2015

TOWN OF ZEBULON

GREENWAY, BICYCLE & PEDESTRIAN MASTER PLAN

ADOPTED OCTOBER 5, 2015

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October 5, 2015

Town of Zebulon
Public Works Department
450 E. Horton Street
Zebulon, North Carolina 27597

Attention: Mr. Chris Ray, Director

Reference: Zebulon Greenway Master Plan
Final Project Report

Mr. Ray:

On behalf of obs landscape architects and AMT Engineering we are pleased to provide this Master Plan of the Town of Zebulon Greenway System. We have thoroughly enjoyed the process of working with the town and the community to prepare the recommendations outlined by this plan and report.

We trust that this document will aid the town in pursuing and securing funding and serve as a tool guiding the actual design, implementation, operations and management of the system.

Respectfully submitted,

Brian H. Starkey, PLA / ASLA
Principal / obs landscape architects

Michael Surasky, PE
Project Manager / Engineer / AMT

Project Team / Acknowledgements

Town of Zebulon Board of Commissioners

Robert S. Matheny	Mayor
R. Dale Beck	Commissioner
Don Bumgarner	Commissioner
Beverly Wall Clark	Commissioner
Curtis P. Strickland	Commissioner
Glenn York	Commissioner

Greenway Advisory Committee

Tim Hale	Parks and Recreation Community Center Coordinator
Smith Raynor	NC State Parks
Melissa Seguin	Senior Environmental Scientist - The EI Group, Inc.
Ray Fulghum	Former Planning Board Member
Jasmine Porter	Youth Council Member
Kim Valentine/Denise Nowell	Zebulon Chamber of Commerce
Joe Beck	Parks and Recreation Advisory Board Member
Beverly Clark	Town Commissioner
Dale Beck	Town Commissioner

Town of Zebulon

Joe Moore	Town Manager
Chris D. Ray	Chairman, Zebulon Public Works Director
Robyn Snow	Public Works Administrative Assistant
Mark Hetrick	Planning Director
Greg Johnson	Parks and Recreation Director

Community Groups

Town of Zebulon Youth Council
Town of Zebulon Chamber of Commerce

Parks and Recreation Advisory Board

John Rex Endowment Staff

Phil Bors	Active Living by Design

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Acronyms and Abbreviation Key

AASHTO – American Association of State Highway and Transportation Officials

ABC – Aggregate Base Course

ACOE – Army Core of Engineers

ADA – Americans with Disabilities Act

ADAAG – Americans with Disabilities Act Accessibility Guidelines

ALBD - Active Living by Design

BOC – Board of Commissioners

CAMPO – Capital Area Metropolitan Planning Organization

CDBG – Community Development Block Grant

CDC – Center for Disease Control

CLOMR – Conditional Letter Of Map Revision

CMAQ – Congestion Mitigation for Air Quality

CPTED – Crime Prevention Through Environmental Design

CTG – Community Transformation Grant

DPR – Division of Parks and Recreation

ETJ – Extraterritorial Jurisdiction

FEMA – Federal Emergency Management Agency

GIS – Geographical Information Systems

GSK – GlaxoSmithKline

LAPP – Locally Administered Projects Program

LARC – Land Acquisition Review Committee

LOMR – Letter of Map Revision

LWCF – Land and Water Conservation Fund

MTIP – Metropolitan Transportation Improvement Program

MUTCD – Manual on Uniform Traffic Control Devices

NC DOC – North Carolina Department of Commerce

NCDENR – North Carolina Department of Environment and Natural Resources

NCDOT – North Carolina Department of Transportation

NEPA – National Environmental Policy Act

OSAPAC – Open Space and Parks Advisory Committee

PARTF – Parks and Recreation Trust Fund

RFP – Request for Proposals

RTP – Recreational Trails Program

ROW - Right of Way

STP-DA – Surface Transportation Program – Direct Allocation

STP-EB – Surface Transportation Program – Bike and Pedestrian Federal Funding

SWAP – Sidewalk Assessment Process

1 Executive Summary

Zebulon Farmer's Market - photo courtesy of Debbie Wheless

Introduction

The Zebulon Greenway Master Plan is a guide for future greenway trail and other pedestrian improvements throughout town. The goals of the plan are to improve connectivity, provide an alternate means of transportation, increase recreational opportunities and access to nature, and promote healthy living. The plan was made possible by a grant from the John Rex Endowment. The planning process was community-based including public open houses and meetings with various civic groups, town staff and a town appointed Greenway Advisory Committee.

Project Study Area

The project study area for the master plan was defined as, and limited to, the Town of Zebulon's ETJ, approximately 8,550 acres. While the project team focused on this area, greenway plans prepared previously by Wake County, neighboring communities and other regional and state-wide trails outside the ETJ were taken into account in order to make connections beyond the ETJ, helping to create a regional greenway system. In particular, the area north of US 64 in the area of the future county reservoir was included along with possible connections toward Wendell.

John Rex Endowment Grant Requirements

The Zebulon Greenway Master Plan was funded by a John Rex Endowment Grant under the project name "Watering the Zebulon Food Desert". The grant was awarded in June 2014. The Town was labelled a food desert by USDA and the purpose of this grant is to address this label by creating an environment that promotes healthy options within the underserved community to increase access to local fresh foods and address the lack of pedestrian sidewalks and transportation downfalls. (lack of mass transit, limited taxi service, lack of bicycle lanes, etc.) The grant also provided technical assistance and guidance from Active Living by Design (ALBD). Throughout the process, the Town provided ALBD interim and final reports.

Master Plan Vision

The vision illustrated by the master plan is based on the fundamental objective of connectivity and providing the opportunity for all residents and visitors to Zebulon to move around town and reach various destinations in a safe and enjoyable manner, contributing to making Zebulon a healthier community.

Guiding Principles

The master planning process was guided by five principles. These principles provided the framework for this plan, as well, and helped define and shape the goals and objectives of the master plan. These guiding principles were:

- Connectivity and accessibility
- Equitable distribution
- Collaboration and coordination
- Communication and engagement of the community
- Development of a plan specific to the needs and desires of the community

Benefits of Greenways

Greenways are protected areas of linear open space that promote healthy living and offer a variety of benefits to the local community. Greenways containing trails are best known for providing recreational opportunities as well as an alternate means of transportation. Typically, these multi-use trails are developed along streams and rivers, railroad corridors, utility easements and/or along existing roads. Greenways have well-documented environmental and economic benefits and they can help promote a community's identity, history and character. Because of their value, communities across North Carolina and the United States are investing in developing greenway systems. The benefits of greenways are as follows:

- Promote healthy living
- Provide recreation opportunities
- Provide an alternative means of transportation
- Protect water quality and wildlife habitat
- Improve property values
- Encourage economic development
- Provide access to nature
- Contribute to a community's identity

Hinshaw Greenway - Cary, NC

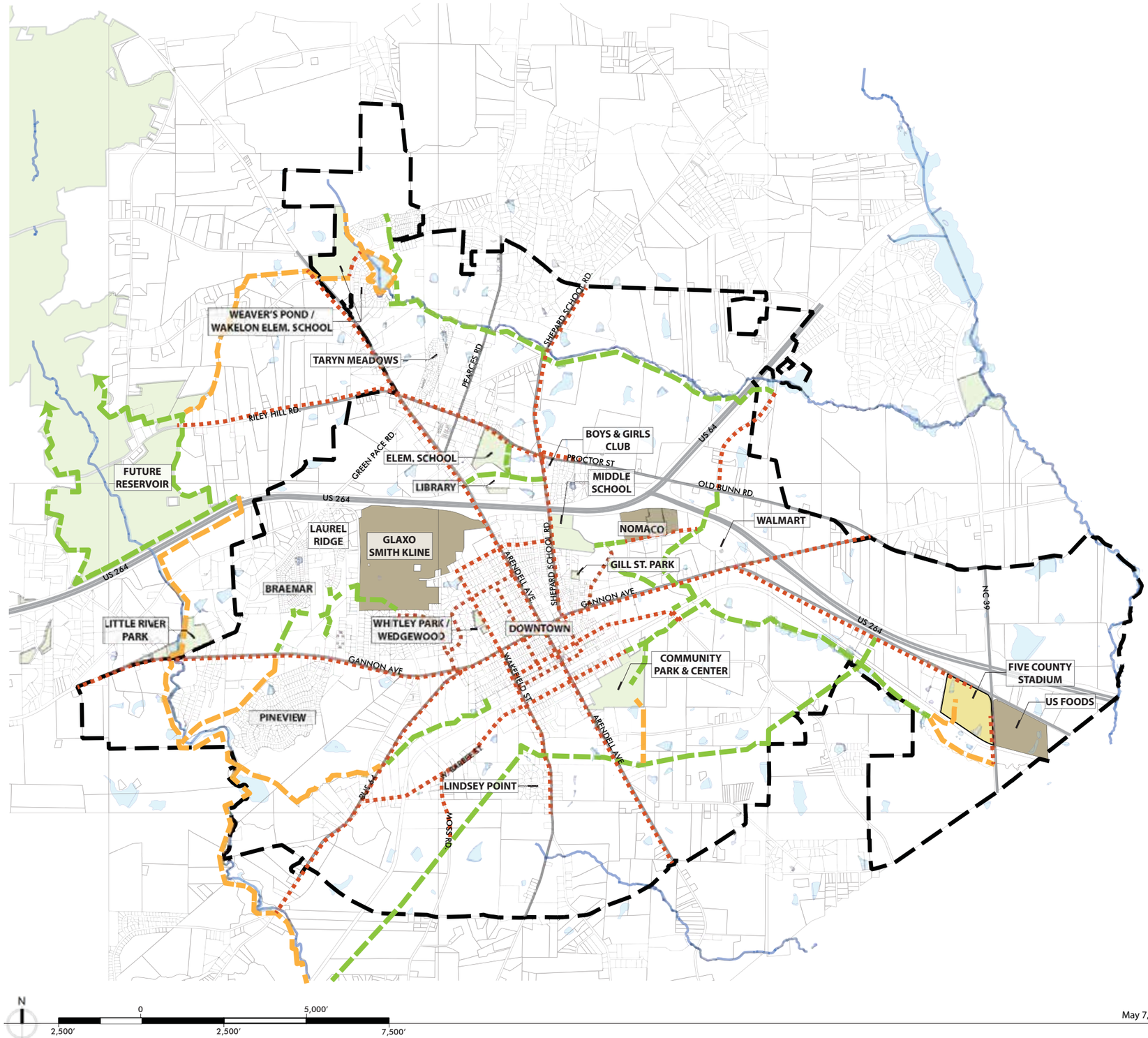
Final Master Plan Recommendations

The final recommendations of the master plan include the identification of 10 primary greenway corridors, more than 20 miles of trails, a blueway corridor, and a tiered system of bicycle and pedestrian improvements along public rights of way. In addition, the final master plan includes:

- Implementation Strategy
- A preliminary opinion of construction costs for two projects within identified greenway corridors and one project along public streets
- The identification of sources of funding for greenways and bike/pedestrian improvement projects
- Design Guidelines including construction details and standards
- Recommendations for Operations, including maintenance and management

Public Open House - Zebulon, NC

Field Investigations - Little Creek Sewer Easement to Five County Stadium behind Zebulon Community Park



May 7, 2015

CORRIDOR MAP

Master Plan

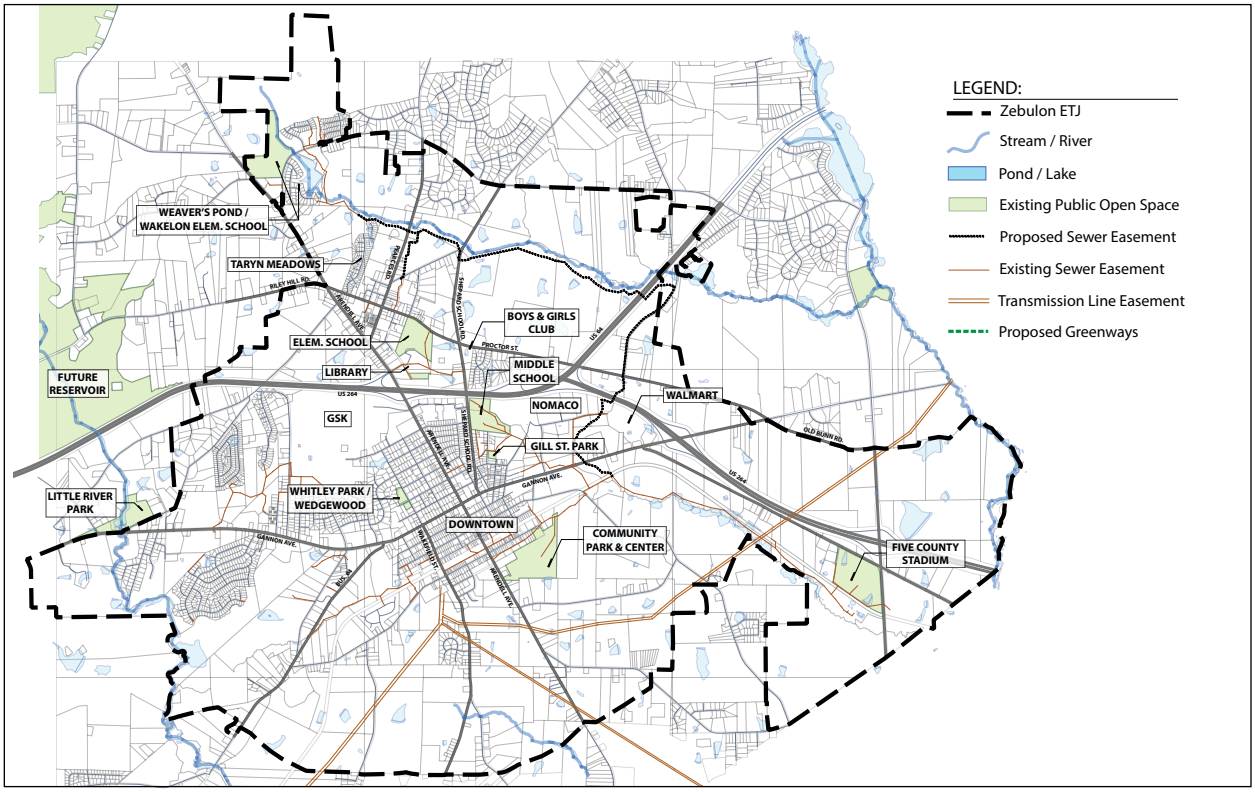
LEGEND:

- Zebulon ETJ
- Stream / River
- Pond / Lake
- Existing Public Open Space
- Industry
- Five County Stadium
- Proposed Greenways / Utility Easements
- Proposed Greenways / No Easements
- Bicycle / Pedestrian I Improvements

The total length of corridors is approximately 21.5 miles, which excludes roadside improvements in the downtown area as well as the blueway along the Little River. This distance also excludes any part of Corridor 7 outside of Zebulon's ETJ.

ZEBULON GREENWAY MASTER PLAN

2 Introduction



Regional Map of the Town of Zebulon

The Zebulon Greenway Master Plan was prepared as a guide for the Town of Zebulon and the future development of a town greenway system, as well as other bicycle and pedestrian improvements. The master plan illustrates how the system will interact with existing and proposed infrastructure, contribute to environmental quality and economic growth and, most importantly, improve the quality of life for citizens and visitors by providing more recreational opportunities and an alternate and safe means of transportation; thereby, creating a healthier community.

Communities all over the United States and North Carolina are investing in greenway systems. This is particularly true in the Triangle and Piedmont areas of North Carolina where communities are developing greenway systems and connecting them together to form a regional system. A well-integrated system can influence growth patterns, preserve open space, create value and generate economic activity, offer a different means of transportation, connect neighborhoods to destinations, improve healthy living, mitigate flooding and erosion, enhance community identity, offer aesthetic value and contribute to the character and identity of the Town.

What is a Greenway?

Greenways are protected areas of linear open space offering a variety of benefits to the local community. They may or may not contain a trail. Greenways were first established to control flooding along waterways. Greenways containing trails are best known for providing recreational opportunities as well as an alternate means of transportation. Typically, these multi-use trails are developed along streams and rivers, railroad corridors, utility easements and/or along existing roads. Greenways have well-documented environmental and economic benefits and they can help promote a community's identity, history and character.

Upper Neuse Greenway - Raleigh, NC

Recreation

Greenways provide opportunities for safe walking, jogging, and biking as well as a way for residents to access natural areas for bird watching, photography and educational activities. Providing these recreational opportunities and access to nature has a significant positive impact on the overall mental and physical health of residents.

Transportation

Trails within greenway systems provide an alternate means of travel from one place to another within a community, such as neighborhoods, parks, libraries, retail centers and schools. This reduces carbon emissions within a community and addresses the needs of those who do not have a vehicle.

Environment

Greenways protect water quality, fragile ecosystems and wildlife habitat and corridors. By providing a natural buffer between development and waterways, greenways help filter pollutants and reduce sedimentation that affects water quality.

Economic

In addition to protecting properties from flooding, greenways make a community more appealing and improve property values. Trails and open space consistently are cited as critical amenities that attract home builders and home buyers. Trails are also consistently credited with inspiring downtown investment and revitalizing downtown areas.

