalization program, to encourage "neo-traditional" development. Items such as streets, parking, sidewalks, and landscaping should be planned in accordance with the Town Center program.

III. STREET SYSTEM CLASSIFICATIONS

An adequate road system must be maintained to allow motorists to travel in an efficient and safe manner. In planning for a road network, it is important to first have an understanding of the different classifications of roads that are proposed by the







Transportation Master Plan. These classification differ from the current Unified Development Ordinance and Standard Specification and Construction Detail Standards. The goal of the new classification system is to:

1. To update terminology and cross section details to meet new demands for increased multi-model planning in the region.
2. To follow similar transportation planning objectives of the new NCDOT Transportation Plan expected to be completed within two years from adoption of the 2027 Comprehensive Plan.

A. The Street Classification System

Streets are classified according to their function. Higher order classification focus on mobility, while lower order classifications accommodate access. As a result, separate design standards are applicable to each class. The intent of the 2027 Comprehensive Plan is to assure the classification in each system is compatible, and the cross section and right-of-way recommended is in compliance with adjacent towns and Wake County.

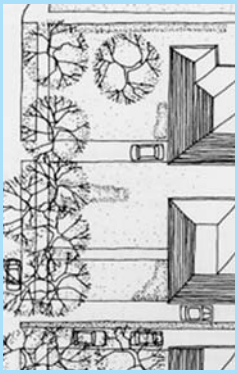
Transportation plans throughout the state generally included two types of maps: A thoroughfare map and a collector street map. Under the new NCDOT terminology one comprehensive map is proposed which shows both. The terms thoroughfare and collectors are replaced.

The collector street plan facilitated the connection between residential and commercial properties and the minor thoroughfares. These connections helped reduce traffic on major facilities by providing a means for inter-neighborhood travel without the need to access higher order streets.

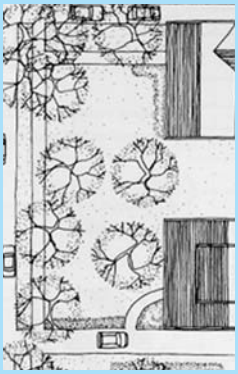
The collector street component of the Transportation Map was developed based on the design district types and densities expected at each district as presented in the 2027 Comprehensive Plan. The roads, and their corresponding cross sections, are planned in such a way as to accommodate neighboring density. For example, roads in the less dense rural areas are predominantly two lanes. While roads through higher density development zones are proposed as three to five lanes where traffic is expected to surpass the capacity of a two-lane roadway. Figure 8.1 shows typical cross sections for various street classifications. Figure 8.2 expands on street classifications for specific streets in Knightdale.
The street classifications are:

Freeway (old terminology Freeway): A multi-lane median divided facility with full

control of access. US 64 Bypass and the Eastern Wake Expressway are identified as Freeways.

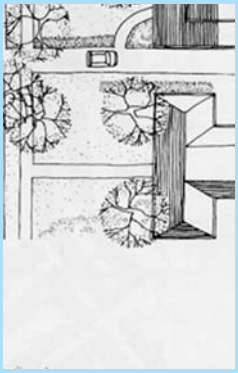


Parkway (old terminology: Principal Arterial): A parkway is a street used to promote moderate mobility with limited access, moderate volume and medium speed. Travel speeds are projected at 30 to 45 miles per hour with a four-lane cross section plus medians with turning pockets or turning lanes. Driveways are encouraged to be primarily right-in/right-out with occasional median crossovers permitted. The street should also focus on design standards that enhance pedestrian safety and aesthetics. Traffic calming measures, reduced turning radii, and landscaping highlight this type of facility.



Boulevard (old terminology: Major and Minor Thoroughfare): A boulevard is a street used to promote moderate mobility with limited access, moderate volume and medium speed. Travel speeds are projected at 30 to 45 miles per hour with a cross section of 4 lanes plus medians with turning pockets or turning lanes. Driveways are encouraged to be primarily right-in/right-out with occasional median crossovers permitted. The street should also focus on pedestrian safety, and design standards should be used that enhance pedestrian safety and aesthetics.

Avenue (old terminology Major and Minor Collector): Avenues focus on access, typically at the expense of speed and mobility. Their intended purpose is to distribute traffic from the boulevards and parkways to the local system. Traffic calming measures, reduced turning radii, and landscaping high light this type of facility.



Local: A minor street, which is intended to carry local traffic from avenue streets to the system of minor streets within large residential neighborhoods, and provide access to local streets, cul-de-sac streets or abutting residential property.

Street Classification cross sections are provided on the following pages and as previously stated will be used to adopt new cross section standards as part of the Unified Development Ordinance rewrite to be completed in July 2004.

B. Level of Service

In addition to an understanding of street classifications, before planning a road network it is important to have an understanding of how a road is evaluated.

The level of service (LOS) is one criteria used to evaluate streets. Traffic volumes and roadway capacity largely determine a level of service. Levels of service are used to identify needed roadway improvements. Levels of service represent a range of

conditions, not a precise volume or condition.
Standardized descriptions of road segment LOS are:

LOS A: Highest level of service, describes primarily free flowing traffic at average travel speeds. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream.

LOS B: Represents reasonably unimpeded traffic flow operations at near free flow speeds. The ability to maneuver within the traffic stream is only slightly restricted.

LOS C: Represents stable traffic flow operations. Ability to maneuver and change lanes is more restricted than in LOS B, although traffic continues to move.

LOS D: Ability to maneuver in traffic is restricted. Small increases in traffic flow may cause substantial increases in queues. Events in the traffic stream can take longer to dissipate.

LOS E: Traffic flow is characterized by significant delays and lower operating speeds. Small disruptions in the traffic stream can lead to long queues. Queues are not easily dissipated, and can often cause stop and go conditions on roadways.

LOS F: Traffic flow is characterized by very low speeds. Traffic operations become stop-and-go. Comfort and convenience are extremely low and frustration is high.

In addition to segmental LOS, there is also an intersection LOS. Intersection LOS is based on average delay.

IV. THE TRANSPORTATION MAP

The Knightdale Transportation Map is located at the end of this section (Figure 8.3). The map replaces the official Knightdale Thoroughfare Plan Map and eventually will replace the current Functional Classification Plan map when the Unified Development Ordinance is rewritten and adopted by July 2004.

As previously stated, the Functional Classification Map is currently used to guide decisions about street type and cross sections required for streets within Knightdale's planning jurisdiction. It is the intent of the 2027 Comprehensive Plan Transportation Map to eventually become the map used to guide decision making for street type and

cross section. At this time it will be used for guidance. When the UDO is rewritten by July 2004, the Functional Classification Map and Transportation Map contained in this section will be merged to form one comprehensive map for street type and cross section requirements.

The Transportation Map is derived through analyzing the 1993 Knightdale Thoroughfare Plan, the 1995 Functional Classification Plan, CAMPO Thoroughfare Plan and suggestions made by the Town's transportation consultant team (Stantec Consulting Services Inc.). A primary concept that evolved from the Transportation Map is that one street may not have the same street classification throughout the length of the street. This Plan intends to recognize that street classifications be allowed to change character as they pass from one design district to another. This Transportation Map is directly correlated to the Design District Map contained in the Design District Master Plan.

A. Mass Transit Component of the Transportation Plan

The Transportation Map shows proposed locations of a commuter rail line and stations. The Town of Knightdale has underway a commuter rail feasibility study to determine the feasibility of commuter rail stations in Knightdale. This study is expected to be completed by December of 2003.

The Town of Knightdale has been exploring commuter rail since 1990, when a study was conducted by Barton-Aschman Associates and Hammer, Siler, George Associates (to) evaluated the potential for transit in the Triangle Region. The findings of the study indicated a transit system would be viable if land use development patterns changed dramatically over the next 20 years. The long-term possibility of transit in the Knightdale area is very good. The railroad line through Knightdale has been designated a future transit route.

In 1992, the Triangle Region Planning Directors Exchange (PDX) authored a report titled, "Land Use and Development Standards to Support Transit in the Research Triangle Region of North Carolina." The PDX was charged, by the Greater Raleigh Metropolitan Planning Organization (which is now the Capital Area MPO) and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization, to develop land use and development standards to support transit.

Numerous other reports have been prepared on commuter rail potential in the Triangle Region. The Triangle Transit Authority (TTA) is preparing for design and construction of Phase I of its commuter rail system.

Other modes of transportation are also being explored. An express bus service connecting Knightdale with the region is being evaluated. Express bus service should be designed to meet the needs of the commuter. The Triangle Transit Authority offers express bus service between Raleigh, Durham, Chapel Hill, Research Triangle Park, and Raleigh-Durham International Airport. The Town of Knightdale will continue to work with the TTA, CAMPO and other organizations to plan for additional modes of transportation.

V. STREET DESIGN GUIDELINES

It is the intent of the Street Design Guidelines to build streets that are integral components of community design. The guidelines encourage the development of a network of interconnecting streets that disperse traffic while connecting and integrating the rural and urban areas of town. Equally important, the guidelines encourage the development of a network of sidewalks and bicycles lanes that provide an attractive and safe mode of travel for cyclists and pedestrians. It is also the intent of these guidelines to be further developed into standards as part of the Unified Development Ordinance rewrite to be completed by July 2004.

The Street Design Guidelines provide a tool to retain, recognize or modify significantly the urban and rural character of streets emerging throughout Knightdale.

A. Street Guidelines

1. Streets in the Town Center, Neighborhood Design Districts and within the Countryside Design District's Village Center should provide on-street parking.
2. Streets should interconnect within a development and with adjoining development. Cul-de-sacs are permitted only where topographic conditions offer no practical alternatives for connections. Street stubs should be provided within a development adjacent to open land to provide for future connections. Streets should be planned with due regard to the designated corridors shown on the Town's transportation, design districts, and open space and parks master plans.
3. Street designs should permit the comfortable use of the street by cars, bicyclists, and pedestrians.
4. The streetscape should include street trees planted in a manner appropriate to their function. Commercial streets should have trees which compliment the façade of the buildings and which shade the sidewalk. Residential streets should provide for an appropriate canopy, which shades both the street and the sidewalk.
5. In the Countryside and Neighborhood Design Districts, natural features like streambeds and stands of significant trees or topographic features like rock outcroppings should be utilized as public amenities and for the visual enhancement of the streetscape.

6. Closed or gated streets should be discouraged.
7. Where practical, a "close" should be encouraged in place of a cul-de-sac. A close is a front space for buildings interior to the block. It may be pedestrian or it may have a one-way roadway loop around a green area, typically used for passive recreation. Its minimum width must coincide with emergency vehicle turning radii.
8. The use of traffic calming measures such as raised (table) intersections, lateral shifts, changes in pavement material, and traffic circles should be encouraged as alternatives to conventional traffic control measures. Speed bumps (or humps) should be discouraged.
9. Valley curbing is encouraged along streets serve homes with front-loaded off-street parking or have occasional off-street parking.
10. As a rule, shorter street light poles are preferred in lieu of fewer, taller, high-intensity lights. The scale of lighting fixtures and the illumination provided should be appropriate for both pedestrian and vehicular movements.
11. Generally on-street parking may provide a physical buffer between the pedestrian and traffic and may reduce the need for off-street surface parking. Parking along all streets should be signed, marked, or otherwise clearly delineated. Marked, on-street parking requires guideline curb and gutter.
12. Blocks should not be less than 200 feet nor more than 1,320 feet (1/4 mile), unless site and topography or other special circumstances are present, or the block is part of a Village Center, Neighborhood Center or Town Center District.
13. Street should be encouraged to have minimum 9' and maximum 12' foot wide travel lanes.
14. Emergency vehicles will have more access routes with a gridded streets and alleys system, so use of the grid street system shall be encouraged throughout higher density areas of the town.