A study was completed on the I-40 pedestrian bridge in Durham, NC in 2013 that demonstrated the benefit of greenways. The results of this study showed that there was a 133% increase in use on the trail section that was studied as well as a 163% increase in calories burned by users. There was also a $3.7 million increase in spending related to trips on the trail. These results are according to "Behavioral Effects of Completing a Critical Link in the American Tobacco Trail," a study released in December of 2014 by the Institute for Transportation Research and Education (ITRE) at N.C. State University.

"The proposed Carolina Thread Trail is projected to raise housing values by 4 percent along the trail's route, for an average of $3,380 per home. Total dollar gain in the affected area running through 15 counties is projected to be $1.7 billion"

– The Potential Economic Impacts of the Proposed Carolina Thread Trail, Econsult Corporation & Greenways Inc. Report to Catawba Land Conservancy / 2007

Community Identity

Greenways contribute to preserving and providing access to a community's important natural, cultural and historic resources in addition to preserving a community's overall aesthetic character.

Guiding Principles

Throughout the master planning process, various ideas and proposals were measured according to five guiding principles that provide the framework for this plan. These principles helped to shape the goals and objectives of the master plan. The guiding principles are:

Zebulon Greenway Advisory Committee Meeting

- Connectivity and accessibility
- Equitable distribution
- Collaboration and coordination
- Communication and engagement of the community
- Development of a plan specific to the needs and desires of the community

Connectivity and Accessibility

In keeping with the objectives of the grant, connectivity and accessibility were key in the selection of proposed greenway trail locations and pedestrian / bicycle improvements. Identifying destinations including retail, commercial, civic and institutional and connecting them to where people live was primary to the process. Within this principle it is envisioned that all trails, walks and other amenities will be accessible for users of all abilities.

Zebulon Public Open House

Equitable Distribution

By examining the entire area within the ETJ, the master plan identifies potential routes and improvements without consideration of the socio – economic status of various areas within the community. This plan will provide residents throughout the town with opportunities to enhance their quality of life and well-being. As Zebulon continues to grow, the system will grow with it and continue to provide connections throughout the Town.

Collaboration and Coordination

Working closely with Town staff, the Project Advisory Committee, Town commissioners, business leaders and various organizations, the project team reached out to and received valuable input throughout the process. The following is a sample of organizations that collaborated and contributed to the recommendations of the master plan:

- Zebulon Chamber of Commerce
- Zebulon Youth Council
- Zebulon Parks and Recreation Advisory Board

Coordination of the project also involved review of and coordination with other town planning documents, including the town's transportation plan and development ordinance.

Communication and Engagement of the Community

Critical to the development of the master plan was the engagement of the local community. This was a key component to the planning process and every effort was made to engage a large and varied group of community members and stakeholders.

The community was made aware of and informed of the process in various and creative ways. These included:

- Announcements in the town newsletter
- Notifications included in utility bills
- Participation by local businesses distributing flyers

Zebulon Public Open House

Farmers Market Luncheon

The community at large was kept informed and engaged during the planning process and provided various opportunities for comment and input. These opportunities included:

- Two open house meetings
- Surveys
- A website
- Presentations at Town Board of Commissioners meetings

Development of a Plan Specific to the Needs and Desires of the Community

This principle is the direct result of a community based process which capitalized on the local knowledge of the community. Involvement of community, residents, town staff and others provided specific information on the needs and desires of the community.

Thorough analysis and community outreach have led to a plan that is rooted in the desires and needs of the community. The community helped identify specific destinations and important connections. We heard from the Youth Council about the importance of the connection to the Boys and Girls Club. We heard about the desire to connect to nature. The master plan also recommends a blueway along the Little River, which was identified as a local amenity.

Design of the Master Plan

The design of the Master Plan was developed based on input from community groups, town staff, and an advisory committee. The goals identified for the project were as follows:

Field Investigations - Taryn Meadows to Weaver's Pond

- Provide opportunities for public involvement in the planning process
- Provide thorough site analysis
- Identify and establish connections between destinations
- Produce a final plan that can guide implementation

Provide Opportunities for Public Involvement in the Planning Process

By conducting a community based process and providing multiple opportunities for community engagement and input, the master plan reflects the needs and desires expressed by the community.

Little River Park

Field Investigations - Blueway Trip down the Little River

Field Investigations - Barbee Street

Provide a Thorough Site Analysis

Through the documentation of land uses, environmental features, existing destinations and existing infrastructure, opportunities and constraints for system development were identified. Documentation was accomplished through GIS mapping of features and existing infrastructure as well as field observations.

Identify and Define Connections Between Destinations

Building on the site analysis and reinforced through field investigations, coordination with town staff and insight from community residents, potential connections between destinations were identified by the project team.

Field Investigations - Blueway Trip down the Little River

Produce a Final Plan That Can Guide Implementation

The final master plan recommendations were conceived based on typical and accepted approaches and standards for greenway trail implementation and the construction of bicycle and pedestrian improvements. It was important that the system be rooted in standards common to greenway development and, while some recommendations require significant investment, the system is based on proven construction standards and realistic expectations.

Field Investigations - Arendell Avenue

3 Planning Process

Introduction

The planning process for the master plan was designed with Town staff to identify and engage as many stakeholders as possible. This provided the project team insight into local knowledge, wants and needs of the community. This process also created a sense of ownership in the project which should prove beneficial, as the system is implemented. Through this process the project team has developed a master plan that is very specific to the Town of Zebulon reflecting community input.

In addition to the feedback from various stakeholders and the community, the project team gathered critical data from Wake County GIS, the Town of Zebulon's Planning Department, Public Works Department, and Parks and Recreation Department.

All of the data that was gathered was then field verified through site visits, GIS information and aerial photography.

Planning Jurisdiction

The planning limits for the master plan was the Town of Zebulon's ETJ. However, the project team took into account a greenway plan completed by Wake County in 2002, as well as greenway and pedestrian plans developed by neighboring communities including Wendell, Knightdale and Raleigh. Also acknowledged were greenway plans on the regional and state level. Several of the corridors identified inside the ETJ directly relate to and would be an extension of the trails identified by the 2002 Wake County plan.

Initial Mapping

The planning process began with the review of existing mapping and relevant documents including the town's Transportation Plan and the 2002 Wake County Greenway Plan.

Base maps for the master plan were created based on Wake County GIS information.

Greenway Information Booth at Christmas Parade - West Barbee Street

Upper Neuse Greenway - Raleigh, NC

Field Investigation - Wedgewood Neighborhood to Gannon Avenue

Zebulon Farmers Market - photo courtesy of Debbie Wheless

John Rex Endowment

The Zebulon Greenway Master Plan was funded by a John Rex Endowment Grant under the project name "Watering the Zebulon Food Desert". The grant was awarded in June 2014. The Town was labelled a food desert and the purpose of this grant is to fight this label by creating an environment that promotes healthy options within the underserved community to increase access to local fresh foods and address the lack of pedestrian sidewalks and transportation downfalls. The grant also provided technical assistance and guidance from Active Living by Design (ALBD). Throughout the process, the Town provided ALBD interim and final reports.

Community Engagement

Engaging the residents of the Zebulon community throughout the process took several forms. It was determined early on that multiple opportunities should be made available to keep the community informed, solicit input and involve the them in the process. The project team developed several methods for the community to receive information and provide input. Three community meetings were held during the process. The first two meetings were held on the same day. One was in the morning and the other at the end of the day. During these meetings, site information was exhibited and discussed. The evening open house was better attended. The third meeting also was held in the evening and at this meeting the project team had preliminary corridor recommendations illustrated for comment and feedback.

In addition to the open house sessions, the public was provided opportunities to comment via surveys handed out at meetings and available at Town Hall and the Community Center. These surveys also were available online via a dedicated project website and through a link on the Town's website. The effort to engage the public and get initial comments began at the Town's Christmas Parade where the project team set up booths at both ends of the parade route to promote the project.

Town staff worked with local business to partner in getting the word out including Arby's, which placed flyers on their serving trays, and a local Papa John's Pizza, which taped flyers to the tops of their pizza boxes.

Informational flyers and notices for public meetings were sent to Town residents in their utility bills and the Town newsletter. Also, a dedicated email address was set up allowing the community direct access to the project team.

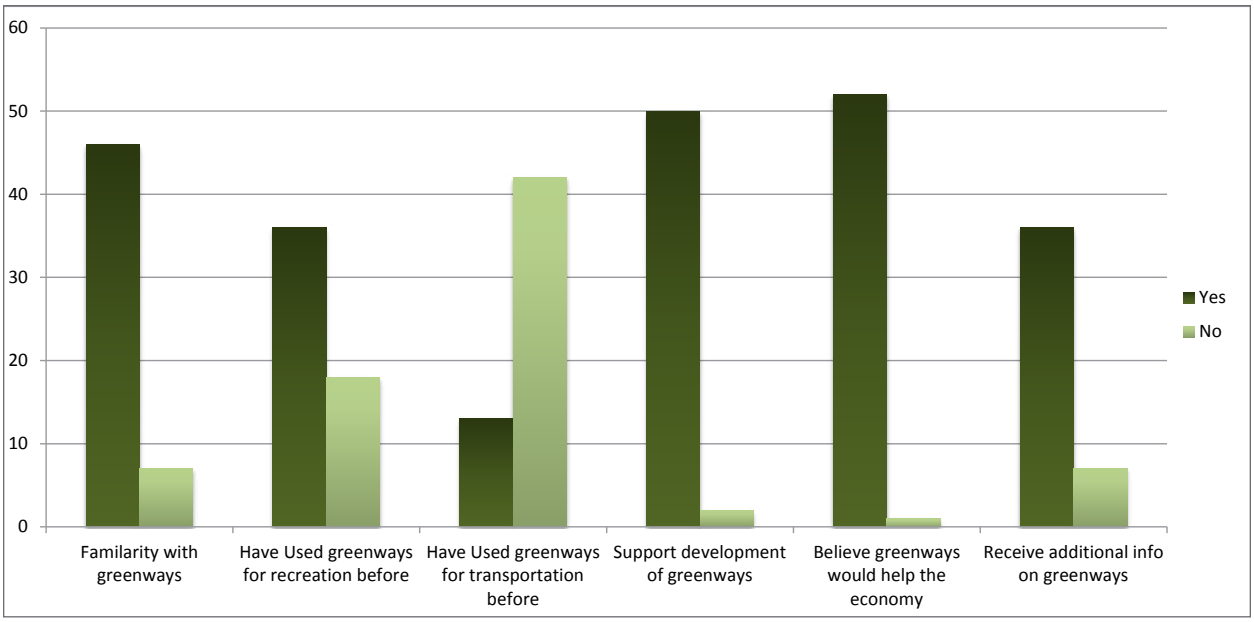
Meetings

The project team met with various community groups and organizations as well as presented regularly to the Greenway Advisory Committee and Board of Commissioners.

In addition to input received from the community, the project team met with several other stakeholders and groups during the process including:

- Zebulon Chamber of Commerce
- Zebulon Youth Council
- Representatives of Weaver's Pond development
- Representatives of the Triangle East Business Park development
- Active Living by Design
- Parks and Recreation Advisory Board

Community Open House



Graph of Survey Summary

Survey Summary

Over the course of the planning process 54 surveys were filled out by residents. Most of these were filled out at the Open House public meetings and others were picked up at the Community Center and Town Hall. Surveys were also distributed at the Christmas Parade.

The surveys defined the community's familiarity with greenways, asked what amenities people were interested in seeing along a greenway, and what outdoor recreation activities the community currently participates in. Overwhelmingly, the surveys demonstrated widespread public support for greenways and bicycle / pedestrian improvements.

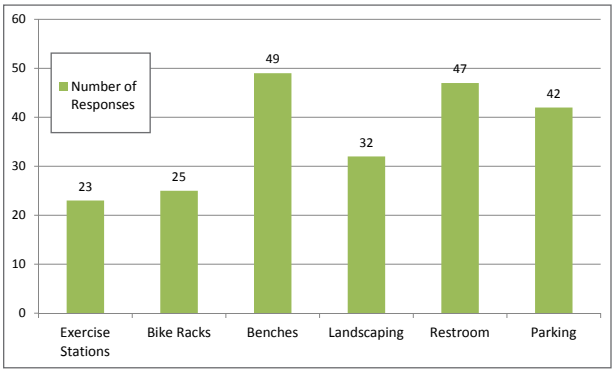


Chart of Requested Amenities

Website

During the planning process residents could access surveys, review updated documents as they were developed and learn about greenways on a project website accessed directly at www.zebulongreenways.com or through a link on the Town of Zebulon's website. This enabled residents to keep up to date on the project, find out about upcoming meetings, take the survey online, leave comments, and review proposed plans.

Site Investigations

Once potential corridors for greenway trails were identified using GIS mapping and aerial photography, site investigations were conducted. The project team and town staff rode and/or walked each of the identified corridors, as well as the street network, to determine recommended locations. These site investigations brought to light the actual experience one might have on the greenway trail or on a multi-use path adjacent to a major road or through a neighborhood. Further, these visits provided the project team further insight to current conditions and level of construction requirements for each corridor.

	Corridors									
Evaluation Criteria	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Grant Objectives - Access to Food	1	1	3	5	1	2	2	2	2	1
Grant Objectives - Healthy Living	4	3	5	4	3	4	1	3	4	4
Potential Cost - Construction	4	1	5	1	1	3	3	2	3	3
Potential Cost - Easements	4	4	5	3	4	4	4	2	3	1
Usage - Potential for Immediate Use	5	2	5	5	2	4	2	2	2	2
Usage - Access to Nature	4	4	3	4	2	3	2	1	3	4
Potential for Private Partnership	5	4	4	3	5	5	4	5	5	4
Private Property Impact	3	4	5	4	5	3	4	3	3	1
Totals	**30**	**23**	**35**	**29**	**23**	**28**	**22**	**20**	**25**	**20**

Top 4 Priority Corridors

Matrix of Prioritization of Trail Corridors

Preliminary analysis of the corridors and potential trail / bike / pedestrian improvements included the need for easements, and right of way acquisition. In addition to the need for easements or other land dedication, the master plan provides information on widths of easements required to construct and maintain the trail as well as providing amenities and potentially protecting open space. This information will help guide the Town in acquisition of access easements, land or right of ways and the development of each greenway segment.

Prioritization

Following the identification of the ten greenway corridors, the project team and town staff conducted an evaluation of each corridor to determine which of the corridors best met the evaluation criteria as defined by the Rex Endowment grant as well as the project objective of connecting destinations. The criteria used in this evaluation included the following questions:

- Grant Objectives / Will the trail and other improvements provide access to food and promotion of healthy living?
- Potential Costs / What will be the costs associated with trails and improvements including both the cost of construction as well as the cost of acquiring easements?
- Potential for Use / Will the trail or pedestrian improvements be immediately utilized?
- Private Participation / Are there opportunities to partner on the implementation of the trail or improvements?
- Nature Access / Does the trail or other improvements provide residents access to nature?
- Property Impact / Will implementation negatively impact adjacent properties?

While not overly scientific, this evaluation helped quantify the attributes and challenges associated with greenway development in each corridor.

The corridors that satisfied the evaluation criteria to the greatest extent were corridors 1, 3, 4 and 6.

This evaluation and the selection of the top four priority corridors was subsequently presented to the Project Advisory Committee for comment and approval.

It should be noted that within a particular corridor there can be several projects. These projects can be a combination of trail as well as pedestrian / bicycle improvements along existing roads and streets. Three projects are identified in the Implementation Strategy section of this report and are evaluated as to potential cost of construction.

4 Inventory and Analysis

Introduction

Inventory & Analysis of lands within the Planning Jurisdiction was initiated at the beginning of the planning process. As the plans evolved, specific areas were revisited throughout the process as needed. Initial inventory & analysis was conducted using GIS mapping with data obtained from Wake County GIS as well as data contained on Google Maps. In addition, the design team conducted several field investigations as part of the process. The first community meeting and meetings with the Greenway Advisory Council also were used to inform the inventory & analysis process. The input received provided the project team greater insight and refined the opportunities and constraints for the greenway, bike and pedestrian system.

Field Investigations

Following initial mapping, the project team conducted on site investigations to gain a further understanding of the character of different neighborhoods, identify potential connections and destinations that were missing from early mapping exercises and confirm or discount ideas that were developed through early mapping. By spending time "on the ground," the project team gained a familiarity with the town, became familiar with under-represented neighborhoods and verified site conditions that could not be obtained solely through mapping or talking with residents that participated in the open house sessions or provided information through surveys. Potential connections, such as the area between the library, the Boys & Girls Club and Zebulon Elementary School, as well as various easements, were confirmed through this effort. Recreational amenities, retail and commercial businesses and other destinations were visited and feasible means of connecting them were confirmed.

This exercise further informed the project team allowing them to have more meaningful conversations with the community.

Sewer Easement from Taryn Meadows to Weaver's Pond

Sewer Easements

During the first field investigation, the design team identified several sewer easements that had the potential to become future greenway corridors. These sewer easements and potential corridors were later documented by analyzing GIS mapping. The project team and the Town's staff conducted a field trip along several of the identified corridors to further document existing conditions.

The project team and the Town staff traversed four sewer easements over the course of a day following heavy rain in the days prior to the trip. Utilizing 4-wheel drive vehicles was a necessity due to the very wet conditions along the corridors, getting the team to places that were unreachable by foot and allowing miles of easements to be explored in one day.

The first sewer easement explored was the easement that connects the Weaver's Pond neighborhood to the Taryn Meadows neighborhood. The easement was fairly dry, although there were a couple wet spots. A good portion of the easement runs through a wooded area and adjacent to Beaverdam Creek. The sewer line tends to run along the middle of the easement with above-ground manholes. The easement continues into a currently undeveloped portion of the Weaver's Pond neighborhood.

Wakelon Elementary School

One of the important destinations identified in this area and visited was Wakelon Elementary School and Park. In addition to the school, the park has parking and a restroom facility making it a desirable trail head. The park also has a playground and multi-purpose fields which contribute to its importance as a destination. Beaverdam Creek separates the park from one of the Weaver's Pond neighborhoods. It was discussed that a connection across the creek could be made.

The second stop on the tour explored the west side of Zebulon and an area across the highway and outside of the Planning Jurisdiction that is slated to be part of a future county reservoir. The design team was most interested in seeing an existing culvert under the highway. When US 264 was built, NCDOT installed a large culvert under the highway to allow a farmer to safely move his livestock from one side of his property to the other side. The culvert is approximately 8' wide by 8' tall and could accommodate a greenway trail that would provide a connection to trails associated with the future reservoir. The south side of US 264 is farm land with a wooded buffer along the highway. The land immediately to the north of US 264 was extremely wet. An existing dirt trail, lined with brush and young trees, leads to the Riley Hill Road part of town.

The team then explored sewer easements that run parallel to the railroad tracks from the Community Park and Community Center to the sewer treatment plant near Five County Stadium. Community Park is a fabulous recreational amenity for the town and should be an obvious choice for a trail head.

The team headed east from Community Park toward E. Horton Street along a corridor that looked a lot like a park trail. This section was dry, the clearing was very wide and the above-ground sewer line was to the side, unlike most of the other easements.

After crossing E. Horton Street, the easement comes closer to the railroad corridor that is to the east and north of it before turning south and following the Little Creek. This section had much longer stretches of wet areas. If a trail is built here, a significant network of boardwalks most likely would be required. On this day, the creek was flowing fast and the team observed a variety of wildlife, natural rock outcroppings and generally commented on the natural feel of the area. This easement traverses a variety of landscapes, from wetlands to woods to meadows. The trail eventually turned south and closely paralleled the train tracks. In some places the railroad bed is elevated 10 or 15 feet above the natural grade. The tracks separate the trail from Five County Stadium and US Alt. 264. The easement ends at the sewer treatment plant, which is just west of NC 39 and south of Five County Stadium parking lot. In order for a trail to be successful here, a connection would need to be made over or under the railroad, or around the waste water treatment plant.

Sewer Easement to Five County Stadium

The fourth and final sewer easement exploration was along a series of easements starting at the Wedgewood neighborhood and ending west of the Hempstede community at W. Gannon Avenue. The segment between Wedgewood Avenue and Worth Hinton Road follows a stream on a southern section of GlaxoSmithKline's property. Similar to the easement near Weaver's Pond, raised manholes are along the center of the easement. This easement could connect to potential sidewalks in the adjacent subdivisions.

Sewer Easement from Taryn Meadows to Weaver's Pond

Crossing Worth Hinton Road, the easement spurred to several communities, including Braemar, Laurel Ridge and Hempstede. An informal path and bridge connected Braemar neighborhood to the easements where there was a picnic shelter and playground. This section was identified as a potential greenway corridor due to the potential for connecting neighborhoods together. Further along this sewer easement toward Gannon Avenue, the ground became extremely wet. It was decided that going any further was not advisable.

Most of the easements explored were wide and accommodating. Many were extremely wet due to the recent heavy rains and some easements were located in flood-prone areas. These easements provide access to a variety of landscapes and wildlife, as well as provide easy connections between neighborhoods and other destinations.

Downtown

The project team conducted a third field investigation, which focused solely on the downtown area. During this process, the team explored the area bounded by Whitley Street to east, Barbee Street to the south, Business 64 to the west, and US 264 to the north via car. On this trip, we studied in closer detail the different neighborhoods in the downtown area, as well as street character.

Sewer Easement behind GlaxoSmithKline

The project team examined traffic volumes on streets to determine potential conflicts with pedestrian and bicycle connections and safety. The team also identified destinations such as shopping, parks and other amenities and how those might be connected at a larger scale. As an example, Judd Street stood out because it directly creates a connection between residential neighborhood, shopping and restaurants and it makes an indirect connection to Whitley Park and the west side of Downtown via Wakefield Street

Potential connections to other parts of town were also identified. For example, Arendell Avenue is an important road through downtown and is one of only a few existing connections to areas north of US 264. Finally, we looked at railroad crossings with an eye toward potential pedestrian improvements in order to better connect the south side of Zebulon with Downtown.

With a more thorough understanding of street character and potential destinations and connections, the project team was able to identify opportunities and develop recommendations for bicycle and pedestrian improvements for downtown.

Gill Street Park

Sewer Easement to Five County Stadium

Mapping

Destinations

The primary objective of the master plan was to identify destinations and establish connections. Input from the community through surveys and discussions helped the team develop a list of important destinations within the Town. The project team also analyzed data from Google Maps and field investigations to further refine the list of potential destinations. Opportunities include schools, parks, the community center, community buildings, Five County Stadium, neighborhoods, and shopping centers.

Natural Features

Using Wake County GIS data, natural features, such as streams and floodplains, were mapped. River and stream corridors make good greenway corridors due to the access to nature that they can provide. Floodplains typically are considered unbuildable, which makes them good candidates for greenway corridors.

Utility Corridors

Using Wake County GIS data, utility corridors were mapped. These corridors include large electrical transmission lines and sewer easements. Development typically is not allowed in these corridors, which makes them strong candidates for greenway corridors.

Sewer systems typically are built in low-lying areas that are either unbuildable or less desirable and many times follow streams or rivers. Easements are dedicated to the system in order to protect them from development and to provide unobstructed access for maintenance. The sewer easements tend to have a cleared width of 20'-30', thus reducing overall construction costs of a greenway. The City of Raleigh owns the sewer easements and greenway easements would need to be applied for where trails are desired.

Electrical transmission lines, like sewer easements, are already cleared, but typically in a larger scale. 100' wide clearings are not uncommon. These corridors typically run in very straight lines and can be good connectors between distant destinations. These corridors provide wildlife habitat as well as provide access to natural meadow landscapes. Recently, Duke Energy Progress has encouraged greenway trails utilizing their transmission line easements. Transmission lines run from Wendell to Zebulon and beyond. These are identified as greenway trails in corridors 5,6, & 7 identified by the master plan.

Power Easement off Moss Road - photo courtesy of Google Maps

Gill Street Park

Whitley Park

Neighborhoods

Established and future neighborhoods inside the Zebulon Planning Jurisdiction were identified through mapping and field investigations. Connecting to where people live is essential for a successful system of greenway trails as well as other bicycle and pedestrian improvements. The project team identified numerous opportunities to connect neighborhoods to each other and to other destinations. Several of these neighborhoods are considered to be in the downtown area.

Downtown

Connecting the downtown area is an important component in the master plan. The project team analyzed the existing infrastructure within downtown, including the widths of streets, traffic volumes, and existing pedestrian and bike accommodations.

Zebulon Cemetery

A greenway trail system that connects the downtown area to neighborhoods and other uses outside of downtown has the potential to spur economic growth specifically in Downtown and reduce the need for parking downtown. A strong street-side or on-street network for bicycles and pedestrians can provide increased connectivity and improved safety, encouraging alternative modes of travel to community amenities such as the community center and park, shopping and other destinations.

Potential Connections outside of the ETJ

While this master plan focuses on connections and destinations within the Zebulon Planning Jurisdiction, the community at large was very interested in connecting to Wendell, Clayton, Knightdale and ultimately the Raleigh greenway system. This was a comment that was heard throughout the community planning process.

In response to this interest, the project team looked closely at potential connections to other municipalities as they related to the system within the Planning Jurisdiction. Wake County completed a county-wide study in 2002 that examined linking municipalities within the county, but did not focus on community-based systems. It was important that the Zebulon Greenway Master Plan acknowledge opportunities to connect to regional destinations. Connecting to Wendell became a priority based on feedback from the community and is shown in corridor 7. This master plan expands on the corridor shown in the 2002 Wake County plan and shows how this connection can tie into the overall Zebulon system.

ZEBULON GREENWAY MASTER PLAN

SITE INVENTORY

DESTINATIONS

LEGEND:

- Zebulon ETJ
- Land Parcel
- Existing Public Open Space
- Industry
- Five County Stadium
- Little River Reservoir
- Existing Library
- Existing School
- Destinations

LITTLE RIVER RESERVOIR
WEAVER'S POND / WAKELON ELEM. SCHOOL
ZEBULON ELEMENTARY SCHOOL
ZEBULON MIDDLE SCHOOL
GLAXO SMITH KLINE
NOMACO
EAST WAKE ACADEMY
GILL ST. PARK
WHITLEY PARK / WEDGEWOOD
US FOODS
RILEY HILL RD.
GREEN PACE RD.
PEARCES RD.
SHEPARD SCHOOL RD.
PROCTOR ST.
OLD BUNN RD.
US 64
US 264
ARENDELL AVE.
GANNON AVE.
HORTON ST.
TEMPLE JOHNSON RD.
W. BARBEE ST.
S. WAKEFIELD ST.
PERRY CURTIS RD.
MOSS RD.

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January 13, 2015

DESTINATIONS:

1. Five County Stadium
2. Triangle East Center
3. Walmart Shopping Center
4. Downtown Zebulon
5. Zebulon Community Center / Park
6. Retail Shopping Area
7. Town Hall
8. Little River Park

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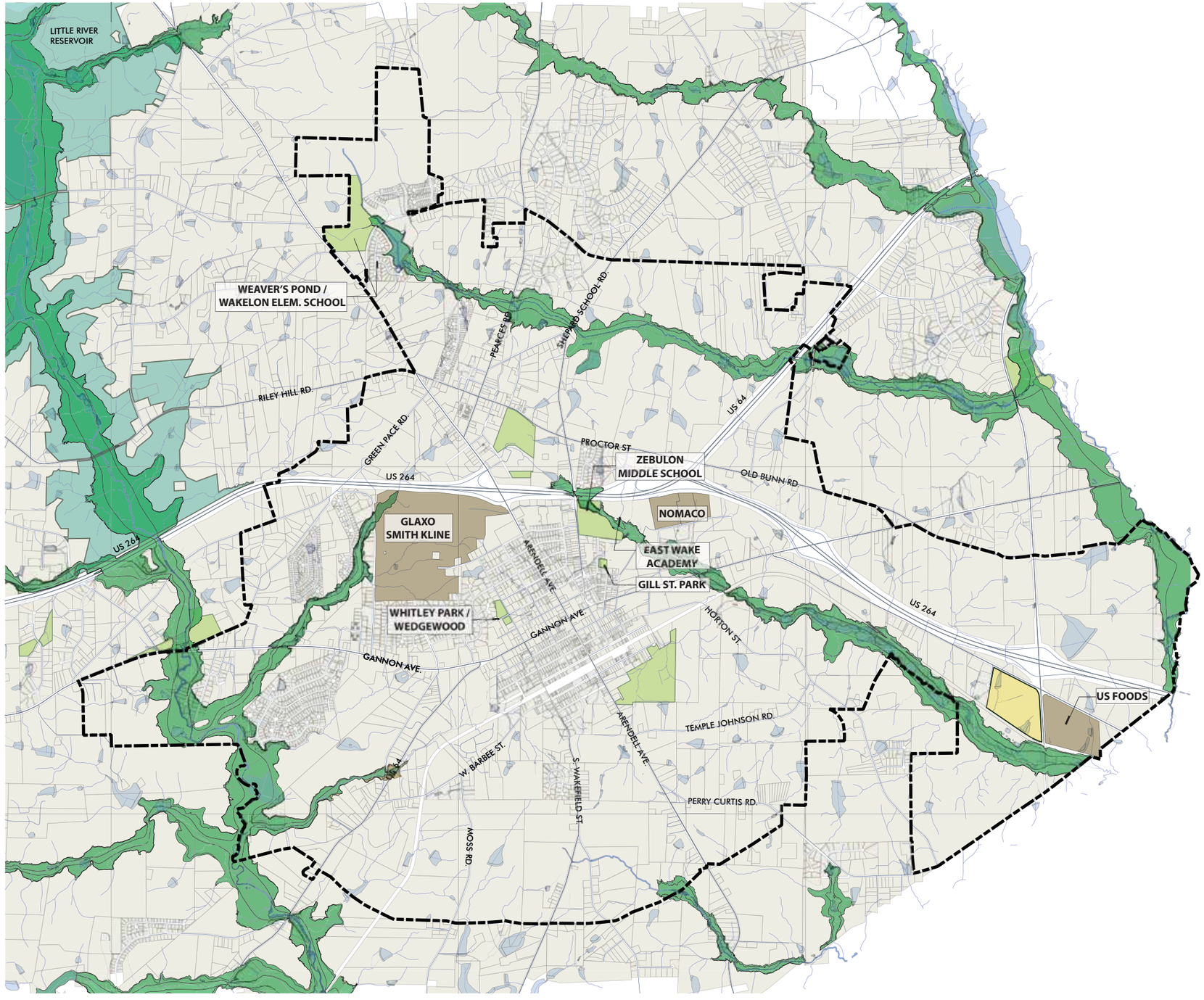
ZEBULON GREENWAY MASTER PLAN

SITE INVENTORY

NATURAL FEATURES



LEGEND:

- Zebulon ETJ
- Land Parcel
- Existing Public Open Space
- Industry
- Five County Stadium
- Little River Reservoir
- Floodplain
- Ponds & Lakes
- Streams & Rivers

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2,500′ 2,500′ 7,500′

January 13, 2015

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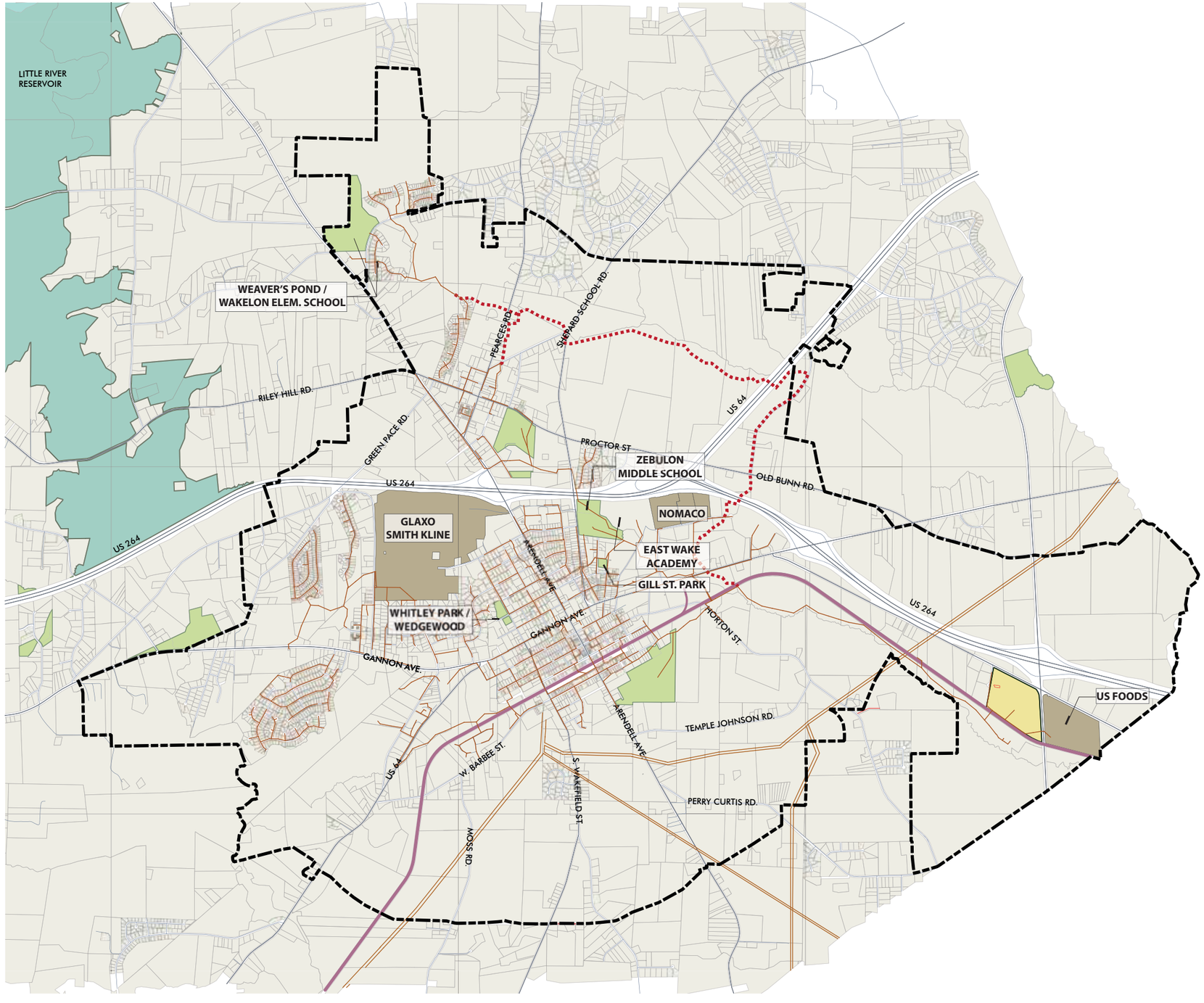
ZEBULON GREENWAY MASTER PLAN