B. Pedestrian and Bicycle Travel

Walking serves an important role in Knightdale's local transportation system. Adequate and safe facilities, such as sidewalks, walking paths, and trails, are necessary to promote pedestrian activity and should be designed to comfortably separate pedestrians from automotive traffic.

Cycling offers an excellent alternative to motorized transportation. While the typical commute distances of current travel patterns do not lend themselves to cycle trips, the increase in employment in Knightdale, coupled with the proposed mixed land use development will offer more cycling opportunities. In addition, opportunities for recreational cycling provides an excellent source of activity, and enhance the quality of life. For these reasons, Knightdale has developed a comprehensive bike plan including both transportation and recreational uses. The plan recommends locations

for independent trails such as the Mingo Creek Greenway, as well as shared facilities along roadways. The recommendations of the bike plan are to be included in the Unified Development Ordinance rewrite as applicable.

The following guidelines are established:

1. Sidewalks should be buffered from fast moving, and heavy volumes of traffic.
2. Sidewalks should be located on both sides of the street within the Town Center and Neighborhood Districts.
3. The design of street intersections should include provisions for safe pedestrian crossing.
4. Sidewalks serving non-residential uses within the Town Center or in any Village Center within the Neighborhood or Countryside Design Districts should be a minimum of eight (8) feet in width, with 10-12 preferable in front of shops.
5. The planting area between the sidewalk and the road should be designed to accommodate both plantings and underground utilities.
6. Planting strips should typically located between the curb and sidewalk and parallel to the street. Within commercial areas and other sidewalks with high pedestrian volumes, grated tree wells may be used in lieu of planting strips. Trees should be planted to not impede the site distances of intersections. The minimum width of all planting strips should be at least 4 feet so as to provide a comfortable and safe separation between vehicular and pedestrian movement.
7. Curb radii should be designed to reduce pedestrian crossing times along all streets requiring sidewalks. In general, curb radii should not exceed 20' in non-pedestrian areas and should not exceed 15' in pedestrian areas. Roll curbs should be allowed for access to commercial or industrial facilities to accommodate large vehicles.
8. Mid-block crossings, bulb-outs, raised crosswalks, and similar techniques may be used to accommodate pedestrians when appropriate traffic and site conditions exist.
9. Street furniture such as benches, waste containers, flower and shrub planters, trees, bollards, lampposts and kiosks should be required to encourage walking.
10. Streets shall have well-marked crosswalks, with medians on wider streets to encourage pedestrian safety.
11. Bicycle travel should be supported with bike lanes on wider streets, and bicycle signal preference or speed tables and medians where bike trails intersect streets.

VI. TRANSPORTATION OBJECTIVES AND ACTION ITEMS

The Objectives and Action Items are provided to direct the planning and implementation strategies related to transportation planning in Knightdale and are in

accordance with the overall goals of the 2027 Comprehensive Plan.

A. Objectives

The Town of Knightdale shall seek to:

1. Ensure that development enhances the mobility options of all residents.
2. Ensure that all development provide safe and convenient accessibility to pedestrians, bicyclists, and vehicles.
3. Work with other regional entities, public and private, to pursue a multi-modal network of transportation options and facilities.
4. Encourage land use development patterns that shorten the average length of vehicle trips as a means of reducing congestion and delay throughout the Town.

B. Action Items

The following are the tasks which provide a course of action to implement the objectives for transportation planning:

1. The Town shall annually review and update the Transportation Plan and Transportation Plan Map to ensure that the Plan is current and meet the needs of the Town and region.
2. The Town shall incorporate regionally-adopted long-range transportation plans into the Town's Transportation Plan.
3. The Town's Transportation Plan shall ensure that all new site plans facilitate safe and direct access for pedestrians. Site plans that emphasize automobile access over universal access shall be discouraged.
4. The Town shall use the development approval process to ensure that new roads are built and existing roads are improved in accordance with adopted plans, ordinances, regulations and policies.
5. The Town shall use the development approval process to ensure right-of-way protection.
6. The Town shall prominently display and keep current the Transportation Plan to enable citizens to make plans and improvements with full knowledge of public intent.
7. Transportation related capital improvement projects shall be evaluated using the following criteria:
    - Is the project needed to protect public health and safety and fulfill the Town's legal obligation to provide facilities and services?
    - Does the project increase the efficiency of existing facilities?
    - Is the project in conformance with the goals and objectives of the Transportation Plan?
8. Knightdale's Transportation Plan shall achieve and continue to achieve the

following goals:

- Ensures street connectivity;
- Encourages alleyways for single-family homes in the Town Center and Neighborhood Districts;
- Discourages through traffic on local streets;
- Reduce the number of access points on major roads.

9. The Town shall require developers to use proven traffic calming design techniques to slow automobile traffic through residential areas.
10. The streets in the Town Center and Neighborhood Districts should be designed to follow the current grid system where possible.
11. The Town shall continue to plan and implement projects that enhance the appearance of major vehicular corridors.
12. The Town shall adopt strategies to allow for the safe and convenient crossing of U.S. 64 at intersections located within the Town Center District. This effort should be coordinated with the NCDOT.
13. The Town shall request that existing US 64 be reclassified upon completion of the US 64 Bypass to reflect the local character of the road. Knightdale shall request to rename existing US 64 to a name appropriate to its new identity.
14. The Town shall review and update the requirements for the Special Highway Overlay District and the Special Thoroughfare Overlay District as they relate to transportation issues.
15. The Town shall continue to explore the provision of mass transit, including commuter rail and bus service.
16. The Town will continue to work with regional public transportation systems to create, encourage, support, and maintain safe and convenient park-and-ride programs and transit-oriented developments.
17. The Town shall prioritize sidewalk and multi-purpose path construction and repair as part of the sidewalk program. An annual update of the sidewalk plan shall be required.
18. The Town shall work toward receiving funds from local, state, federal, and non-profit sources for pedestrian and bicycle related transportation improvements.
19. The Town shall pursue and participate in efforts to introduce commuter rail service along the Town's existing, underutilized rail corridor.

FIGURE 8.1: Typical Street Cross-Section - Town Center District

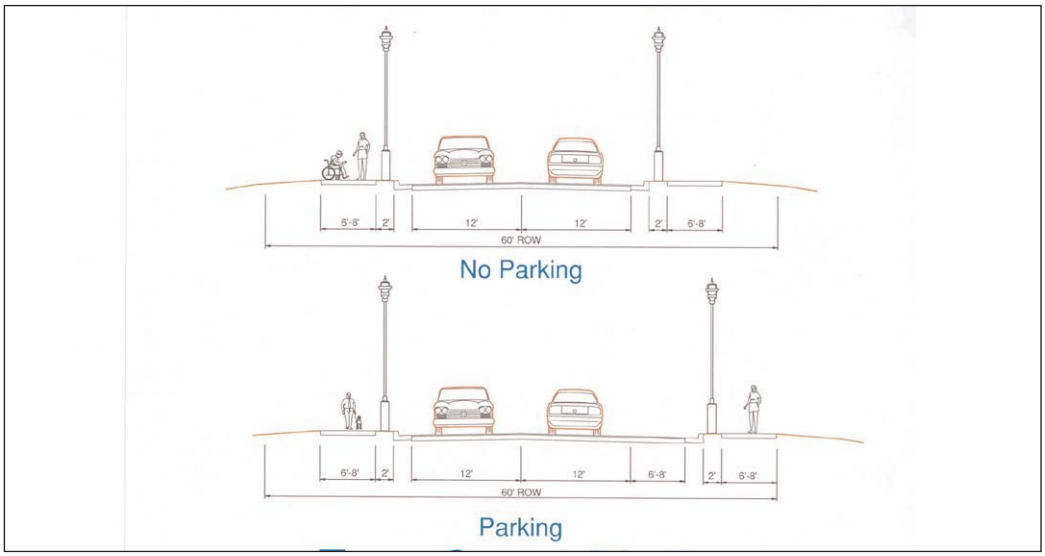


FIGURE 8.2: Typical Street Cross-Section - Countryside/Suburban District

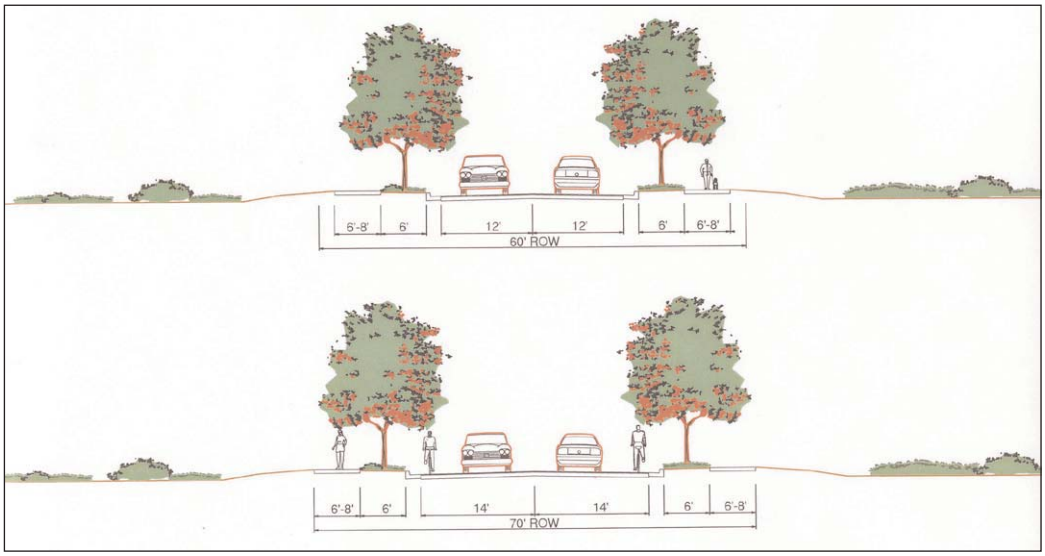
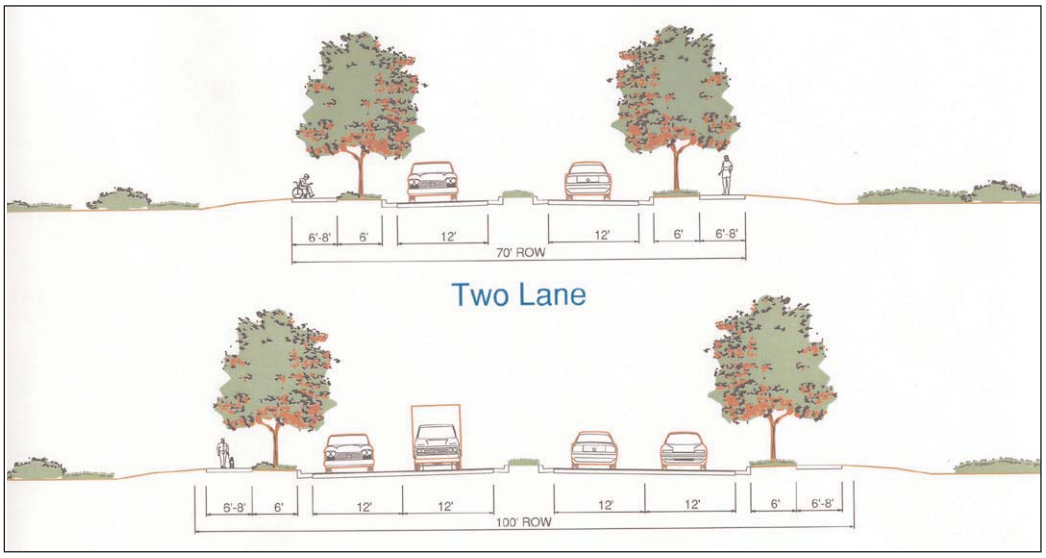


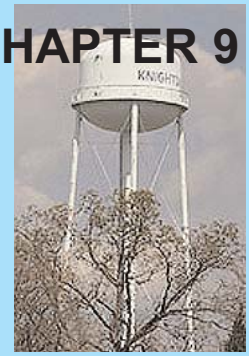
FIGURE 8.3: Typical Street Cross-Section - Highway/Special Purpose District



SEE FIGURE 8.4: RECOMMENDED CROSS SECTIONS

SEE FIGURE 8.5: TRANSPORTATION MAP

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

CHAPTER 10

IMPLEMENTATION STRATEGIES

I. INTRODUCTION

In both public and private sector decision-making processes, implementation goals can translate into actions that either support or impede the achievement Knightdale's 2027 Comprehensive Plan. The Knightdale Comprehensive Plan is the primary tool and policy document used to inform and guide decision-making with respect to the future growth and development of the community. The Comprehensive Plan has three fundamental characteristics.