SITE INVENTORY

UTILITY CORRIDORS



LEGEND:

- Zebulon ETJ
- Land Parcel
- Existing Public Open Space
- Industry
- Five County Stadium
- Little River Reservoir
- Transmission Line Corridor
- Proposed Sewer Outfall
- Railroad Corrdior

January 13, 2015

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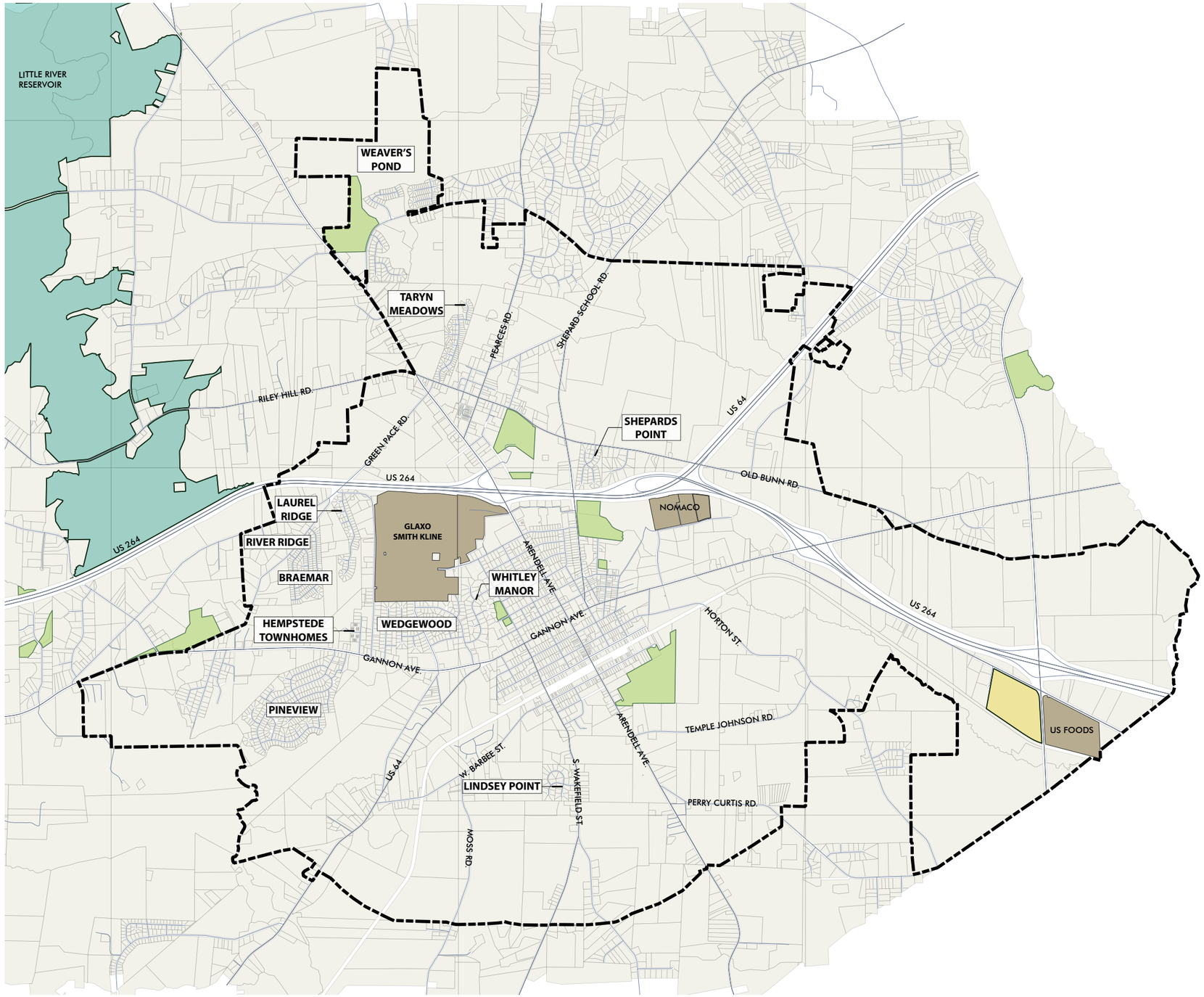
SITE INVENTORY

NEIGHBORHOODS



LEGEND:

- Zebulon ETJ
- Land Parcel
- Existing Public Open Space
- Industry
- Five County Stadium
- Little River Reservoir

April 7, 2015

ZEBULON GREENWAY MASTER PLAN

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5 System Components

Wakefield Street Photo Simulation showing Sharrows

Introduction

The Master Plan identifies various system components that, together, create a comprehensive greenway system. These components include and define variations in trail design, pedestrian and bicycle improvements, and facilities and amenities throughout the system. These components reflect existing conditions as well as context and ultimately influence potential use and the experience of the user.

Trail Types

The master plan identifies four primary classifications of trails. These classifications reflect variations in purpose and design. These classifications are:

- Greenway Trails
- Spur Trails
- Urban Trails
- Blueways

Greenway Trails

Greenway trails are typically 8'-12' wide asphalt-paved trails with a 2' wide compacted stone (compacted ABC) shoulder. These trail types are typically located through natural areas, within parks, and in conjunction with utility easements. Trails are to be built to withstand occasional vehicle traffic for maintenance and emergency access purposes. The stone subbase should be determined based on a geotechnical investigation of each specific corridor.

In some locations a greenway trail can be natural and unpaved, partially paved or have a gravel surface.

Blue Loop - Raleigh Art Museum

Spur Trails

Spur trails are normally short distance trails that provide connections from neighborhoods, adjacent land uses, public facilities, retail, and civic uses to the larger greenway trail system. These trails can be narrower than the typical 8'-12' greenway trail but should not be narrower than 6'. These trails should also be built to greenway trail standards and be able to withstand an occasional vehicle for either maintenance or emergency access.

Spur trails typically occupy narrower corridors and can be close to established residences or other land uses and, therefore, may include additional amenities to screen or separate the trail from private property. These may include retaining walls to limit grading onto adjacent parcels, fencing to keep users off private property and limit access to facilities such as storm water ponds, and landscaping to minimize views and maintain privacy of adjacent land uses.

Spur Trail - Cary, NC

Urban Trails

Urban trails refer to those accommodations for bicycles and pedestrians located along or within established streets and road rights of way. Components of these trails include those amenities and features associated with greenway trails as well as street improvements for bicycles and pedestrian crossings.

Sidewalks

Sidewalks are pedestrian-centric and encourage safe walking conditions. The minimum sidewalk width should be 6' and located a minimum of 3' off the back of curb. Sidewalks typically are associated with roads and often are constructed of concrete.

NC55 Streetside Trail - Cary, NC

Roadside Trails

A roadside trail is used along roads where higher pedestrian traffic volumes are expected and the potential for bicycle traffic is significant. Often, these trails are found in locations where there is a desire to keep bicycles off of the street. These trails are typically 8-10' wide and are ideally set at least 5' off the back of curb. In situations where there is limited room, these trails can be constructed closer to or along the back of curb. They can be constructed of asphalt or concrete.

Street Crossings

In urban areas, designated street crossings will be necessary. The scale, size, speed limit, and amount of traffic on the street will determine the various approaches to street crossings and details which can be used.

Low traffic volume streets can have crossings that are as simple as a crosswalk and signage. These should be located at street intersections that have stop signs or signals.

Batchelor Branch Creek Road Crossing - Cary, NC

Black Creek Greenway Road Crossing - Cary, NC

Crossings of major roads with high traffic may require a pedestrian refuge island, pedestrian activated signals and flashing street signs in addition to signage. These can be located at intersections or in some cases mid-block.

American Tobacco Trail Bridge - Durham, NC

Black Creek Greenway Underpass - Cary, NC

Sharrows on Lassiter Mill Road - Raleigh, NC

Crossings at major highways will require either an underpass or bridge. These underpasses and bridges can be expensive and should be designed to be visually attractive, durable and safe. Bridges and underpasses also provide an opportunity for public art and can also be designed to be a gateway into town.

Bike Lanes

Bike lanes are dedicated travel lanes within an existing or new roadway. They are to be 4'-5' wide and identified with signage and pavement markings.

Sharrows

Sharrows are lane markings on the road that indicate that cyclists are going to be in the same lane and have a right to ride. They are intended to make motorists aware of bicycles and that they need to share the road.

Street Classifications

The master plan identifies three levels of improvements for urban trails and other accommodations based on a tiered designation of the road and street network including classification of the road, destinations located along the road and the potential for future development.

Tier 1 Streets

Tier 1 Streets are to include bike lanes, 8' sidewalks, and signage. Streets that are classified as Tier 1 Streets are as follows:

- Arendell Avenue
- Gannon Avenue
- Mack-Todd Road / Business 64

Arendell Avenue - photo courtesy of Google Maps

Tier 2 Streets

Tier 2 Streets are to include sharrows, 5-8' sidewalks, and signage. Streets that are classified as Tier 2 Streets are as follows:

- Barbee Street
- Horton Street between Wakefield Street and greenway corridor #8
- Judd Street
- Shepard School Road / Poplar Street
- Stratford Drive
- Vance Street between Arendell Avenue and Poplar Street
- Wakefield Street

Wakefield Street - photo courtesy of Google Maps

Tier 3 Streets

Tier 3 Streets are to include 5-6' sidewalks. Tier 3 Streets are as follows:

- Church Street
- Franklin Street
- Horton Street between Wakefield Street and greenway corridor #6
- Vance Street between Arendell Avenue and Wakefield Street

S. Wakefield Street - photo courtesy of Google Maps

Little River Blueway Corridor - Zebulon, NC

Blueways

A blueway is a river/stream that is navigable and can be used for recreational activity or movement from one destination to another. The river/stream itself may not require much improvement but will require access points for kayaks and canoes. These access points will require management. In addition to access points, some wayfinding signage may be required along the blueway. Along the western edge of the town's ETJ and connecting to Little River Park and eventually the future reservoir, the Little River offers potential for a designated blueway.

Facilities and Amenities

Facilities and amenities throughout the greenway system include trailheads, restrooms, directional signage, educational signage, bicycle stairways, exercise stations, benches, shelters and public art.

Trailheads can be specific for greenway use or make use of an existing public facility like a park, library, stadium or shopping center. Bollards and / or gates at trailheads prevent vehicles from accessing the greenway trail

Trailheads can typically include parking, signage, trash receptacles and restrooms.

Along the trail, various amenities such as benches, dog waste stations, signage (both directional and educational), exercise stations, benches, shelters and public art can included. While many of these are functional, amenities can also provide educational opportunities and enhance the identity of a corridor or trail.

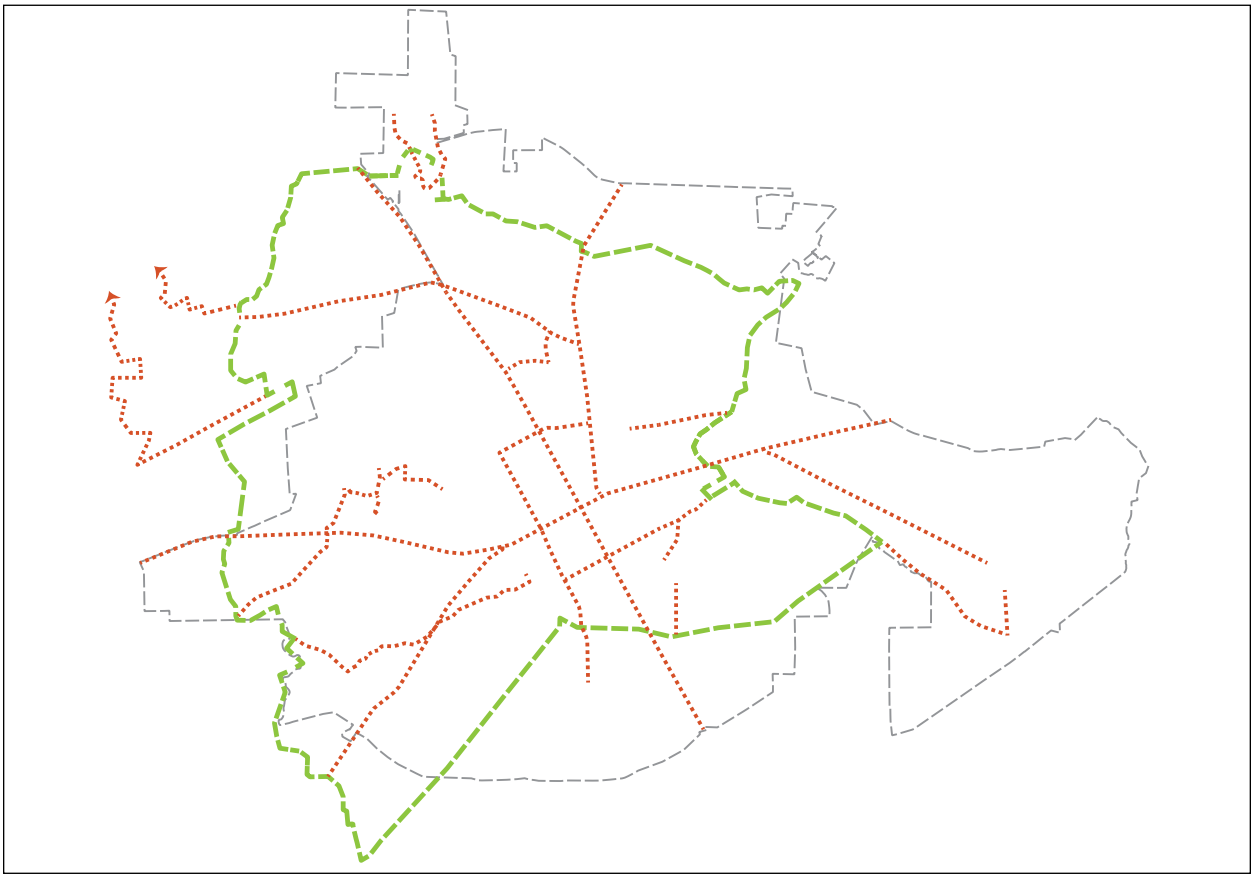
Bolin Creek Trail Wayfinding Signage - Chapel Hill, NC

Bolin Creek Trail Bicycle Stairway - Chapel Hill, NC

Trailhead Speight Branch Greenway - Cary, NC

Wayfinding signage - Chapel Hill, NC

6 Trail System



Belt and Spokes Concept

Introduction

The vision for the Zebulon Greenway System illustrated by the master plan is based on a belt and spokes concept, consisting of off-road greenway trails and urban roadside bicycle and pedestrian improvements. A continuous loop has been proposed around the Town of Zebulon, utilizing various off-road greenway corridors, other greenway corridors and roadside improvements radiating out from downtown to connect with the loop. The system creates connections between destinations and neighborhoods, provides access to community amenities and recreational opportunities, promotes alternative modes of transportation, and encourages healthy lifestyles.

Ten greenway corridors, totalling approximately 21.5 miles, a tiered system for urban trails and a blueway, are recommended by the master plan.

Greenway corridors primarily consist of off-road trails independent of bike and pedestrian improvements, but in some cases these urban roadside improvements are critical to completing the connections within a corridor and are, therefore, considered part of the corridor. Corridor 3 is a prime example of this.

Many of the greenway corridors follow public utility easements, limiting land acquisition costs and the lengthy process of gaining approval from private land owners. However, in some cases, property will still need to be acquired or easements obtained in order to complete connections.