- First, it provides generalized future land use and public facility and service guidance and direction with respect to growth and development. It is not intended to be a rigid or inflexible blueprint.
- Second, it is comprehensive in its scope and intent in order to address a broad range of interrelated components of the town's physical, fiscal, social and economic factors related to growth.
- Third, it is long range in its horizon addressing not only pressing concerns of today, but considers those of tomorrow.

The Comprehensive Plan, when adopted and as regularly updated is intended to function as the consistent and focused basis for decision-making and management of the community's resources, vision and decision-making to manage growth and development.

Plan Implementation actions generally fall into three categories:

- Ordinance modifications,
- Capital improvement programming
- Policy and legislative initiatives.

Each contains a series of steps, actions and activities logically designed to coordinate and measure implementation progress. This chapter contains two primary sections:

- Growth Management Strategy
- Unified Development Ordinance Modifications

The capital improvement programming implementation strategies are found throughout the document. For instance, capital sewer and water projects are found in the Public Utilities Master Plan. Other policy initiatives are found in the objectives and action items contained within other chapters.

II. GROWTH MANAGEMENT STRATEGY

A. Introduction

Wake County coordinated a county-wide project, from September 2000 through January 2003, that developed a coordinated strategy addressing issues related to Wake County's recent, extraordinary growth. The 42-member Growth Management Task Force consisted of three representatives from the county, the 12 municipalities, and the Wake County Public School System. The overall effort to develop a Growth Management Strategy for Wake County included three phases:

1. Phase One: Identify Key Issues and Common Objectives
2. Phase Two: Prepare the Growth Management Strategy
3. Phase Three: Implementation

The Task Force developed broad common objectives, targeting seven key issues:

1. Respecting the uniqueness of each community
2. Land Use and Development Standards
3. Schools
4. Transportation
5. Open Space
6. Water and Sewer
7. Paying for Growth

The next step was to develop the Growth Management Strategy and provide implementation tools that respected each community's autonomy, while at the same time providing a framework for addressing common concerns that affected more than one jurisdiction. A series of major, recurring themes emerged as especially important for the Task Force members:

- Work Cooperatively, but Preserve Local Autonomy
- Different Circumstances Call for Different Growth Strategies
- Rural Character Must Be Preserved
- Protect the Natural Environment and Historic Resources
- Raise the Bar on Development Quality While Ensuring a Healthy Economy

For each major issue considered, the Task Force looked at general strategies and specific tools designed to implement the common objectives from Phase One. Through the course of a year, Task Force members selected two or three specific strategies per issue to be highlighted as a recommended high priorities. These high priority recommendations are the common objectives Task Force members believed

should be implemented first.

Of course, not all implementation tools are appropriate for every community. One tool that makes sense for a small town may not make sense in a larger urbanized town The Task Force's intent was agreement of general strategies that made sense for the entire county, recognizing that each community needs to choose a set of implementation tools based on local circumstances.

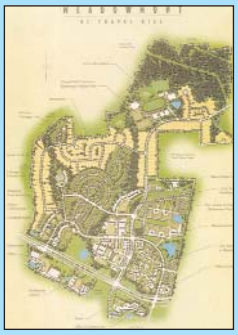
B. Knightdale Growth Management Strategy

Based on the findings and recommendations of the Wake County Growth Management Strategy, the following recommendations are provided in accordance with Knightdale's individual strategies. The recommendations are based on the high-priority strategies listed in the Executive Summary of the Wake County Growth Management Strategy.

1. Community Character and Land Use

Strategy 1: Preserve and Enhance Knightdale's Tree Canopy

Strategy	*Authority*	*Status*	*Timeframe*
1. Tree Protection Ordinances to : · Regulate Clear Cutting · Protect Specimen protect Species	HB 910 authorizes Knightdale to regulate clear-cutting and to 'specimen trees'.	Knightdale to adopt new clear cutting and specimen tree ordinance as part of the UDO re-write.	By July 2004
2. Research additional and amended tree and shrub planting requirements	General Zoning Authority: NCGS 160A-381	Staff to research 1. Street tree plantings 2. Buffer yard widths and planting numbers Propose text changes in UDO re-write.	By July 2004
3. Establish conservation subdivisions (local ordinance that allows or requires development on smaller lots than allowed in normal subdivisions, in order to reserve higher percentage of common open space and natural features)	General Zoning Authority: NCGS 160A-371	Countryside District of Design District Master Plan encourages preservation of open space and natural areas; conservation sub-divisions would provide for preservation of open space. Staff will research pros and cons and propose a text change as part of the UDO re-write.	By July 2004
4. Encourage Community Tree Planting Programs (Voluntary neighborhood - or - community based program to plant trees	No special authorization needed.	Planning and Appearance Board to review feasibility of this program	By January 2005



Strategy 2: Adopt Regulations to Protect and Enhance Community Appearance Historic Preservation/Neighborhood Conservation

Strategy	***Authority***	***Status***	***Timeframe***
1.List historic properties and structure on National List of Historic Places	No special authorization needed	Maintain current level of effort; create a database to review historic, structures and places.	On-going
2. Adopt local historic preservation ordinance	Authorized by NCGS 160A-400	Review current ordinances related to historic preservation and update as part of the UDO re-write.	By July 2004
3. Possible creation of neighborhood conservation overlay district (This is a local designation for areas that do not meet historic district status, or that are intended to be regulated in a more flexible manner than full-fledged historic districts	Authorized by NCGS 160A-381	Research neighborhood conservation overlay districts and propose possible amendments as part of the UDO re-write.	By July 2004
4. Adaptive reuse (establish-ment of new uses, in older, often vacant, buildings.)	No special authority needed.	Maintain an inventory of vacant buildings and encourage reuse of those buildings through dialogue with the Chamber of Commerce	Prepare initial list by February 2004. On-going thereafter.

Visual Quality of New Development			
Strategy	***Authority***	***Status***	***Timeframe***
1. Adopt additional appearance standards. (Standards applying to residential and/or nonresidential development designed to improve the visual character of new development; can be mandatory (standards) or recommended (guidelines).	Authorized by NCGS 160A-451	In accordance with the DesignDistricts Master Plan, a series of guidelines are established and are to be turned into standards as part of the UDO re-write. Staff to research all guidelines and craft amendments to the UDO	By July 2004
2. Review current landscaping requirements	Authorized by NCGS 160A-381	Staff to review all current landscape requirements and propose changes/additions as needed. Clear cutting ordinance to be adopted. Street tree and bufferyards to be amended.	By July 2004
3. Implement additional open space dedication requirements (local requirements for dedication of open space.	Authorized by NCGS 160A-371	As outlined in the Countryside District guidelines, preservation of open space is encouraged. Review current code standards for passive recreation requirements; research conservation subdivision pros/cons; and propose open space dedication standards as part of the UDO re-write.	By July 2004

Infill Development			
Strategy	***Authority***	***Status***	***Timeframe***
1. Adopt downtown focus area plan	Authorized by NCGS 160A-361	After adoption of 2027 Comprehensive Plan, complete Downtown Focus Area Plan.	By 2005
2. Adopt standards for desirable infill development. (In accordance with Design District Master Plan Guidelines and proposed transit locations, the downtown area is to be planned for higher density areas around a commuter rail station.)	Authorized by NCGS 160A-381	Research infill development standards from comparable towns; convert design guidelines related to infill development into standards as part of the UDO re-write.	By July 2004

2. Schools

Strategy 1: Adopt Regulations and Incentives to Create More Diverse Communities

Strategy	*Authority*	*Status*	*Timeframe*
1. Adopt mixed-use development regulations and incentives. (Local regulations and incentives designed to ensure that new development contains a mix of land uses (residential and non-residential.)	Authorized by NCGS 160A-381	As part of the UDO re-write, include new ordinances for mixed-use developments, master planned subdivisions and neo-traditional design.	By July 2004
2. Review and possibly adopt inclusionary housing ordinances (Local ordinances that require a certain percentage of each development to include affordable housing units or a mix of housing units.)	Statutes do not explicitly provide this authority	Staff to review this type of ordinance and determine if necessary as Knightdale has a high percentage of affordable housing.	By July 2004
3. Adopt affordable housing incentives (Density bonuses, procedural streamlining and other incentives designated to encourage, rather than require, the provision of affordable housing.)	Authorized by NCGS 160A-381	Staff to review this type of ordinance by researching pros and cons for affordable housing ordinances. Propose a text amendment as part of the UDO re-write if needed.	By July 2004

Strategy 2: Obtain Better Technical Information from Stakeholders

Strategy	*Authority*	*Status*	*Timeframe*
1. Establish informal tech-planning group	No special authorization needed	Work with Wake County to establish group to discuss school location criteria.	On-going

3. Transportation

Strategy 1: Ensure Planning and Regulations that Make the Land Use/Transportation Connection and Reduce Vehicle Miles Traveled

Strategy	*Authority*	*Status*	*Timeframe*
1. Continue to identify preferred growth areas (Areas that contain existing or planned concentrations of jobs and infrastructure)	Authorized by NCGS 160A-361	Continue to monitor adopted land use plans: design district master plan, official zoning map, regional plans	On-going
2. Coordinate the location planned transportation improvements with desired land uses and intensities	Authorized by NCGS 160A-361	2027 Comprehensive Plan of has examined this strategy. US 64 Bypass Focus Area Plan has planned for land use d ensities around interchanges. Continue to monitor development patterns and update regulations as needed.	On-going
3. Ensure zoning allows higher minimum densities in preferred growth areas	Authorized by NCGS 160A-381	Design District Master Plan encourages higher densities in preferred growth areas. Site design and district standards are to be adopted as part of the UDO re-write	UDO Update by July 2004; Continue to monitor this as an on-going project
4. Adopt regulations or incentives to promote mixed-use development	Authorized by NCGS 160A-381	Design District Master Plan encourages mixed-use developments. Standards and incentives are to be adopted as part of the UDO re-write.	UDO Update by July 2004;
5. Adopt standards and incentives to reinforce pedestrian-friendly environment	Authorized by NCGS 160A-381	2027 Comprehensive Plan contains numerous guide-lines supportive of the pedestrian friendly environment. Standards and incentives are to be adopted as part of the UDO re-write.	By July 2004
6. Tailor parking standards to promote mixed-use development	Authorized by NCGS 160A-381	2027 Comprehensive Plan encourages mixed-use developments. Standards and incentives are to be adopted as part of the UDO re-write.	By July 2004

Strategy 2: Work Cooperatively to Coordinate Local Transportation Programs

Strategy	*Authority*	*Status*	*Timeframe*
1. Coordinate development and updating of transportation plans	Authorized by NCGS 160A-361	Continue to coordinate with Wake County and adjacent municipalities via CAMPO and Planners, Managers, and Task Force meetings/ workshops.	On-going
2. Wake County to coordinate countywide and regional transportation programs. Municipalities	No special authorization needed. Some individual tools, such as impact fees, may need enabling authority.	Continue to coordinate to participate in process. with Wake County and adjacent municipalities via CAMPO, Planners, Managers, and Task Force meetings/workshops.	On-going
3. Seek legislation for mechanism to address extra-jurisdictional transportation impacts (Wake County seeking authority for mechanism to address extra-jurisdictional impacts; options might include countywide system of impact fees, or interlocal agreements to address projects or regional impact.)	Authorized by NCGS 160A-381	Continue to coordinate with Wake County and adjacent municipalities via CAMPO, Planners, Managers, and Task Force meetings/ workshops.	On-going
4. Plan for and implement a multi-modal secondary road network that is consistent with the primary road network	Authorized by NCGS 136.662	County and municipalities coordinate with CAMPO and state to plan and implement secondary road network for multi-modal use and to support desired development patterns.	On-going

4. Open Space

Strategy 1: Establish a Permanent, Dedicated Funding Source to Acquire Open Space

Strategy	*Authority*	*Status*	*Timeframe*
1. Increase local sales tax to provide dedicated source of funds for open space acquisition	Wake County currently imposes 2 cent local option sales tax	Sales tax was just increased, but not dedicated for open space acquisition in Knightdale. Research feasibility of increasing this tax for open space purposes.	By 2005
2. Adopt real estate transfer tax (Levy a tax on real estate transactions, authority assessed on the actual sales price (including land and improvements) to provide dedicated source of funds for open space acquisition.)	Special legislation required. No jurisdictions have feasibility	Work with other municipalities in researching of imposing this tax.	By 2005
3. Adopt open space impact fee	Special legislation required. No jurisdictions have authority	Work with other municipalities in researching feasibility of imposing this tax.	By 2005
4. Increase property tax by modest amount to provide dedicated source of funds for open space acquisition.	No special authorization needed.	Research the feasibility of increasing property tax for open space acquisition.	By 2005

Strategy 2: Adopt Model Conservation Subdivision Ordinance

Strategy	*Authority*	*Status*	*Timeframe*
Revise open space development ordinance to adopt model conservation subdivision ordinance (Local ordinance that allows or requires development on smaller lots than allowed in typical subdivisions, in order to reserve higher percentage of common open space and natural features.)	Authorized by NCGS 160A-371	Staff to re-write open space development ordinance to new conservation subdivision ordinance as part of UDO re-write	By July 2004

4. Water and Sewer

Strategy 1: Continue to Work Cooperatively to Merge Water and Sewer Utilities

Strategy	*Authority*	*Status*	*Timeframe*
Implement Wake County Water/Sewer Plan, including development of single utility by 2015	No special authorization needed	Knightdale evaluating feasibility of merging utility systems with the City of Raleigh	On-going

Strategy 2: Adopt Uniform Natural Resource Protection Standards and Incentives

Strategy	*Authority*	*Status*	*Timeframe*
Adopt uniform natural resource protection standards. (Local governments agree to adopt uniform regulations , but each jurisdiction could adopt their own more stringent regulations.)	Zoning authority: NCGS 160A-381; Authority to protect water quality and supply: NCGS 43-214.5; NCGS 143-355 Authority to adopt local erosion control program: NCGS 113A-60HB 910 authorizes Knightdale to regulate clear cutting and to protect specimen trees.	New clear cutting and specimen tree ordinance to be adopted as part of the UDO re-write. Knightdale staff are also preparing NPDES Phase II application which will require new ordinances to be written.	On-going

Strategy 3: Implement Demand Management Strategies

Strategy	*Authority*	*Status*	*Timeframe*
Implement Demand Management Strategies (Local governments to adopt tools such as water conservation rates, conservation rates, water fixture retrofits, or water reclamation and reuse ordinances to reduce per capita consumption of water.)	Authority to adopt local water supply plans: NCGS 143-355(l)	Knightdale to evaluate demand management strategies, determine feasibility and prepare recommendations.	2005

4. Paying for Growth

Strategy 1: Work Cooperatively to Develop a Joint Funding Strategy to Pay for Growth

Strategy	*Authority*	*Status*	*Timeframe*
Work Cooperatively to Develop a Joint Funding Strategy to Pay for Growth (Local governments to work together to secure legislative authority for wide variety of cost recovery tools, and then use revenue from those tools to make improvements on local infrastructure and facilities.)	No authority needed to work together; however, the full range of tools will be available to all jurisdictions only if the common legislative agenda is pursued.	Continue to coordinate with Wake County and adjacent municipalities via Planners, Managers, and Task Force meetings/workshops.	On-going

Strategy 2: Prepare and Adopt State Legislative Agenda to Enable Range of Cost-Recovery Tools

Strategy	*Authority*	*Status*	*Timeframe*
Prepare and Adopt State Legislative Agenda to Enable Range of Cost-Recovery Tools (Establish working group to develop common agenda of cost-recovery tools, and jointly lobby North Carolina legislature for approval.)	No authority needed to submit common legislative agenda	Group yet to be established. Work through Planners and Managers regular meetings to discuss this issue.	On-going

C. Next Steps in the Growth Management Strategy

The Wake County Growth Management Strategy will be presented to each local government's governing board in the fall of 2003. Each local government will ultimately be responsible for implementation of the overall strategy. The strategy, as outlined above, is a modification of the Wake County Growth Management Strategy that addresses Knightdale's concerns and issues.

For the next two to three years, Knightdale will be addressing these implementation strategies.

III. UNIFIED DEVELOPMENT ORDINANCE MODIFICATIONS

Updating the Town of Knightdale Unified Development Ordinance is a major implementation priority.

Concurrent with 2027 Comprehensive Plan update efforts, NRS Associates prepared an assessment and evaluation of existing land development ordinances. At the same time, Stantec Consulting, Inc. provided a listing of transportation related ordinance changes necessary to insure Plan and regulatory consistency.

NRS Associates drew up thirteen code assessment criteria categories based on interviews of the Town staff, Town board members (elected and appointed) and the development community. Generally, the statements of those interviewed are characterized in a composite form, providing a current perception of the Town of Knightdale's development codes and the regulatory environment.

The following are those assessments:

1. Definitions - There are shortcomings with the variety of sections and locations where definitions are found in the codes. Due to the age of various ordinance sections, the use definitions often appear inadequate to cope with new, changing or unanticipated uses and activities. Multiple opportunities are then presented which support allegations of staff mis-interpretations and/or inconsistencies. The following definition related issues are identified as significant for Code evaluation:

- Need for general update of overall definitions
- Overlap and conflicts
- Absent or outdated definitions
- Bikeway definition revision
- Street definitions revision to meet comprehensive plan

2. Format - The existing regulations are reasonably well written, but need to be compiled in a User-friendly format. Footers and bold text within the various chapters and sections is needed for identification and differentiation. The following format issues are identified as significant for Code evaluation:

- Style and readability issues
- Lack of user friendly format and language
- Need to consolidate all land development related requirements in a single code
- Need clear and useful topic index

3. Zoning Districts - There is substantial agreement that various existing zoning district classifications require significant amendment, modernization, replacement, substitution and/or revisions. There is similar agreement that updated agricultural, residential and non-residential districts are desired along with new approaches to specific uses and conditions. The following zoning district issues are identified as significant for Code evaluation:

- Review need and application of agricultural districts
- Lack of effective cluster district
- Rail Transit Terminal Overlay District
- Consider Revisions to Planned Unit Development districts, residential and non-residential
- Potential Downtown overlay district
- Corridor Overlay districts generally
- Lack of creativity and flexibility generally

4. Permitted Use Lists - There is a general consensus that existing permitted uses listed within each zoning districts as permitted by-right, special use or as conditional uses are seriously out of date. This is compounded by the lack of modern, comprehensive and clear definitions. Re-examining the appropriateness of present classifications of specific uses within each district is warranted. The following use list issues are identified as significant for Code evaluation:

- Overall update of use list
- Day care
- Churches, schools and related institutions
- Conflict in interpretations
- Fixing of responsibility for interpretations
- Carefully evaluate use by right, special and conditional use lists and clarity of conditions to be met

5. District Provisions - As expected, code complaints centered around the perceptions of adequacy or inadequacy of code content and needs of the various stakeholders. Recognizing that out of date language and, in many cases, no clear or specifically drawn provisions for density, intensity, height, bulk, set-back, access, parking, driveway, noise, lighting, signage, related design standards and/or improvement requirements, the present system of project review and approvals becomes confrontational. The following district provision issues are identified as significant for Code evaluation:

- Evaluate and update general district provisions
- Private streets
- Homeowners association requirements

- Maintenance bonds
- Planned unit development regulations
- Update transportation and park impact fee methodology
- Signs, banners and balloons
- Fencing, razor wire
- Parking, loading storage requirements
- Lighting standards
- Noise decibel standards
- Churches & Schools, by-right or conditional use.
- Planned unit development minimum lots size
- Consider requiring developer pre-public hearing meetings with neighbors
- Consider variable district height, bulk, setback and other design standards to insure neighbor integrity at and adjacent to residential zoning district boundaries

6. Requirements vs. Practice - In general, there appears little problem or concern from the developer community that projects are being delayed, or subjected to lengthy or untimely administrative re-review procedures. The following requirements versus practices issues are identified as significant for Code evaluation:

- Street LOS, level of service standards, TIA improvement and dedication standards and equity
- Off premises signs vs. billboard enforcement
- Lighting standards
- Noise standards
- Site plan, building group and related "completed plan" submission requirements

7. Review Criteria, Administrative Review Procedures - The one area of agreement, from all segments of the interest groups is the process and timing considerations involved with the Town Council and it's administrative procedures. Knightdale's unique requirements for development applications first being scheduled at a Town Council meeting and then referred to the Boards and Commissions for normal hearing and decision-making recommendations, subjects the projects to unwarranted, lengthy and untimely administrative review. The following review and administrative issues are identified as significant for Code evaluation:

- Town Council should be last to hear cases, not first.
- Revision of civil enforcement procedures and penalties
- Uniform addresses and address assignment responsibility
- Timely provision of approved subdivision maps to Public Safety Department

8. Design Standards - Considering the age and format of the current zoning ordinance, height, bulk, set back and related design standards in most cases are overlapping, conflicting, poorly interpreted or non-existent. The nature of new development creates a variety of unanticipated impacts on adjacent land uses in the absence of modern definitions and illustrated design standards. The following design standard issues are identified as significant for Code evaluation:

- Need for courtyard standards.
- Need for clear and consistent definitions and application of traffic LOS standards.
- Need for clear and consistent application of Traffic Impact Analysis (TIA) improvement thresholds
- Remove promise of median cut
- Combine STOD & SHOD, clarify depth
- Revise neo-traditional intent to be consistent in Plan and Code
- Need for clear and consistent application of cul-de-sac standards
- Need for clear and consistent application of primary vs. secondary entrance standards
- Revise to address street calming standards
- Add sight line requirements
- Address right of way street donations and agreement to maintain
- Need for clear and consistent application of gated community standards
- Need for clear and consistent application of street width standards
- Need for clear and consistent application of side walk standards
- Need for clear and consistent application of parking, loading & storage standards
- Need for clear and consistent application of landscaping standards
- Consider "walk-able community" connectivity standards

9. Use Topic Issues - Highly visible land use topics unique to a community often prompt issues requiring a special evaluation. These issues are generally a consequence of either outmoded definitions in the ordinances, omissions in older district Use lists, vague specific zoning district provisions, or review criteria addressing the impacts of such uses. The following "special" issues are identified as significant for Code evaluation:

- Mixed Use Developments
- Home occupations
- Banners and balloons
- Cluster and PUD flexibility
- Patio home lot size and yard interpretations
- Churches, schools and other non-residential uses in residential areas

10. Subdivision Improvements Specifications - Unfortunately, the uniform application of zoning and subdivision requirements leaves significant space for interpretation and confusion. This is experienced by both staff and the development community. The confusion is a result of improvement requirements, design standards and administrative policies found in multiple zoning and subdivision regulations, improvement standard manuals, town management administrative policy and un-adopted technical code documents.