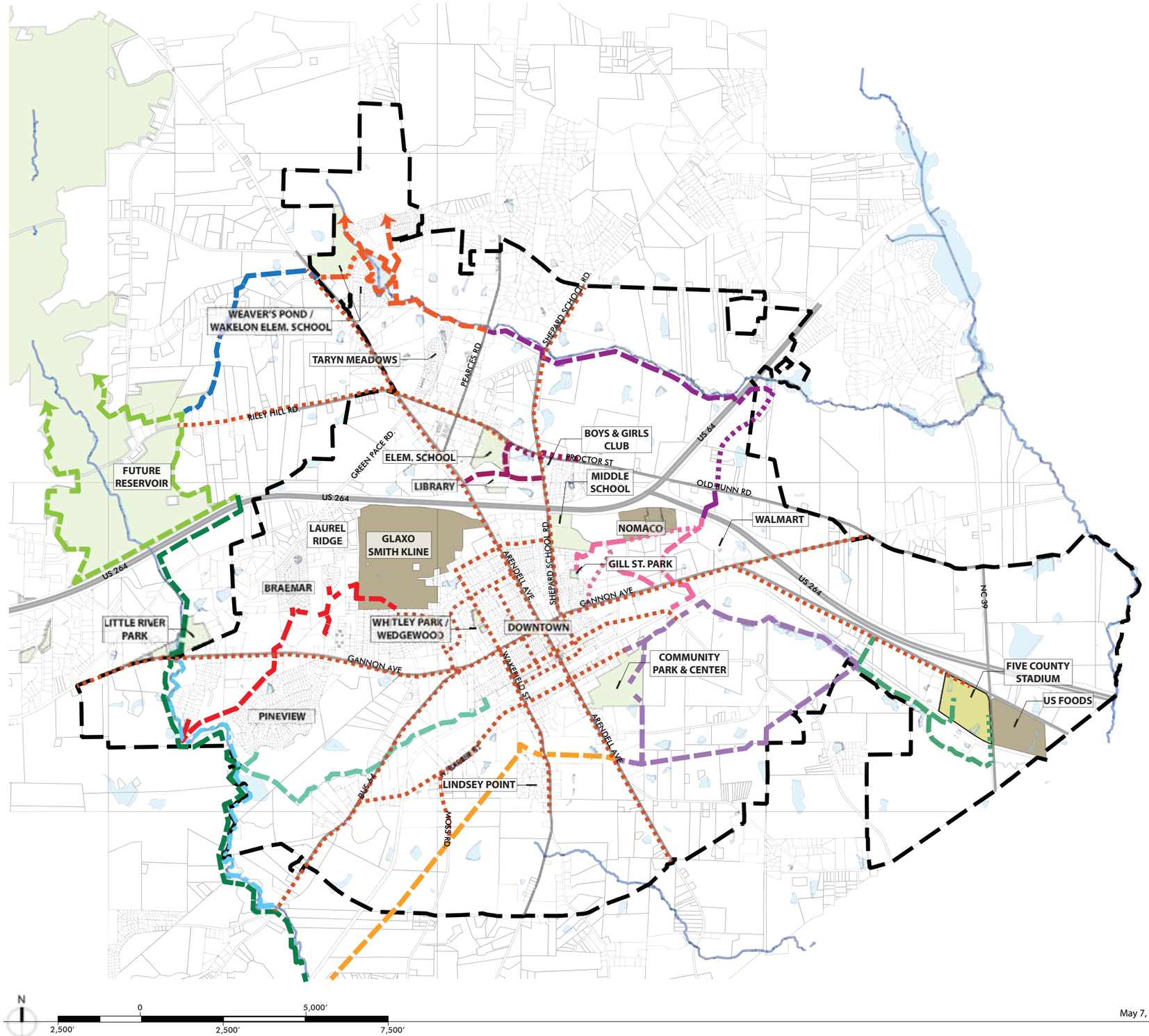
Within existing utility easements, greenway easements will need to be obtained prior to approval and implementation.

The majority of the trail system is contained within the Town's ETJ. However, certain connections and destinations were deemed important enough to examine potential connections outside of the ETJ. For example, connecting to the future reservoir and Wake County's planned trails was considered extremely important. In this instance, trails outside of the ETJ are being proposed, despite the Town lacking any planning jurisdiction in those areas.

General Recommendations

In order to protect the natural beauty, wildlife habitat and user experience, the Town of Zebulon should make all reasonable attempts to protect designated greenway corridors by restricting developments, and purchasing and/or encouraging the dedication of conservation easements along various corridors particularly corridors 1,2,5,6 and 9.

When considering a proposed development along a designated greenway corridor, the town should require the dedication of greenway easement at a minimum and perhaps the construction or a fee in lieu payment for greenway construction.



May 7, 2015

CORRIDOR KEY MAP

Master Plan

LEGEND:

- Zebulon ETJ
- Stream / River
- Pond / Lake
- Existing Public Open Space
- Industry
- Five County Stadium
- Bicycle / Pedestrian Improvements

PROPOSED TRAILS:

- Proposed Greenways from Wake County
- Little River Trail
- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Corridor 6
- Corridor 7
- Corridor 8
- Corridor 9
- Corridor 10
- Blueway

The total length of corridors is approximately 21.5 miles, which excludes roadside improvements in the downtown area as well as the blueway along the Little River. This distance also excludes any part of Corridors 7 and 10 outside of Zebulon's ETJ.

ZEBULON GREENWAY MASTER PLAN

Corridor #1

At 2.5 miles, Corridor 1 connects multiple neighborhoods to each other and to Wakelon Elementary School and Park. The western portion of this corridor is centered around the Weaver's Pond community and creates connections between the 3 developments, including a paved trail around Hendricks Pond. A section of trail extends across Pippin Road, ties into the park, and continues north allowing connections to future development. The park, with plentiful parking, a picnic shelter and restroom facilities, can function as a trailhead for this corridor. Trails north of Pippin Road follow existing stream buffers. Pedestrian and bike accommodations along Pippin Road between the park and the southern edge of the Wakelon School property should be improved in order to tie into a proposed trail that connects to Arendell Avenue

To the east of Weaver's Pond, Corridor 1 follows an existing sewer easement that connects to the Taryn Meadows neighborhood. The easement follows Beaverdam Creek, providing access to nature. Continuing to the east, the corridor crosses Pearces Road and connects with Corridor 2.

Wakelon Elementary School Park

Wakelon Elementary School

Creek Behind Taryn Meadows

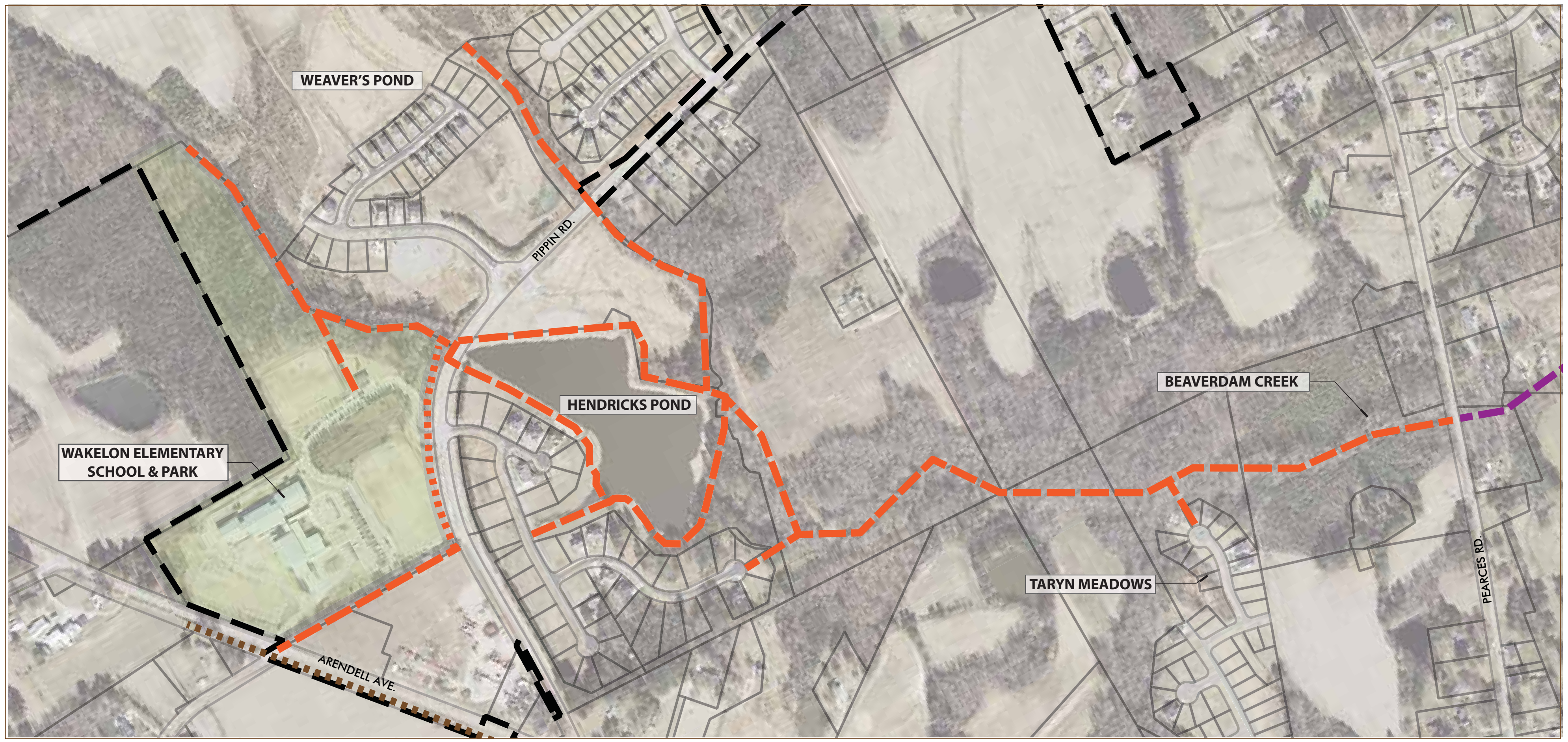
Hendricks Pond at Weaver's Pond

Playground at Weaver's Pond

Sewer Easement from Weaver's Pond to Taryn Meadows

CORRIDOR 1

Wakelon School - Weaver's Pond - Taryn Meadows



May 7, 2015

ZEBULON GREENWAY MASTER PLAN

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 1 - Trail
- Corridor 1 - Bicycle / Pedestrian Improvements
- Corridor 2 - Trail

DESCRIPTION:

Approximately 2.6 miles.

Provides a connection between the Taryn Meadows Community, the Weaver's Pond Community and Wakelon Elementary School and Park.

Provides a trail around Weaver's Pond (Hendricks Pond).

Continues along the proposed sewer easement to Pearces Road.

Connects to Bicycle and Pedestrian Improvements along Arendell Ave.

Greenway Access requires modifications to utility easement descriptions.

Requires new easement between Arendell Ave. and Pippin Rd. and around Hendricks Pond.

Road crossing at Pippin Rd.

Additional right-of-way or easement along Pippin might be needed for bicycle / pedestrian improvements.

Corridor #2

Following the Beaverdam Creek and future Beaverdam sewer force main, Corridor 2 provides a scenic 3-mile route between Pearces Road and US 264. Future development is expected in this part of town and this Greenway corridor will serve that development. This corridor contains three road crossings, two of which are over the highway. Crossing US 264 (future 495) and US 64 will be a major and expensive undertaking, but will be important in completing connections. Crossing the highways will provide connections to the Walmart shopping center and to trails south of US 264 (future 495). An at-grade road crossing will be required at Pearces Road and Shepard School Road.

Example of a highway crossing - Cary, NC

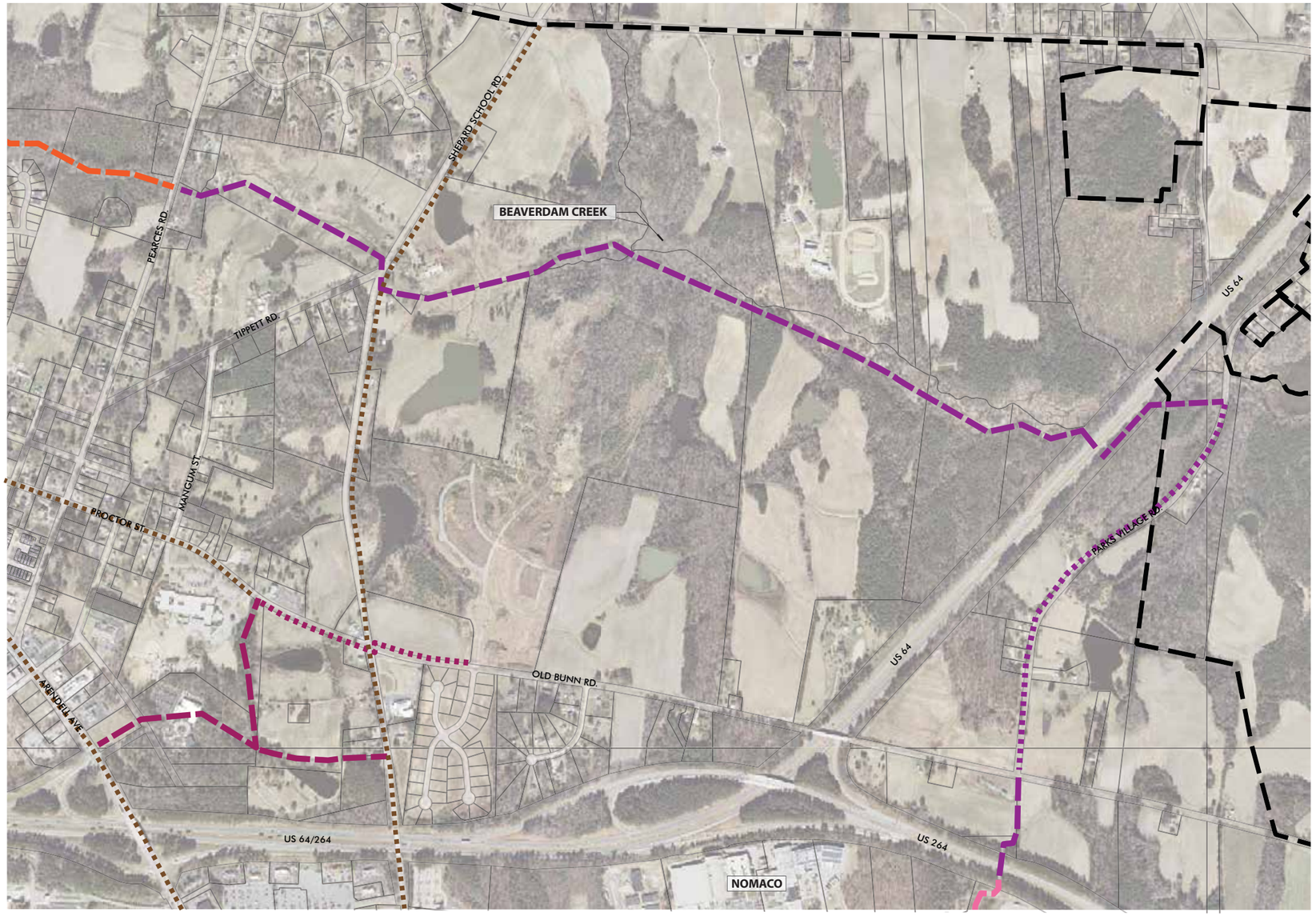
Example of an at-grade road crossing - Cary, NC

Walmart Shopping Center

Shepard School Road at Beaverdam Creek Crossing - photo courtesy of Google Maps

Pearces Road at Beaverdam Creek Crossing - photo courtesy of Google Maps

Parks Village Road - photo courtesy of Google Maps



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May 7, 2015

CORRIDOR 2

Pearces Rd. - US 64 - US 264

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 2 - Trail
- Corridor 2 - Bicycle / Pedestrian Improvements
- Corridor 1 - Trail
- Corridor 3 - Trail
- Corridor 3 - Bicycle / Pedestrian Improvements
- Corridor 4 - Trail

DESCRIPTION:

Approximately 2.75 miles.

Provides a connection from Pearces Road and Corridor 1, across US 64 and US 264, to Corridor 4.

Road crossings at Shepard School Road, US 64 and US 264.

Crossing the highway will be a major project.

The connection runs along the Beaverdam Creek Sewer outfall easement as well as Beaverdam Creek.

Greenway Access requires modifications to utility easement descriptions.

Additional right-of-way or easement will be required along Parks Village Road.

ZEBULON GREENWAY MASTER PLAN

Corridor #3

Corridor 3 provides connections between the Wake County Library, Eastern Regional Center, Zebulon Elementary School and the Boys & Girls Club. This corridor provides safe access to facilities that serve under-privileged citizens of Zebulon as well as students at the elementary school. Teachers at the school currently teach nature-themed lessons in the wooded area on the south end of the school property. Formalizing this path provides a safer experience and opens the opportunity for librarians to conduct a larger variety of instructional sessions outdoors.

The route mostly follows sewer easements connecting the library to the school and to Shepard School Road. In order to complete the connection to the Boys & Girls Club, bike and pedestrian improvements along Shepard School Road and/or a paved off-road trail between Proctor Street and Shepard School Road will be required. An off-road trail along Old Bunn Road can connect to a future development. The corridor should extend from the library to Arendell Avenue in order to tie into the larger network of bike and pedestrian accommodations. Bike and pedestrian improvements along Proctor Street west of the school, while not specifically part of this corridor, will help connect neighborhoods such as Taryn Meadows with the school, library and businesses along Arendell Avenue. Bike and pedestrian improvements along Shepard School Road also can connect Zebulon Middle School.