The consequence is substantial discomfort with the entire process of administrative review and enforcement. For instance, just the variety of coordination issues like water and wastewater supply, school and other service providers during a subdivision process should be clearly defined within updated and clear subdivision regulations within the Land Development Code. The following subdivision specification issues are identified as significant for Code evaluation:

- Need for clear, adopted and uniformly applied facility improvement standards for all service providers with emphasis on clarity of processes and procedures
- Reevaluate street lighting and spacing standards
- Evaluate thresholds for under-grounding electrical utilities

11. Subdivision Administrative Review Procedures - Despite procedural efforts to streamline the process, the developer community and staff agree that despite adopted subdivision regulations or practices, projects can be delayed and are subjected to lengthy or untimely administrative re-review procedures. Staff sees the problem in the processes as failures by the developer to submit properly "completed plans." The development community sees the problem as the Town's last minute application of unwarranted requirements that necessitate either a short turn around of plan revisions or delays in project approvals or public hearings. The following subdivision review and administrative issues are identified as significant for Code evaluation:

- Need for clear, adopted and uniformly applied improvement review procedures
- Need clear distinctions among zoning and subdivision regulatory requirements, public improvement design standards manuals and management policies
- Need a revised and up to date community "collector" street plan and process to insure connectivity among subdivisions to major arterial streets
- Need a formal GIS mapping program to locate and document "approved subdivisions"

12. Board/Committee Procedures & Practices - The following Board/Commission administrative issues were identified as significant for Code evaluation:

- Maintain clear distinctive division concerning Board and Commission findings that subdivisions meet applicable technical design standards rather than becoming involved in subjective review of design preferences. Boards and staff should recognize the ministerial nature of confirming a subdivision as meeting the technical requirements of the current ordinances.

13. Transportation Impact Fees - The methodology and cost basis for calculation and exaction of transportation impact fees is out of date and should be revised. This impact fee power is given to only a handful of municipalities in North Carolina and should be carefully structured to achieve its intent.

CHAPTER 11

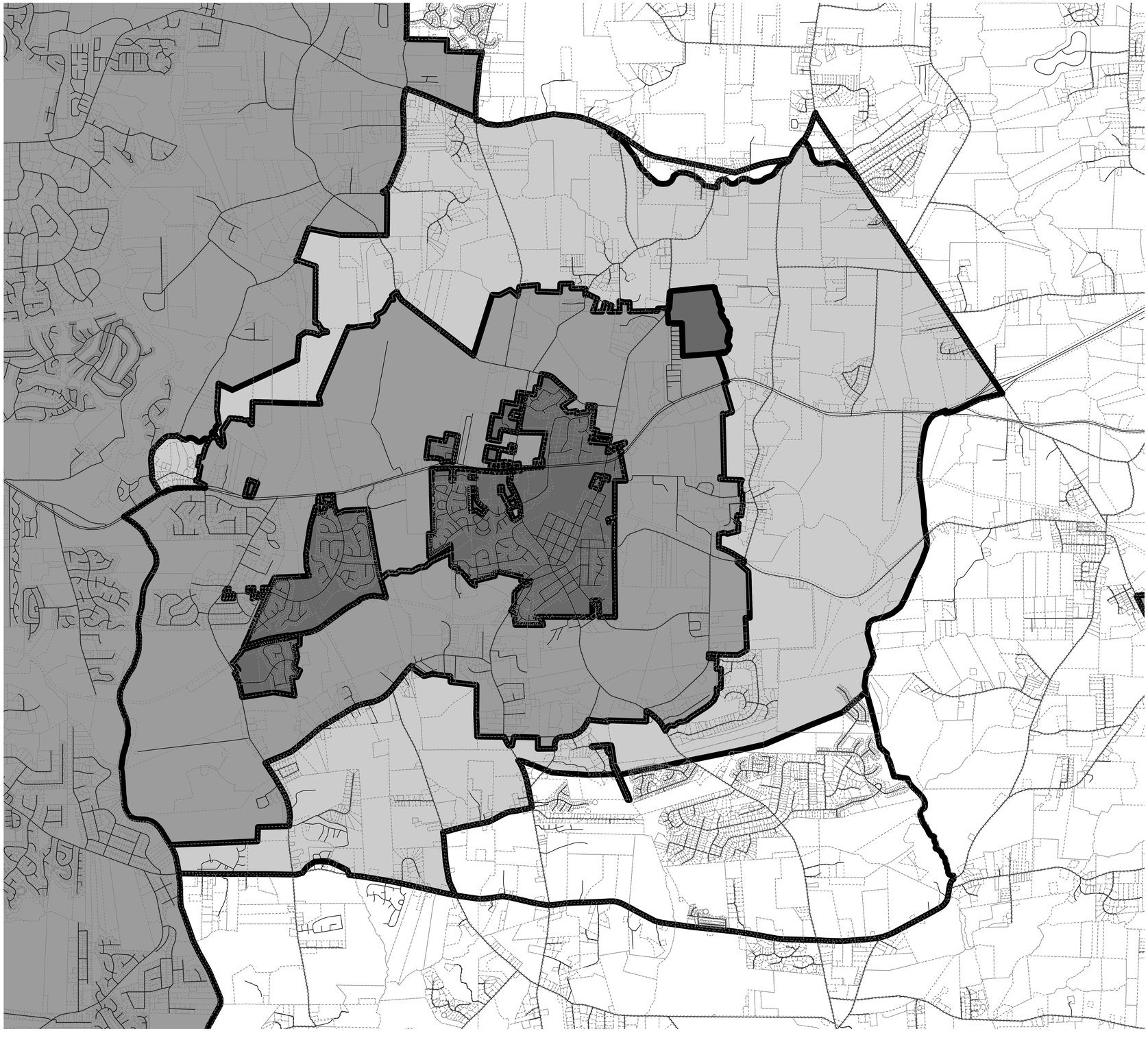
FOCUS AREA PLANS

Village Green

FOCUS AREA PLAN: 1. US 64 BYPASS STUDY FINAL REPORT

Community Space

KNIGHTDALE PLANNING AREA BOUNDARIES



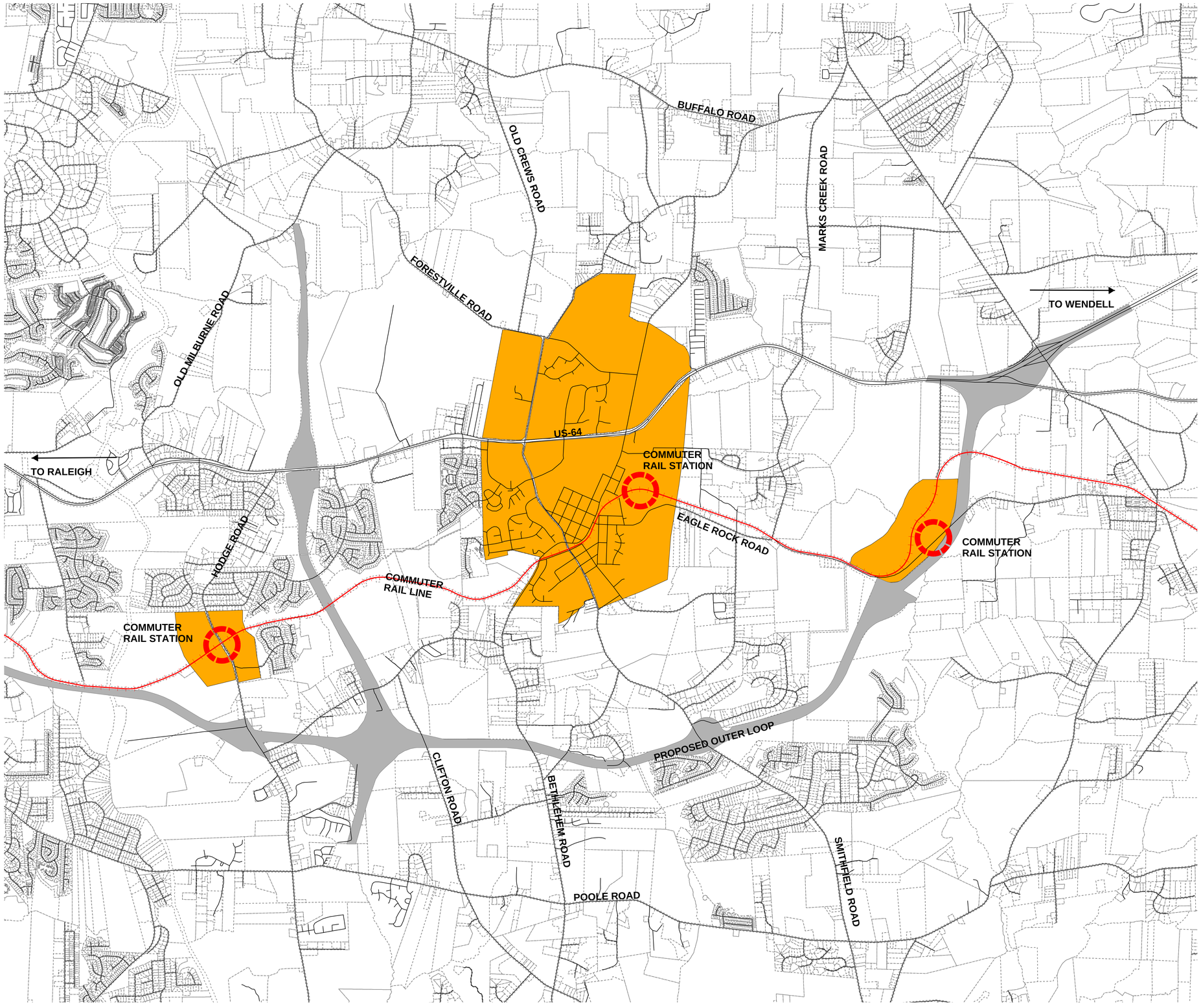
LEGEND

- STREETS
- PARCELS
- CORPORATE LIMITS
- EXTRA-TERRITORIAL JURISDICTION
- SHORT RANGE URBAN SERVICE AREA
- LONG RANGE URBAN SERVICE AREA

N

FIGURE 3.1

TOWN CENTER DISTRICT



LEGEND

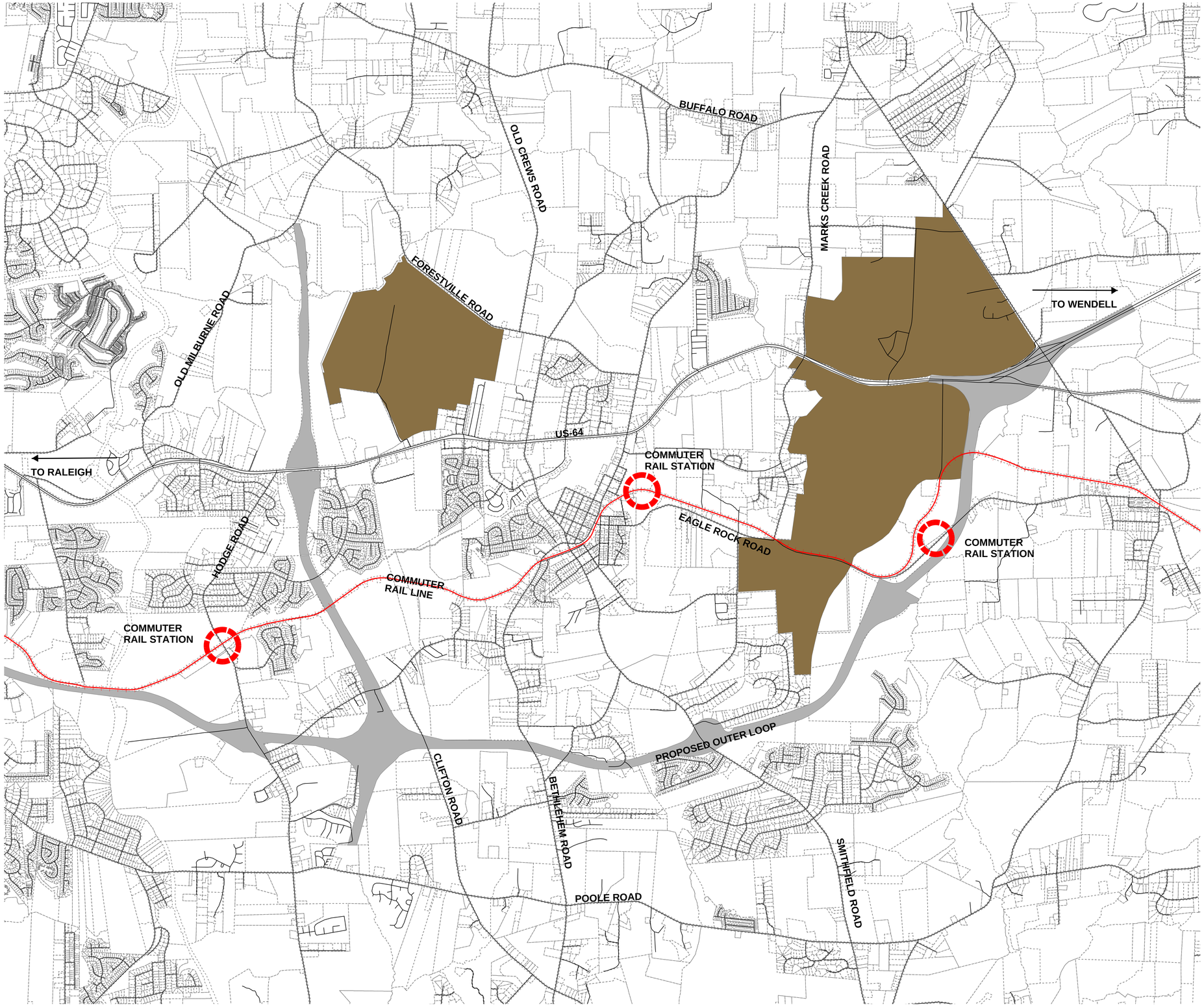
- TOWN CENTER DISTRICT
- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- COMMUTER RAIL STATION

NOTE:
THE TOWN DISTRICT PROVIDES FOR REVITALIZATION, REUSE, AND INFILL DEVELOPMENT. A BROAD ARRAY OF USES IS EXPECTED IN A PATTERN WHICH INTEGRATES SHOPS, RESTAURANTS, SERVICES, WORK PLACES, CIVIC, EDUCATIONAL AND RELIGIOUS FACILITIES, AND HIGHER DENSITY HOUSING IN A COMPACT, PEDESTRIAN-ORIENTED ENVIRONMENT. THE TOWN CENTER ANCHORS THE SURROUNDING RESIDENTIAL NEIGHBORHOODS WHILE ALSO SERVING THE BROADER COMMUNITY. THE DISTRICT IS CODED TO ACCOMMODATE THE HIGHER OVERALL INTENSITY OF DEVELOPMENT REQUIRED TO SUPPORT RAIL STATIONS.

N

FIGURE 5.5

SPECIAL USE DISTRICT



LEGEND

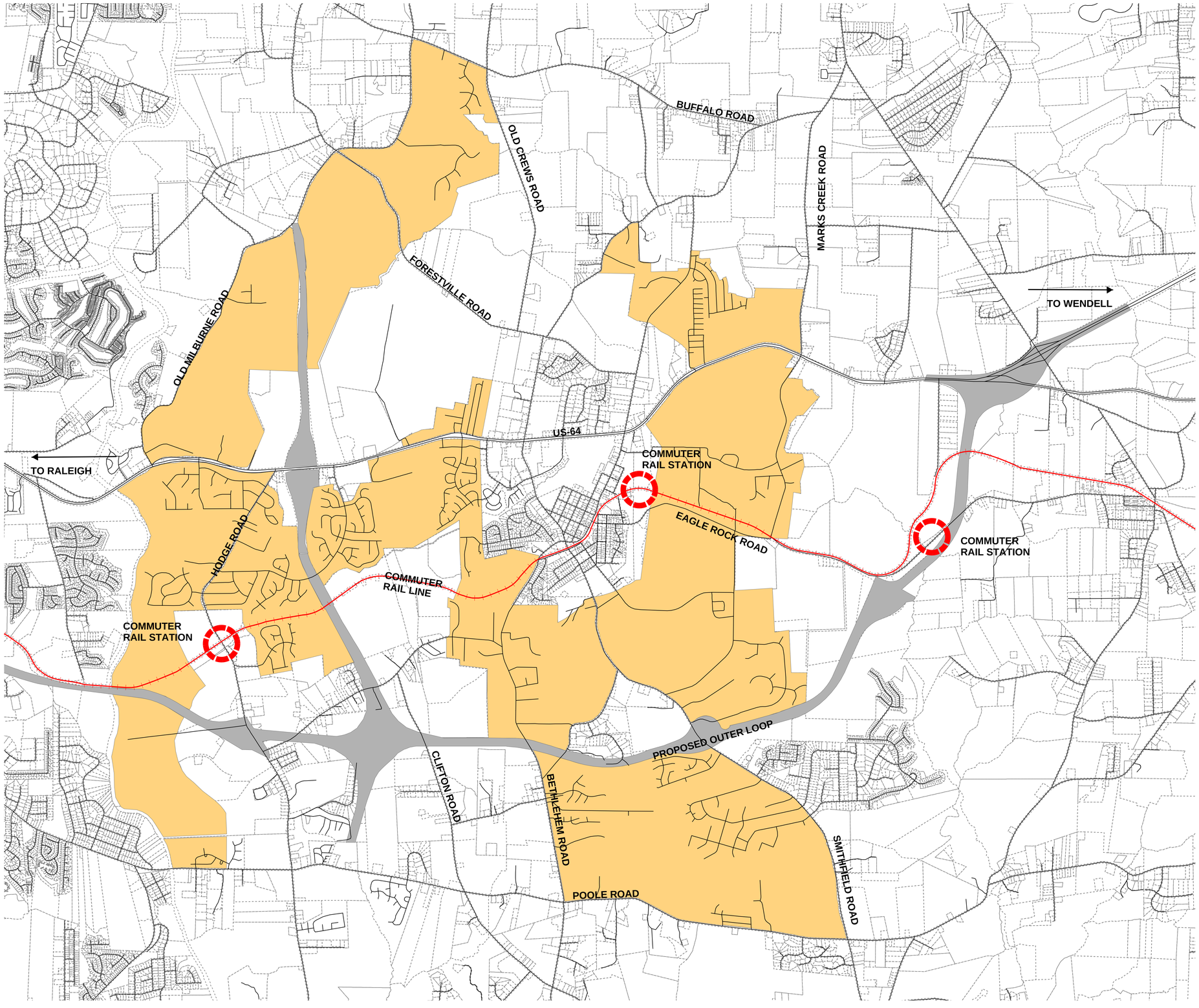
- SPECIAL USE DISTRICT
- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- COMMUTER RAIL STATION

NOTE:
THE SPECIAL USE DISTRICT IS ESTABLISHED TO PROVIDE FOR LARGE BUSINESSES OR INDUSTRIA COMPLEXES, WHICH BECAUSE OF THEIR SCALE, THE NATURE OF THE USE ARE LESS COMPATIBLE WITH THE FABRIC OF THE COMMUNITY.

N

FIGURE 5.7

NEIGHBORHOOD DISTRICT



LEGEND

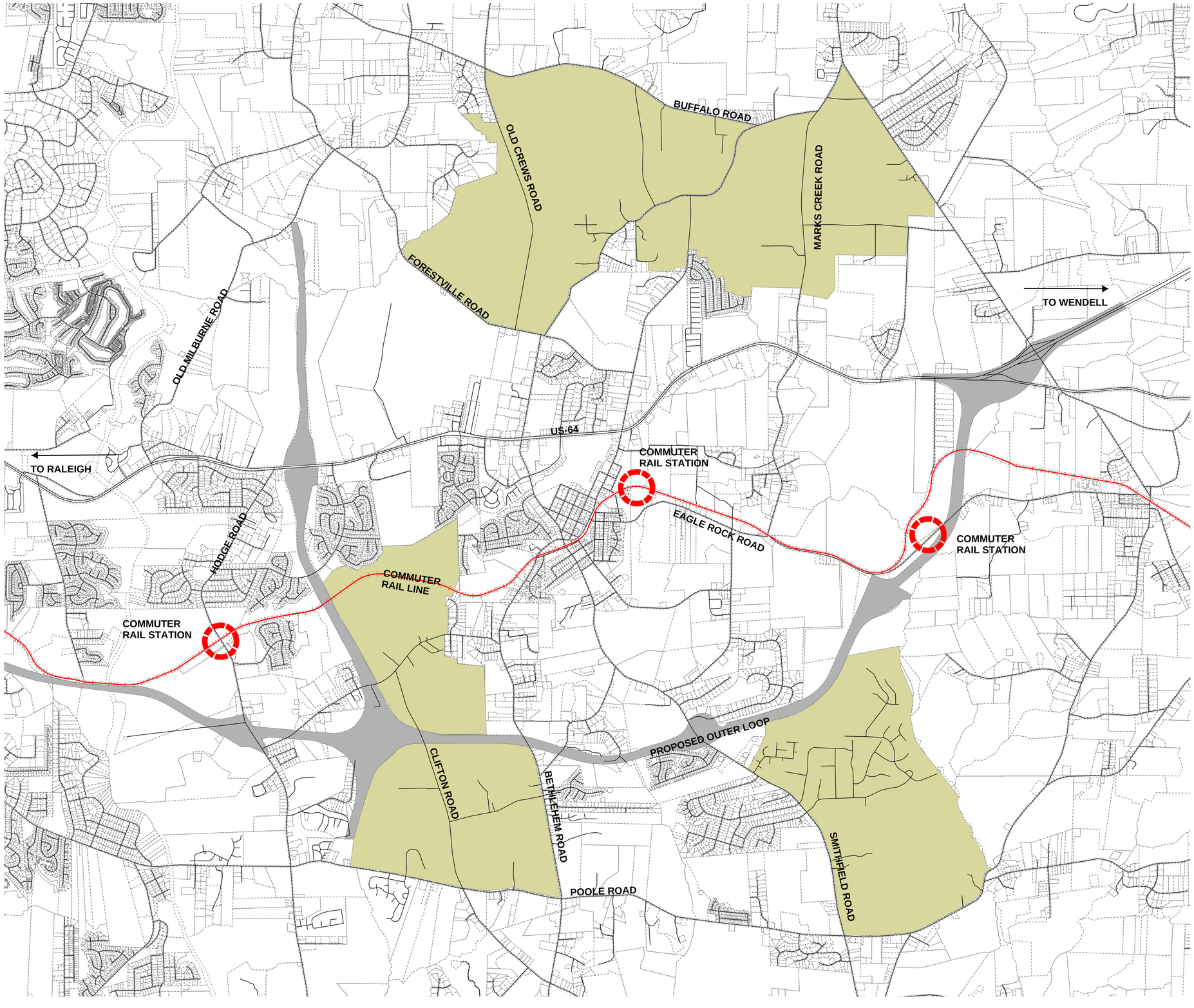
- NEIGHBORHOOD DISTRICT
- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- COMMUTER RAIL STATION

NOTE:
THE NEIGHBORHOOD DISTRICT PROVIDES FOR PREDOMINANTLY SINGLE-FAMILY RESIDENTIAL DEVELOPMENT SURROUNDING THE TRADITIONAL TOWN CENTER AND ITS LOGICAL EXTENSIONS. A RANGE OF HOUSING TYPES IS ENCOURAGED. BUSINESS ACTIVITY IS PERMITTED IN MIXED-USE BUILDINGS AT RESIDENTIAL SCALE ACCORDING TO LOCATIONAL CRITERIA. MULTI-FAMILY BUILDINGS ARE ONLY PERMITTED WITHIN A TEN-MINUTE WALK (1/2 MILE) OF THE DESIGNATED TOWN CENTERS.