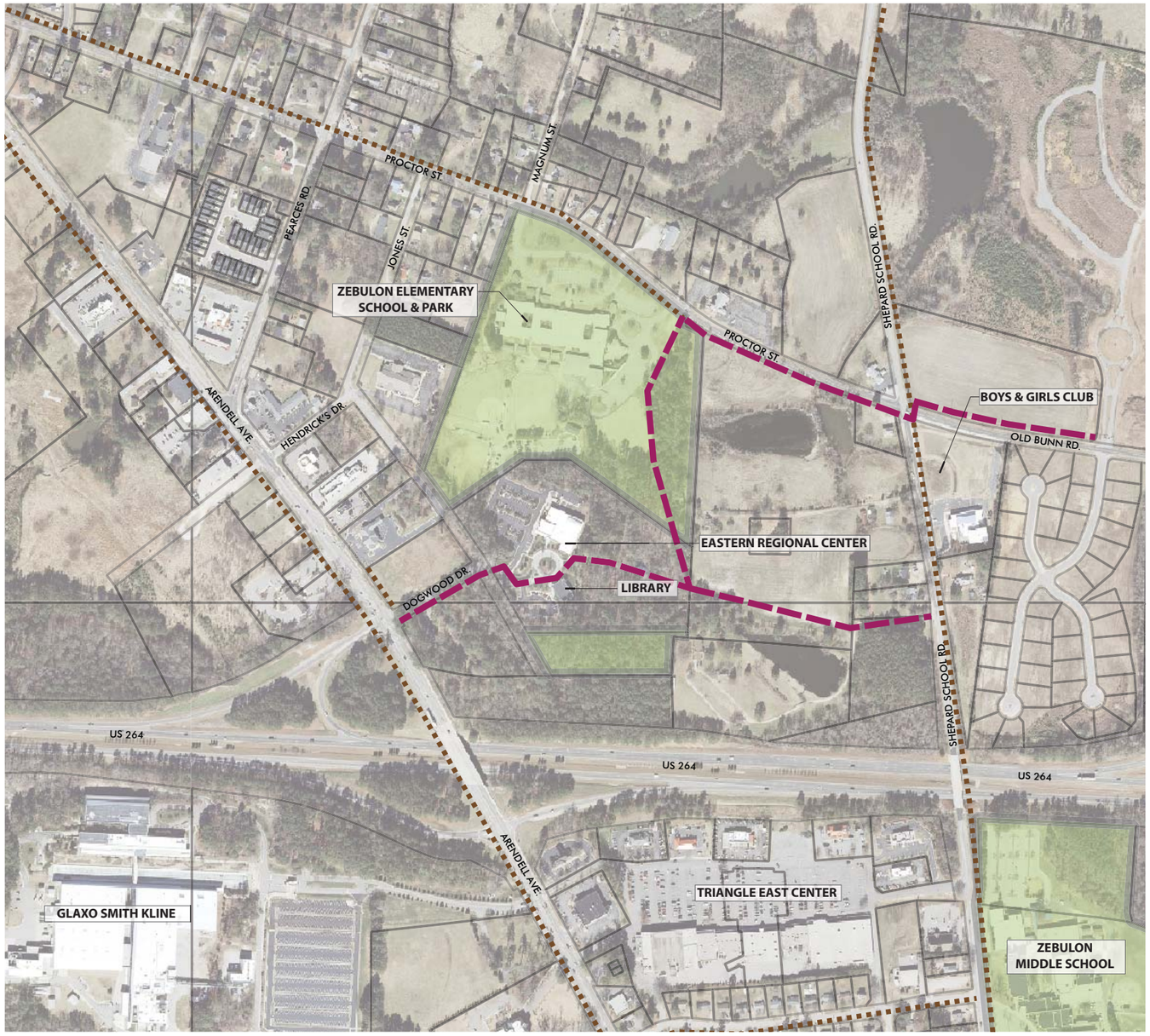
Zebulon Elementary School -
photo courtesy of Google Maps

Existing natural trail behind Library

Zebulon Library

Sewer Easement behind Library

Boys and Girls Club



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CORRIDOR 3

East Wake Library - Elementary School - Boys & Girls Club

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 3 - Trail

DESCRIPTION:

Approximately 1.1 miles.

Provides a connection between the Elementary School, the Library, Eastern Regional Center, Boys & Girls Club and adjacent neighborhoods.

Ties into pedestrian / bicycle improvements along Proctor Street, completing a connection to the Boys & Girls Club.

Greenway connection is made along an existing sewer easement.

Greenway Access requires modifications to utility easement descriptions.

Road crossing at Shepard School Rd. and Proctor St.

ZEBULON GREENWAY MASTER PLAN

May 7, 2015

Corridor #4

Combining bicycle and pedestrian improvements with off-road trails makes up Corridor 4, creating several connections to multiple destinations. The major destinations within this corridor are the Fairfield community, the Zebulon Middle School, Wake Tech Regional Campus, Nomaco and Walmart. Roadside improvements along NMC Drive create a safer connection between Walmart, Nomaco and the Middle School. An off-road trail connects the Fairfield community, Gill Street Park, and Town cemetery to the Middle School and East Wake Academy. Another off-road corridor provides a connection to Corridor 6 and requires a road crossing at Gannon Avenue. Corridor 2 is connected to this corridor via a spur behind the Walmart.

Many of the off-road routes are along existing or proposed sewer easements. The Town will need to dedicate Greenway easements along these routes.

The plan for Triangle East Business Park includes trails and the developer has shown an interest in working with the Town as plans for these trails develop. Not only do these trails provide connections to destinations, they provide the opportunity for recreation centered around the businesses located in this complex.

Gill Street Park

Zebulon Town Cemetery

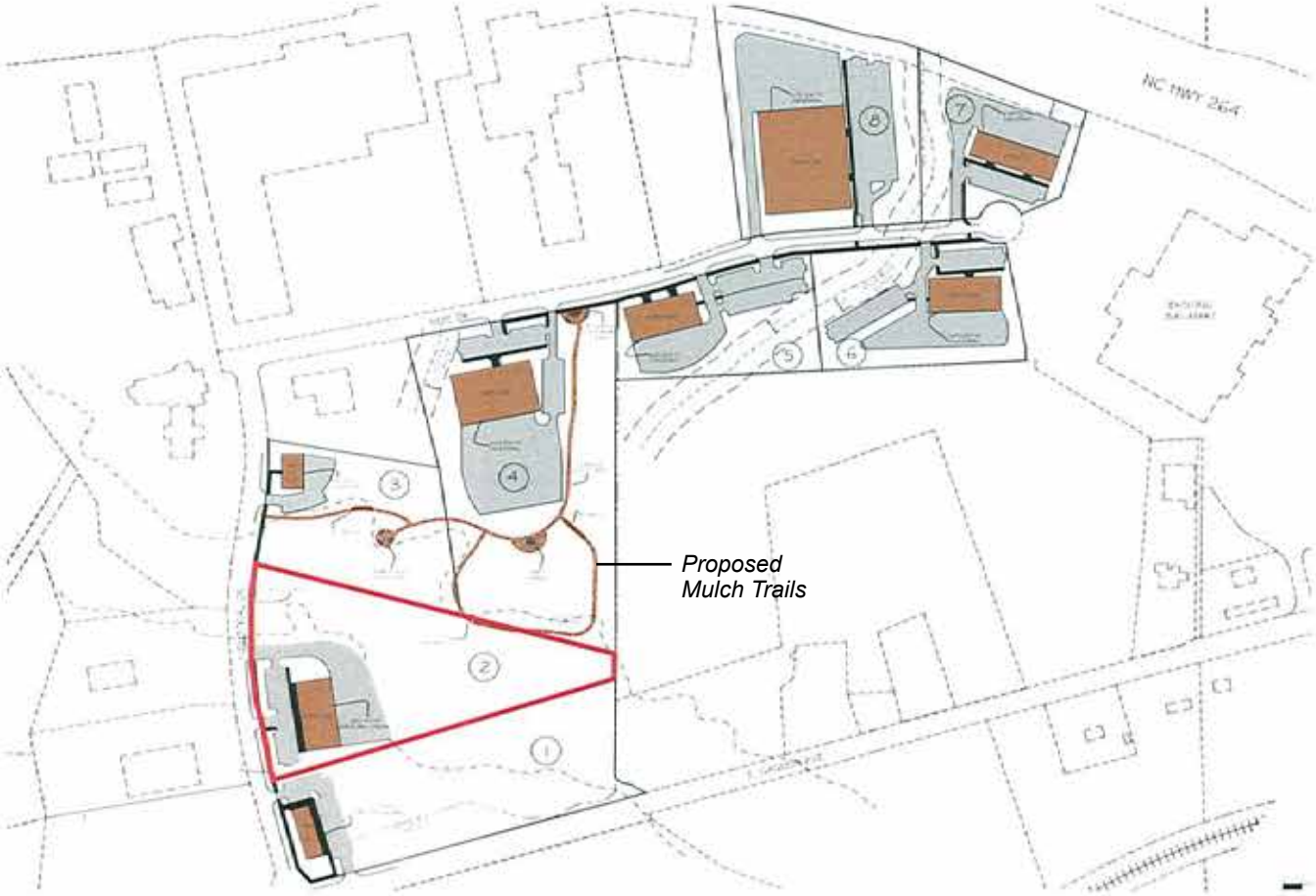
Spur behind Walmart Shopping Center

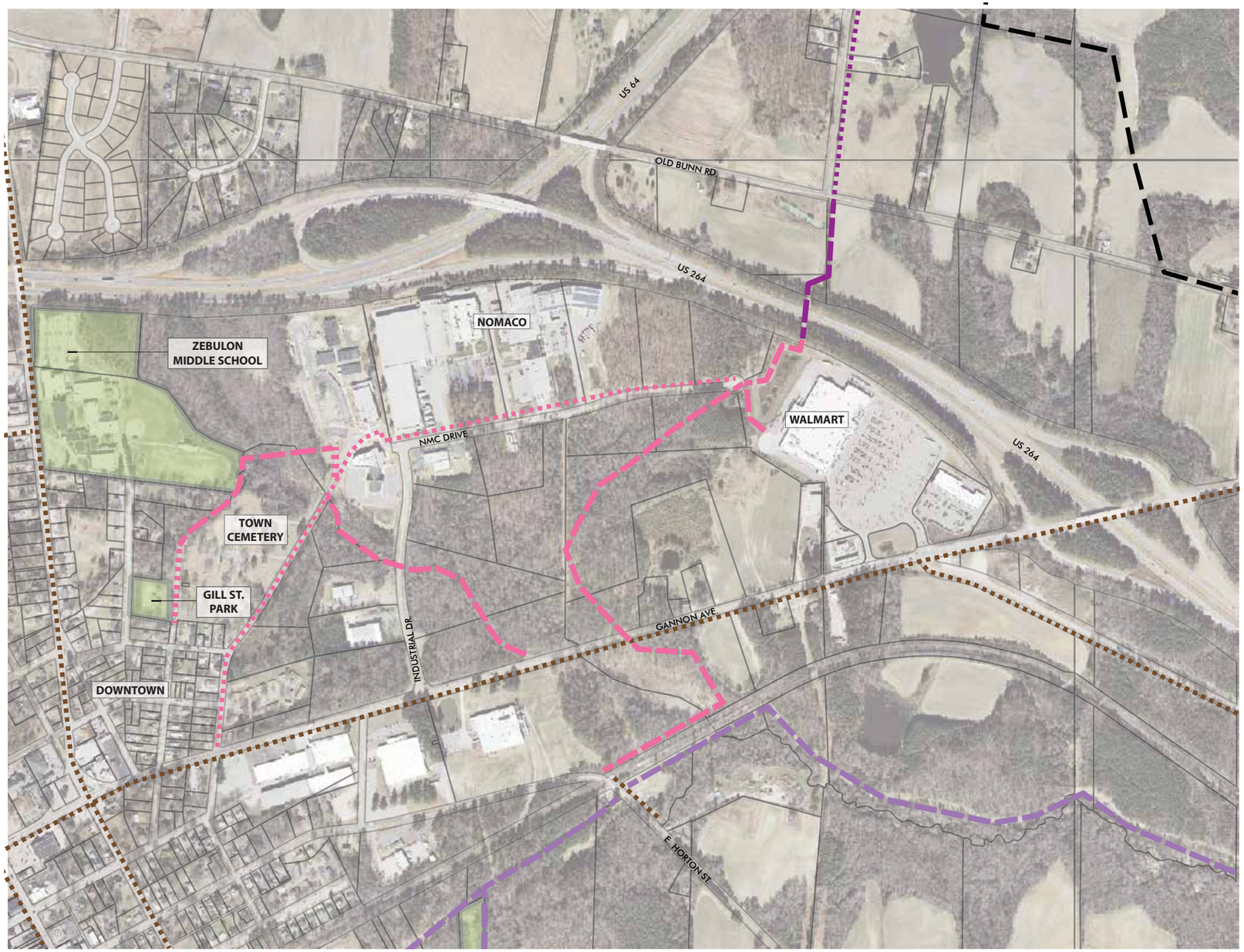
Nomaco

Walmart Shopping Center

Zebulon Middle School

TRIANGLE EAST BUSINESS PARK MASTER PLAN





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May 7, 2015

CORRIDOR 4

Middle School - Nomaco - Walmart - Gannon Ave.

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 4 - Trail
- Corridor 4 - Bicycle / Pedestrian Improvements
- Corridor 2 - Trail
- Corridor 2 - Bicycle Pedestrain Improvements
- Corridor 6 - Trail

DESCRIPTION:

Approximately 2.2 miles

Provides a connection from US 264 to Gannon Avenue along the proposed Beaverdam Creek Sewer Outfall.

Creates a connection to Nomaco, the middle school and Gill Street Park via bicycle / pedestrian improvements.

Connects Gannon Avenue to Corridor 6, which connects to Zebulon Community Park.

Greenway Access requires modifications to utility easement descriptions.

Road crossings at Gannon Ave. and Industrial Dr.

ZEBULON GREENWAY MASTER PLAN

obs landscape architects

AMT CONSULTING ENGINEERS

Corridor #5

This 2 mile long corridor makes the connection to Five County Stadium from Corridor 6. The majority of the corridor follows the Little Creek until it crosses NC-39. The Little Creek provides beautiful scenery and bountiful wildlife viewing opportunities, but it also creates a very wet corridor that will require extensive boardwalks.

A portion of the corridor follows an existing sewer easement that ends at the sewer treatment plant. The plan offers two options for connecting to Five County Stadium. The first option follows the creek around the treatment plant along property lines and connects to NC-39. Bike and pedestrian improvements, along with at-grade railroad crossing improvements, will be needed along NC-39. The second option connects to the Five County Stadium parking lot, which could serve as a trailhead, north of the sewer treatment plant. The best option for crossing the railroad needs further exploration.

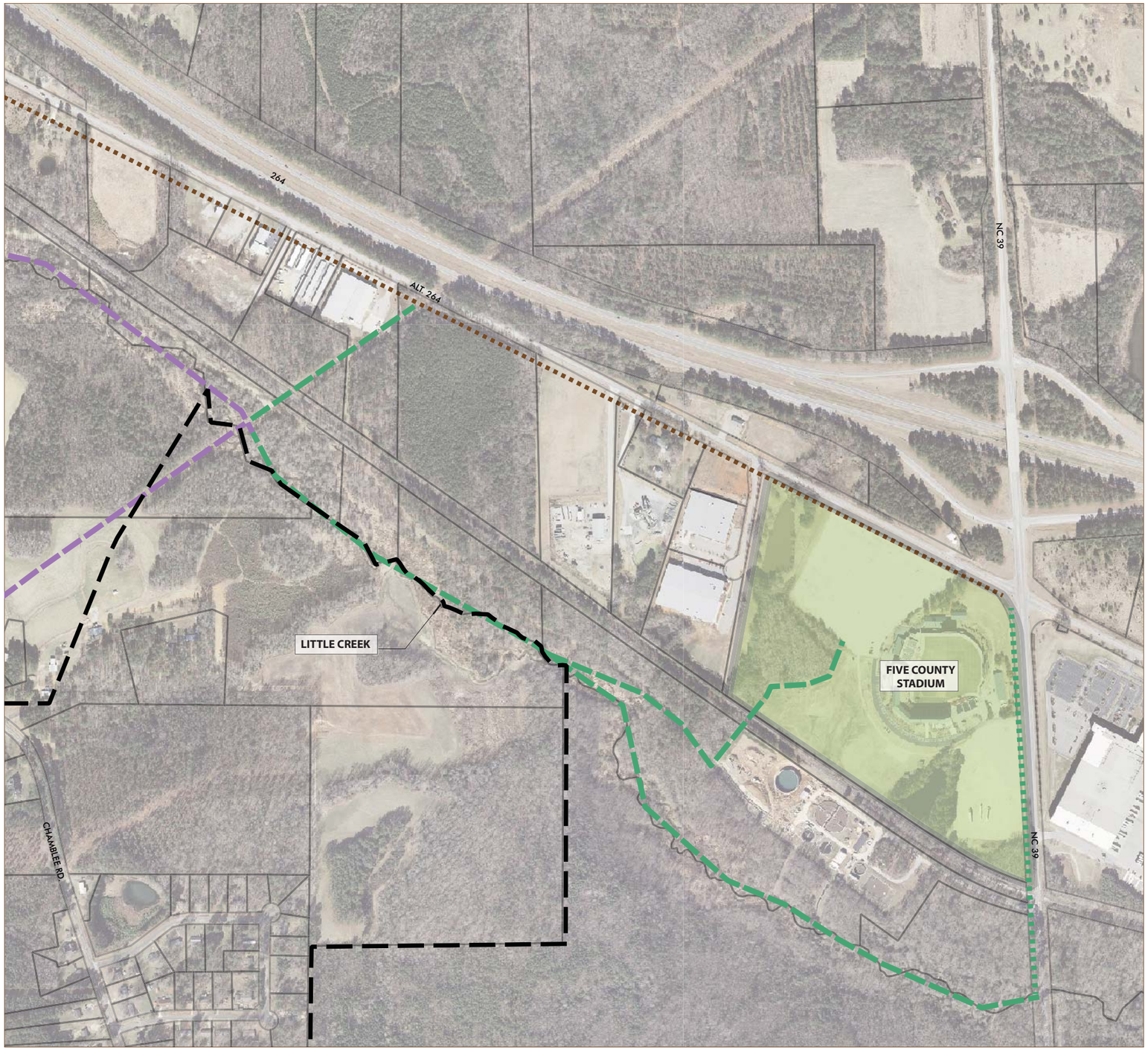
The corridor also completes the connection of Corridor 6 to US-264 Alt. The spur follows the electric transmission line easement and would tie into on-street bike and pedestrian improvements.