N

FIGURE 5.4

COUNTRYSIDE DISTRICT



LEGEND

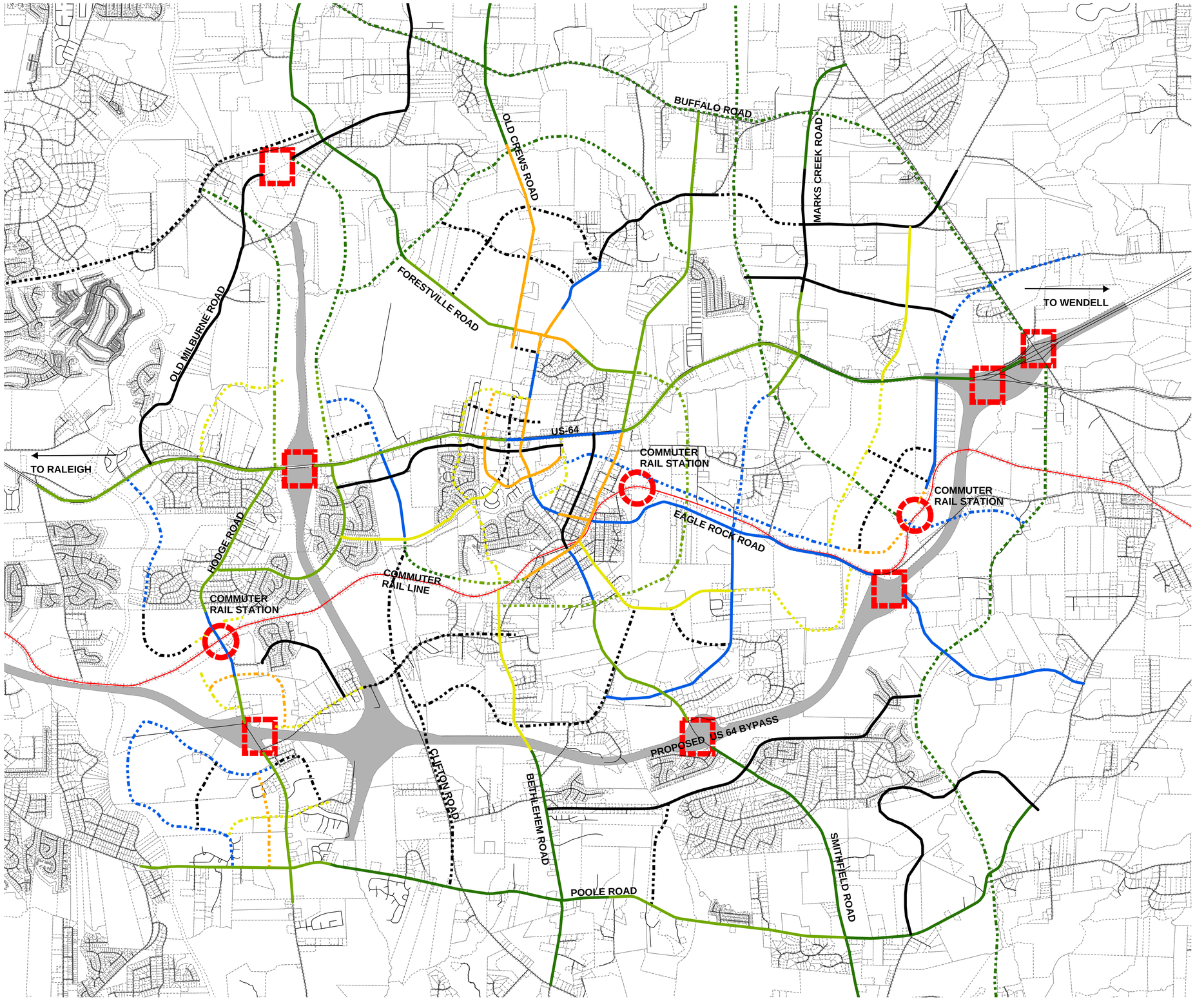
- COUNTRYSIDE DISTRICT
- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- COMMUTER RAIL STATION

NOTE:
THE COUNTRYSIDE DISTRICT IS PROVIDED TO ENCOURAGE THE DEVELOPMENT OF LOW-DENSITY COMPACT NEIGHBORHOOD, AGRICULTURAL USES AND RURAL COMPOUNDS THAT SET ASIDE SIGNIFICANT NATURAL VISTAS AND LANDSCAPE FEATURES FOR PERMANENT CONSERVATION. DENSITY OF DEVELOPMENT IS REGULATED ON A SLIDING SCALE; PERMITTED DENSITIES RISE WITH INCREASED OPEN SPACE PRESERVATION. DEVELOPMENT TYPES ASSOCIATED WITH THIS DISTRICT ARE FARMS, SINGLE HOUSE, AND THE FARMHOUSE CLUSTER, AS CLUSTER DEVELOPMENTS.

N

FIGURE 5.3

TRANSPORTATION MAP



LEGEND

- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- PR. PARKWAY
- EX. PARKWAY
- PR. BOULEVARD
- EX. BOULEVARD
- PR. AVENUE
- EX. AVENUE
- PR. LOCAL ST. (COMM.).
- EX. LOCAL ST. (COMM.)
- PR. LOCAL ST. (RES.)
- EX. LOCAL ST. (RES.)
- PR. LOCAL ST. (NEIGHBOR.)
- EX. LOCAL ST.NEIGHBORHOOD
- PR. COMMUTER RAIL STATION
- PR. FREEWAY INTERCHANGE

N

FIGURE 8.5

DESIGN DISTRICT MAP

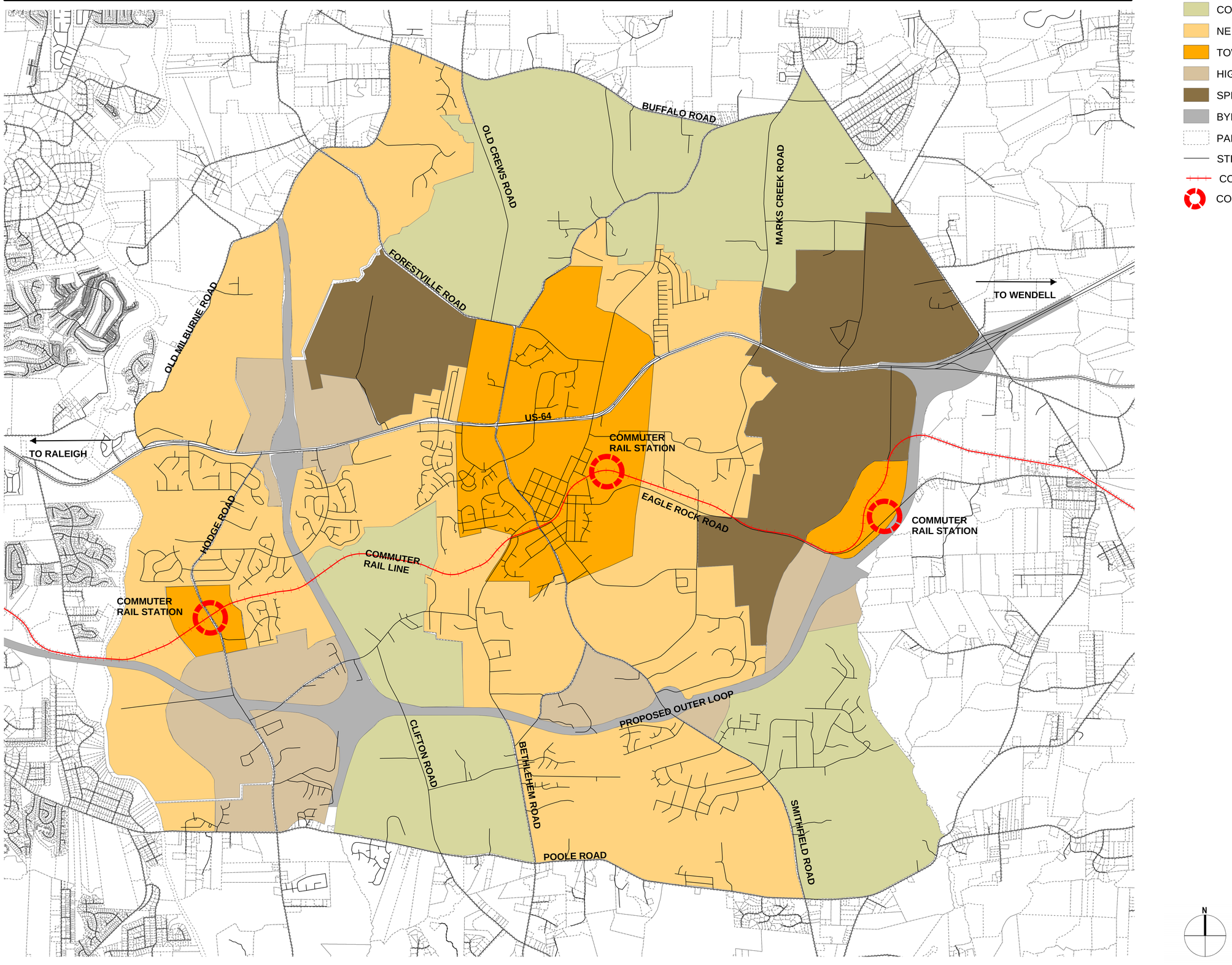
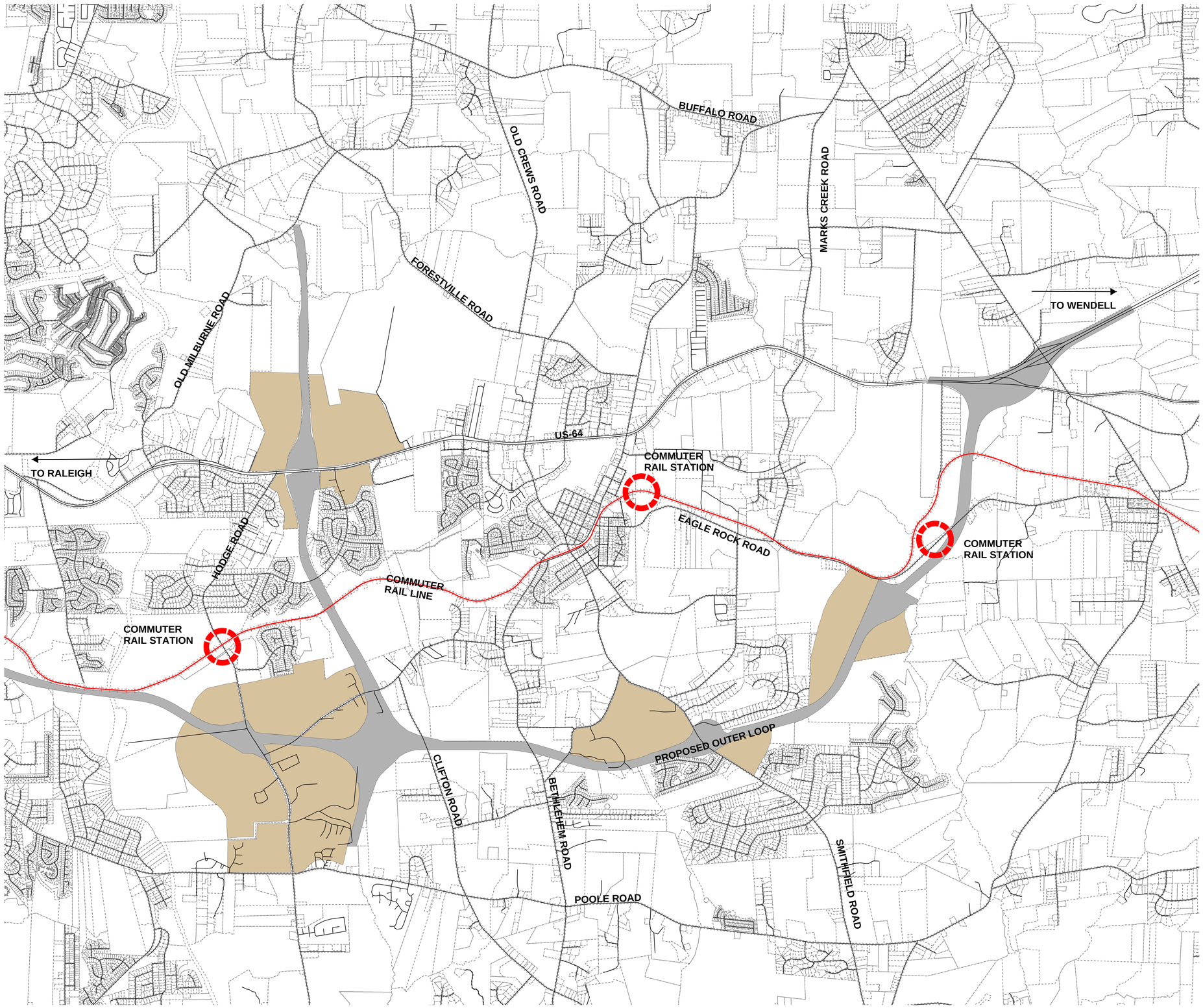