Five County Stadium

Railroad Corridor behind Five County Stadium

Rock Outcropping along sewer easement

Prairie Landscape



May 7, 2015

CORRIDOR 5

5 County Stadium - Alt 264 - NC 39

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 5 - Trail
- Corridor 5 - Bicycle / Pedestrian Improvements
- Corridor 6 - Trail

DESCRIPTION:

Approximately 2.0 miles

Provides multiple connection opportunities to Five County Stadium from Corridor 6 (and Zebulon Community Park).

Follows Little Creek.

Potential trail head at Five County Stadium.

Greenway Access requires modifications to utility easement descriptions.

Requires new easement from waste treatment plant to NC 39 and Five County Stadium.

Requires railroad crossing(s).

ZEBULON GREENWAY MASTER PLAN

Corridor #6

Corridor 6 is a 3.5 mile loop trail providing an attractive recreational opportunity. This corridor would be well-suited for exercise stations throughout its entirety. The Community Park will function as the trailhead and provides amenities such as restrooms, parking, playgrounds and athletic fields. The Community Center is adjacent to the Park and is another important amenity. It also provides an opportunity to integrate educational programs from the Community Center and Park with this trail.

Starting and ending at the Zebulon Community Park, Corridor 6 is the only corridor that does not directly connect two destinations. However, it does tie into other corridors in order to complete connections to other parts of the town.

This corridor has a diversity of landscapes. The northern section travels through wooded areas, which then transitions to a wetland stream corridor – both along a sewer line easement. The greenway corridor makes a sharp turn back to the west along an electrical transmission line easement and passes through an agrarian landscape. In order to connect back to the Community Park, the trail will need to traverse three parcels of private farm land. This connecting spur runs along parcel lines in an attempt to limit impact on property owners.

Another spur at the southwest end of the corridor ties the route to Corridor 7, which leads to Wendell. Bicycle and pedestrian improvements along Arendell Avenue will add another option to connect back to the park. Street-side improvements along Barbee Street to the north of the park will enhance a neighborhood connection to the corridor. This corridor will require 3 street crossings. This corridor will also require an easement from private property owners for the connection from the transmission line easement to the park.

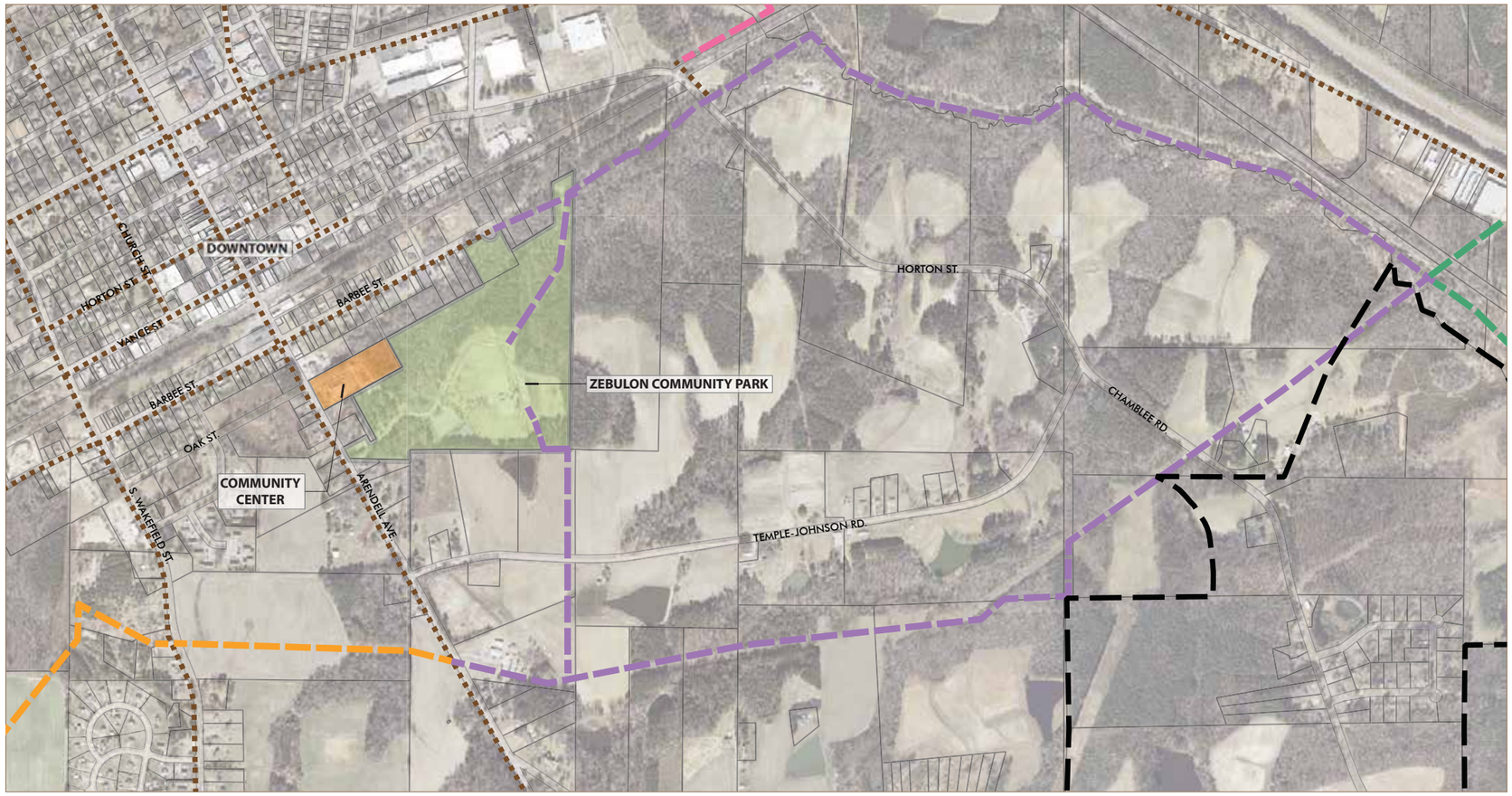
Zebulon Community Center

Zebulon Community Park

Sewer Easement

Zebulon Community Park

Zebulon Farmer's Market -
photo courtesy of Debbie Wheless



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May 7, 2015

CORRIDOR 6

Community Park- Little Creek Loop

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 6 - Trail
- Corridor 5 - Trail
- Corridor 7 - Trail

DESCRIPTION:

Approximately 3.5miles.

Creates a recreational loop with Zebulon Community Park as a hub.

Provides a connection from Zebulon Community Park to Five County Stadium via Corridor 5.

Follows electrical transmission line easements and sewer easements.

Greenway Access requires modifications to utility easement descriptions.

Requires new easement between the electrical transmission lines and Zebulon Community Park.

Road crossings at Chamblee and Temple-Johnson Roads.

ZEBULON GREENWAY MASTER PLAN

Corridor #7

Residents overwhelmingly asked for greenway connections to Wendell. This corridor accomplishes just that.

Corridor 7 follows large electric transmission lines that lead from Zebulon to Wendell. Duke Progress owns the easements and they typically are amenable to greenway easements within their utility easements. The main access points for this corridor would be at S. Wakefield Street and Arendell Avenue on the south side of downtown, with a secondary connection at Moss Road. Bike and pedestrian improvements will be required along these streets to complete the connections to Downtown.

This corridor parallels the railroad and crosses the Little River, which will require extensive bridging. The river crossing provides an opportunity to tie into the future Little River Trail as well as the Blueway. Coordination with the Town of Wendell will be required to complete the connections.

Power Easement at Moss Road
photo courtesy of Google Maps

Power Easement at Wakefield Street
photo courtesy of Google Maps

Little River Crossing adjacent to the railroad - photo courtesy of Google Maps

CORRIDOR 7

Wendell Connection

LEGEND:

- Zebulon ETJ
- Stream / River
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Proposed Trail Corridor 7
- Proposed Trail Corridor 6

DESCRIPTION:

Approximately 1.8 miles from Arendell Ave. to the Zebulon ETJ limits

Provides a connection to Wendell via electric transmisison line easements.

Ties into downtown network at S. Wakefield St. and Arendell Ave.

Greenway Access requires modifications to utility easement descriptions.

Road crossing at S. Wakefield and Moss Streets

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April 7, 2015

ZEBULON GREENWAY MASTER PLAN

Corridor #8

At approximately 2 miles long, Corridor 8 will connect Downtown Zebulon to the future Little River Trail and to the Pineview neighborhood. It also connects to roadside improvements along Business 64 / Mack Todd Road. A major road crossing would be required at Bus. 64 and a smaller crossing would be required at Pony Road The portion of the corridor between Mack Todd Road and Downtown follows an existing sewer easement. Roadside improvements along Horton Street would be recommended to strengthen the connections between Downtown and the greenway trail system.

West of Bus. 64, the corridor follows FEMA floodplain along property lines and will tie into the future Little River Trail. A spur connecting to Southland Drive in the Pineview development is recommended. Southland Drive dead ends, making it an easy connection point and potential trailhead for the neighborhood.

Dead End at Southland Drive in Pineview - photo courtesy of Google Maps

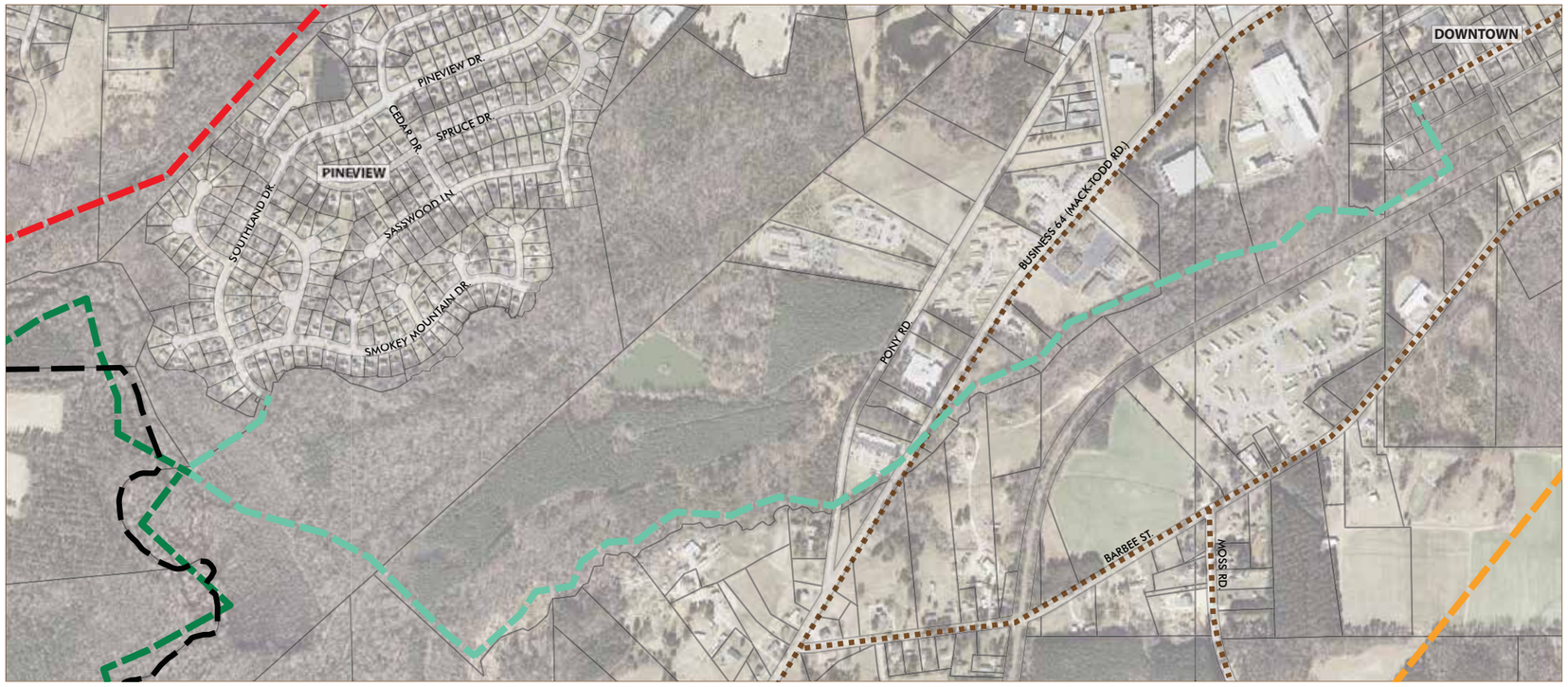
Bullock's Mini Storage & Flea Market on Pony Road photo courtesy of Google Maps

Example of a trailhead with parking - Raleigh, NC

Sewer Crossing at Business 64 (Mack Todd Road) photo courtesy of Google Maps

Example of a trailhead without parking, Raleigh, NC photo courtesy of Google Maps

Dead End at W. Horton Street photo courtesy of Google Maps



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May 7, 2015

CORRIDOR 8

Downtown - Pineview - Little River Trail / Blueway

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 8 - Trail
- Corridor 9 - Trail
- Corridor 7 - Trail

DESCRIPTION:

Approximately 2.0 miles

Provides a connection between downtown and the Little River Trail along existing sewer easements and floodplains.

At-grade crossing at Business 64 creates connection to bicycle / pedestrian improvements along Bus. 64.

Greenway Access requires modifications to utility easement descriptions.

Requires new easement between Bus. 64 and the Little River Trail.

Road crossing at Business 64 / Mack Todd Road and Pony Road.

ZEBULON GREENWAY MASTER PLAN

Corridor #9

This corridor is approximately 2 miles long and connects several neighborhoods to the future Little River Trail, which is planned by Wake County. This corridor is split by W. Gannon Avenue/ NC 97. The portion north of NC 97 is contained within existing sewer easements, which would need to be modified to include greenway access. This section of the corridor would connect the Wedgewood, Braemar, Laurel Ridge, Hempstede and Pineview neighborhoods to each other, and to the downtown roadside network via the Wedgewood neighborhood. These sewer easements are already being used as walking paths by residents of the adjacent neighborhoods. Directly adjacent to Braemar is a picnic shelter and a playground structure.

Two road crossings will be required with this corridor. The first being at Worth Hinton Rd, which also would include a small section of roadside improvements in order to connect the easements and, therefore, the trails. The second crossing would be at W. Gannon Avenue

South of Gannon Rd, the corridor travels through a wooded FEMA floodplain between the Pineview and Rivercrest Estates neighborhoods, and connects with the future Little River Trail. Being in a floodplain, the land will not be developed in the future; however, a greenway easement will be required. The corridor will follow small streams that flow to the Little River through this area. Bridges and sections of boardwalk will be required for a trail.