FIGURE 5.1

HIGHWAY DISTRICT



LEGEND

- HIGHWAY DISTRICT
- BYPASS
- PARCEL
- STREETS
- COMMUTER RAIL LINE
- COMMUTER RAIL STATION

NOTE:
THE HIGHWAY DISTRICT PROVIDES PRIMARILY FOR AUTO-DEPENDENT COMMERCIAL USES. THIS DISTRICT WILL SERVE THE IMMEDIATE COMMUNITY AND INTERSTATE TRAVELERS. BECAUSE OF THE SCALE AND ACCESS REQUIREMENTS OF USES IN THIS CATEGORY, DEVELOPMENT AT DISTRICT BOUNDARIES MUST PROVIDE A COMPATIBLE TRANSITION TO USES OUTSIDE THE DISTRICT. HOUSING IS PERMITTED WHEN INTEGRATED WITH HIGHER-DENSITY COMMERCIAL DEVELOPMENT.

N

FIGURE 5.6

LEGEND

- Proposed Water Projects - 2003-2005
- Proposed Water Projects - 2005-2010
- Proposed Water Projects - 2010-2015
- Proposed Water Projects - 2015-2020

WATER SYSTEM FACILITIES MAP

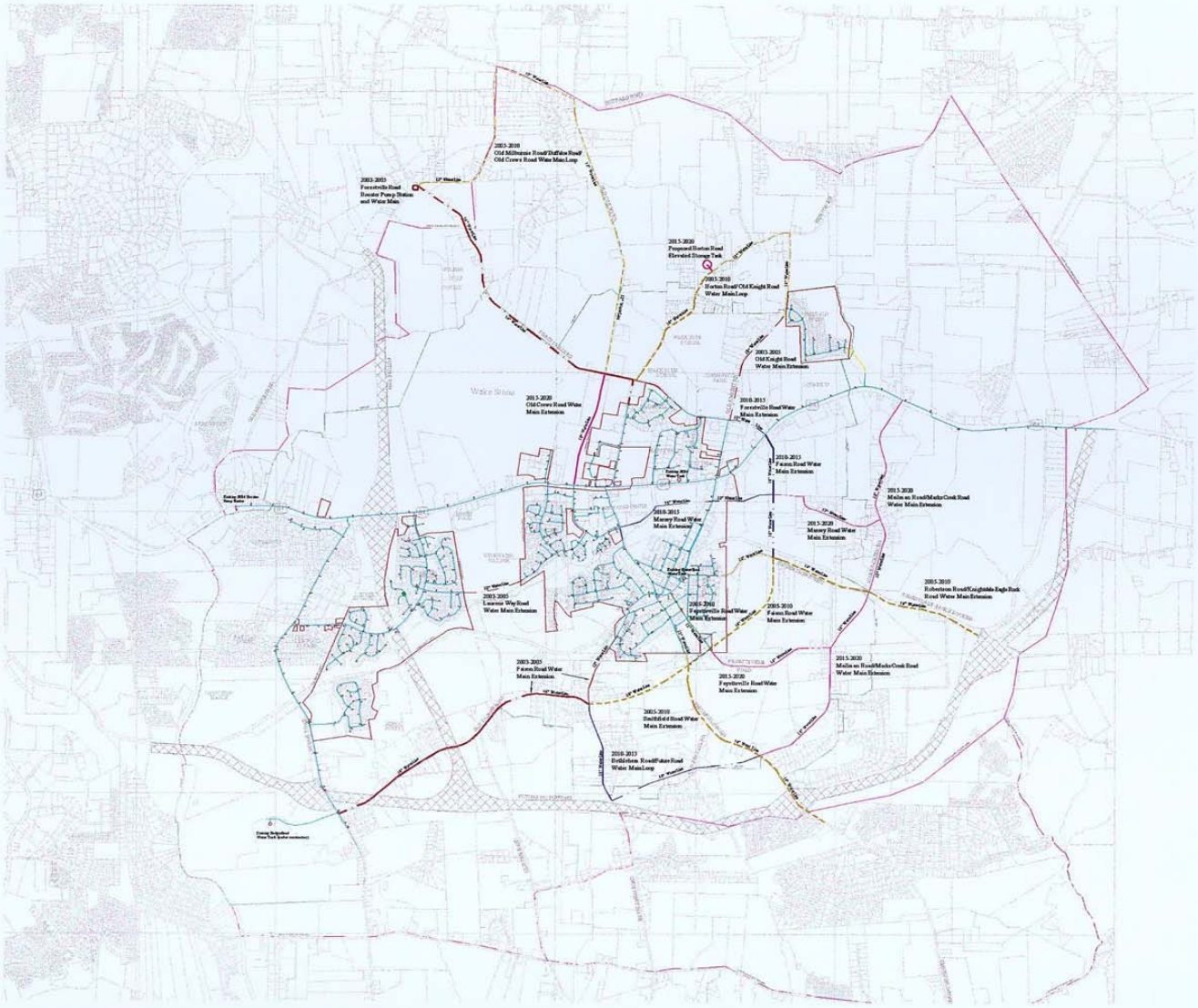


FIGURE 9.2

LEGEND

- Proposed Sewer projects - 2003-2005
- Proposed Sewer projects - 2005-2010
- Proposed Sewer projects - 2010-2015
- Proposed Sewer projects - 2015-2020
- Proposed Sanitary Sewer Force Mains
- Post Study Sewer Mains
- PS NAME — Existing Pump Stations
- Existing Knightdale Sanitary Sewer
- Existing Knightdale Force Mains
- Existing Raleigh Sanitary Sewer

WASTEWATER COLLECTION FACILITIES MAP

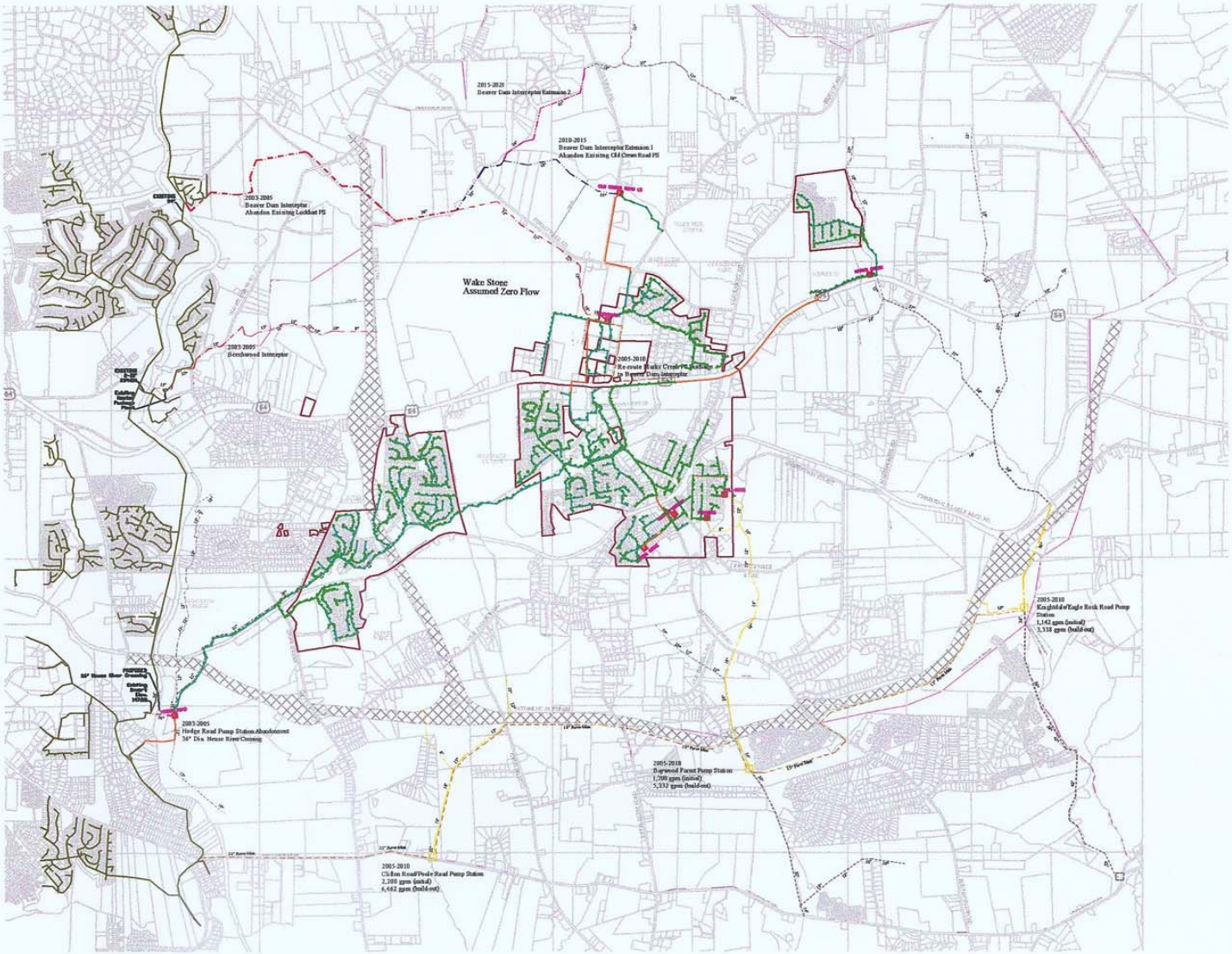


FIGURE 9.1