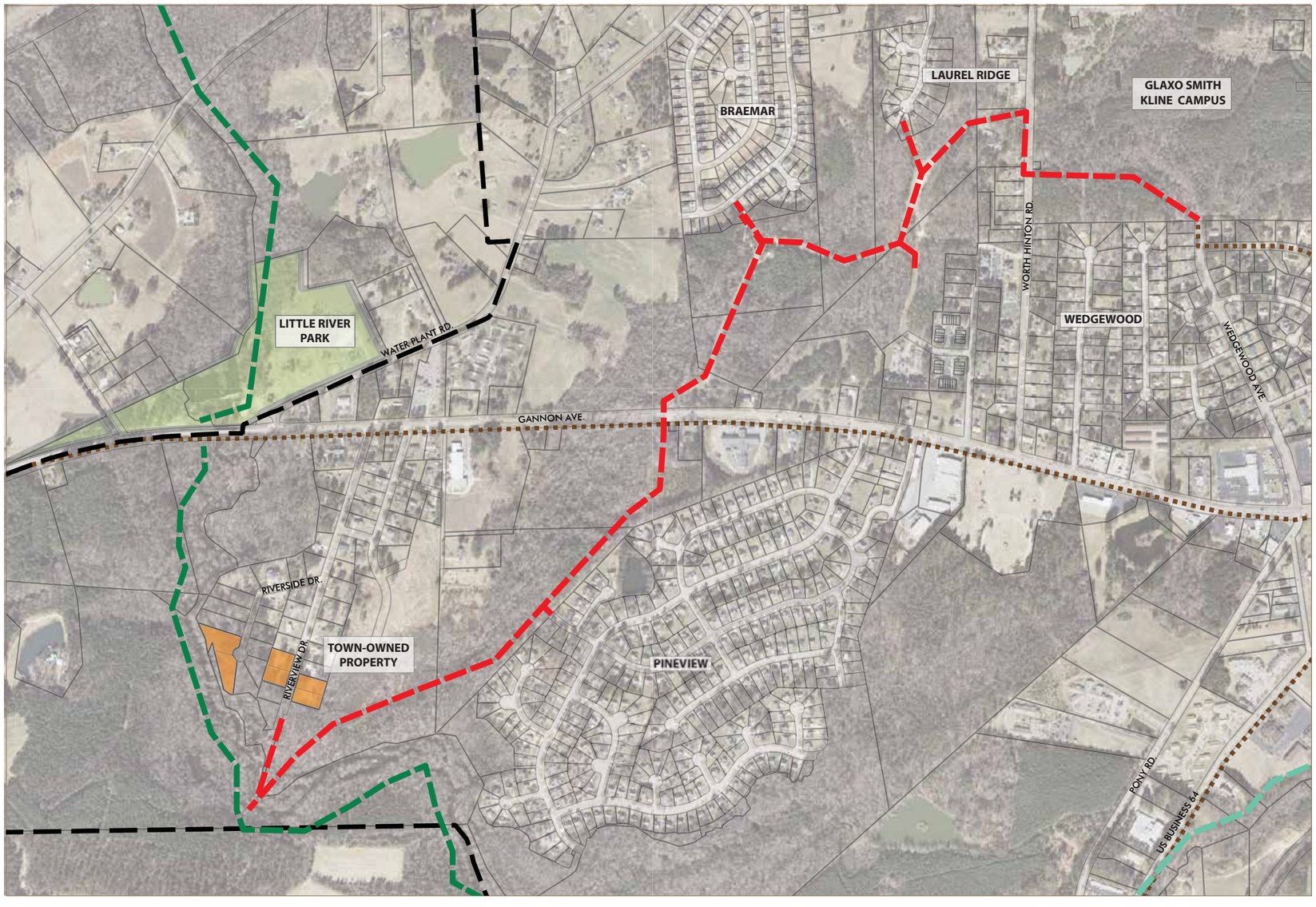
Spurs will connect the neighborhoods to the trail. In Pineview, Spruce Drive dead ends and is an ideal location for a spur, whereas many of the other roads within the development end in cul-de-sacs, making it difficult to build spurs. In the Rivercrest Estates neighborhood, the Town of Zebulon owns 2 parcels at the end of Riverside Drive and 4 at the end of Riverview Drive. These parcels could accommodate a trailhead with parking and other amenities.

Laurel Ridge - photo courtesy of Google Maps

Sewer Easement in Braemar Neighborhood

Sewer Easement crossing on Gannon Avenue
photo courtesy of Google Maps

Town Owned Property on Riverview Street



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May 7, 2015

CORRIDOR 9

Wedgewood - Glaxo - Laurel Ridge - Braemar - Little River Trail

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 9 - Trail
- Little River Trail
- Corridor 8 - Trail

DESCRIPTION:

Approximately 2.0 miles

Connects several neighborhoods and Downtown to the Little River Trail.

A portion of the trail follows existing sewer easements and another portion runs through floodplains.

Greenway Access requires modifications to utility easement descriptions.

Requires new easement between Gannon Ave. and the Little River Trail.

Road crossings at Gannon Ave. and Worth Hilton Road.

ZEBULON GREENWAY MASTER PLAN

Corridor #10

Corridor 10 is approximately 1.5 miles long. Wake County has proposed trails around the future county reservoir and this corridor will complete the loop and connect back to the Weaver's Pond/ Wakelon Elementary School area. This corridor also connects the Weaver's Pond/Wakelon Elementary School area to roadside improvements along Riley Hill Road.

Unlike most of the proposed corridors, this corridor is completely on private property. In order to limit issues with property, the trail follows a stream corridor along property lines. This corridor will require a road crossing on Cunningham Road as well as Zebulon Road. Property acquisition and/ or greenway easements would need to be obtained along the entire route.

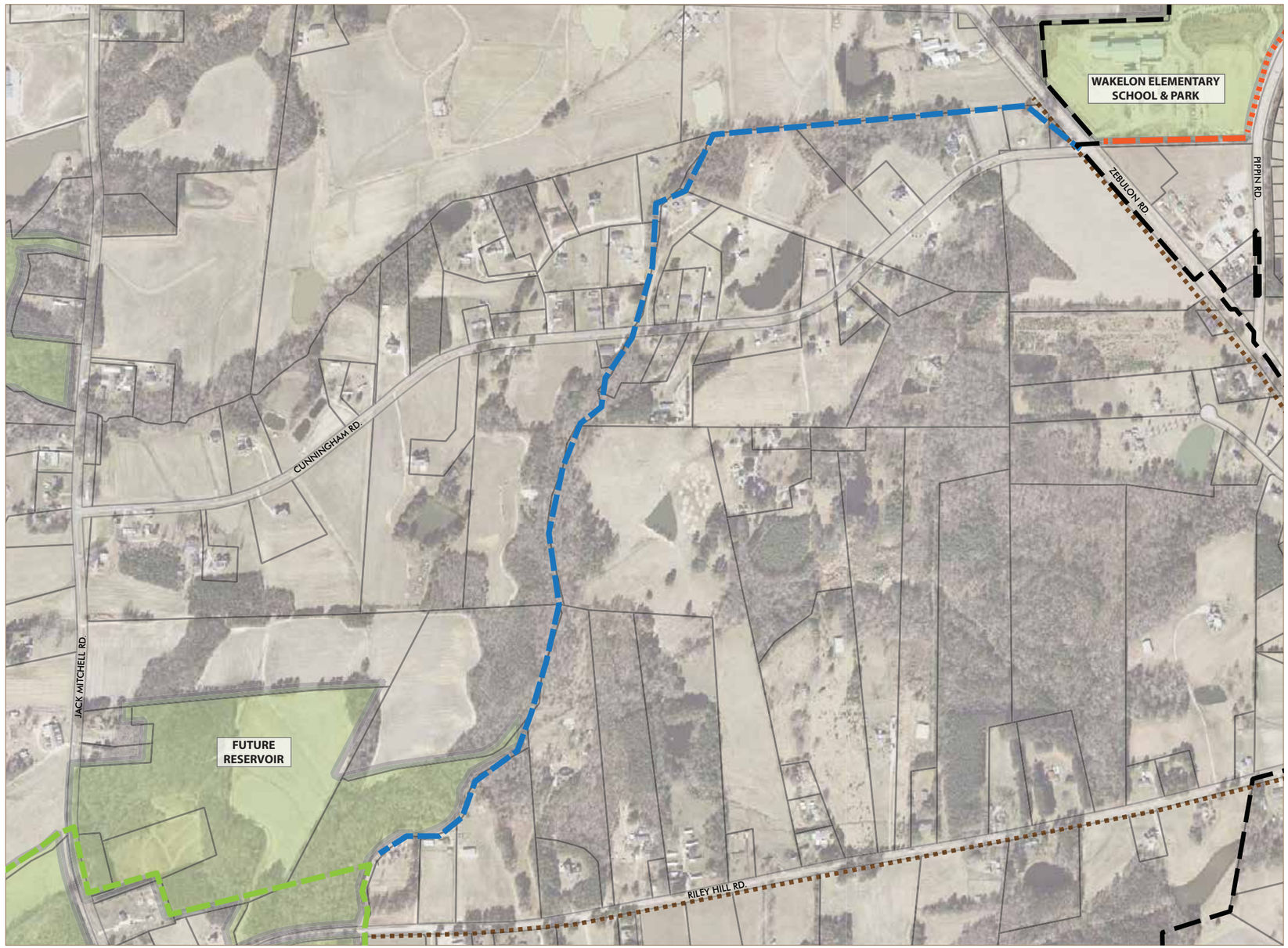
Corridor 10 is outside of the Town's current ETJ and the Town has no planning jurisdiction in this area.

Wakelon Elementary School

Zebulon Road - photo courtesy of Google Maps

Cunningham Road - photo courtesy of Google Maps

Example of a road crossing - Cary, NC



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May 7, 2015

CORRIDOR 10

Future Reservoir - Wakelon Elementary School

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 10 - Trail
- Corridor 1 - Trail
- Corridor 1 - Bicycle / Pedestrian Improvements
- Future Reservoir Trail

DESCRIPTION:

Approximately 1.5 miles

Provides a connection between the future reservoir / Little River Trail, the Weaver's Pond neighborhood and Wakelon Elementary School and Park.

Trail follows parcel edges along a stream corridor and will require new easements.

Road crossing at Cunningham Rd.

ZEBULON GREENWAY MASTER PLAN

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Urban Trails

In addition to the ten identified greenway corridors, the Master Plan illustrates bicycle / pedestrian improvements to downtown and neighborhood streets. This is consistent with the belt and spokes concept connecting urban destinations and connecting the urban core to suburban areas. These improvements could be as simple as constructing a sidewalk where there isn't one or creating bike lanes or other indicators (sharrows) on major streets. In the downtown area, connections can be made between parks, such as Whitley Park to the Community Park or schools and neighborhoods and downtown retail. Making these connections in the urban area maintains mobility and is paramount to creating economic development, providing access to food sources and healthy living.

The Master Plan identifies three (3) tiers of improvements and matches them with certain streets in the urban core. This system is very similar to a Comprehensive Plan where roadways are tiered by thoroughfare or collector status. All of the tiers will include signage and wayfinding. This could include something as simple as a designation on a small sign or future placement of directional signs to certain destinations such as parks, schools, retail areas or other destinations.

Tier 1 - Major Mobility Corridors: these streets move the most traffic for all modes and connect to major locations outside of downtown. They are the arterials of the system. These streets will ultimately include bike lanes and wider sidewalks to accommodate complete streets, as envision by the adoption of a complete streets policy by NCDOT in 2009. Streets included in Tier 1 are:

- Arendell Avenue
- Gannon Avenue
- Mack-Todd Road/Business US 64

Tier 2 - Minor Mobility Corridors: these streets also connect to areas outside of downtown, but are not major mobility movers for vehicles. There is an opportunity on these streets to truly create a nexus between all modes of travel in the complete streets concept. These streets will have wider sidewalks to accommodate all types of users and sharrows on the roadway to let the driver know that bicycles are also be using the pavement. Streets included in Tier 2 are:

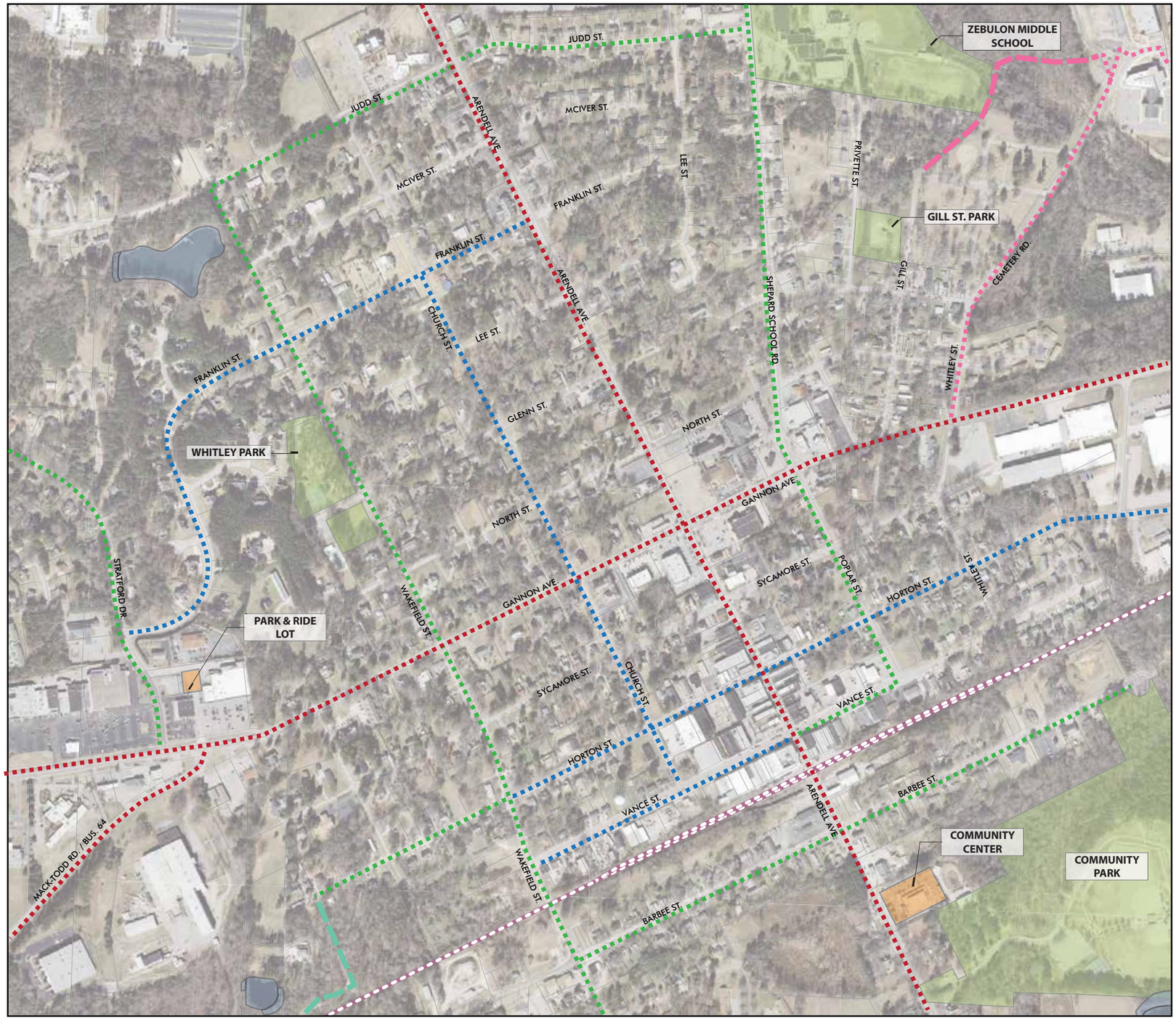
- Barbee Street
- Horton Street (west of Wakefield Street)
- Judd Street
- Shepard School Road/Poplar Street
- Stratford Road
- Vance Street (east of Arendell Avenue)
- Wakefield Street

Shepard School Road is a good candidate for pedestrian / bike improvements.

Lack of pedestrian facilities along Gannon Ave. create unsafe conditions.

Tier 3 - Local Corridors: these streets are the slower speed corridors within the urban core. They connect the mobility corridors to each other and are streets where all modes will mesh because of the low speeds. These streets are more about connecting neighborhoods to destinations as well as keeping the integrity of the downtown commercial corridor and will include sidewalks and sharrows. Streets included in Tier 3 are:

- Church Street
- Franklin Avenue
- Horton Street (east of Wakefield Street)
- Vance Street (between Wakefield Street and Arendell Avenue)



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May 7, 2015

DOWNTOWN

Urban Trails Map

LEGEND:

- Downtown
- Land Parcel
- Existing Public Open Space
- Industry
- Corridor 8
- Corridor 4 - Bike/Ped Improvements
- Corridor 4 - Trail

Tiered Improvements:

TIER	BIKE LANES	SIDEWALK WIDTH	SIGNAGE
1	Yes	8′	Yes
2	Sharrow	5-8′	Yes
3	No	5-6′	Yes

Tier 1 Streets:
Arendell Ave.
Gannon Ave.
Mack-Todd Rd. / Bus. 64

Tier 2 Streets:
Barbee St.
Horton St.
Judd St.
Shepard School Rd. / Poplar St.
Stratford Rd.
Vance St.
Wakefield St.

Tier 3 Streets:
Church St.
Franklin Ave.
Horton St.
Vance St.

ZEBULON GREENWAY MASTER PLAN

Blueway

A Blueway is a protected stretch of river that is dedicated to preservation and recreational activities. In Zebulon, a 2.3-mile stretch of the Little River between Little River Park and Business 64 / Mack Todd Road is to be dedicated as a Blueway. As part of the development of this corridor, the Town would be responsible for clearing debris in the river and along the shore to allow for safe passage in small, man-powered boats, as well as for continued maintenance.

Formalized boat launches for put-in and take-out would be required at key points along the river, including Little River Park, the Pineview neighborhood and Mack Todd Road. If the Town were to decide to extend the Blueway further downstream, a safe portage option around the dam at Mack Todd Road would be required. The Town could decide to extend the Blueway further south in order to connect with Corridor #7, which follows an electrical transmission line to Wendell, where it crosses the Little River.

Signage at boat launches and along the route would be desired to provide branding, wayfinding and regulation.

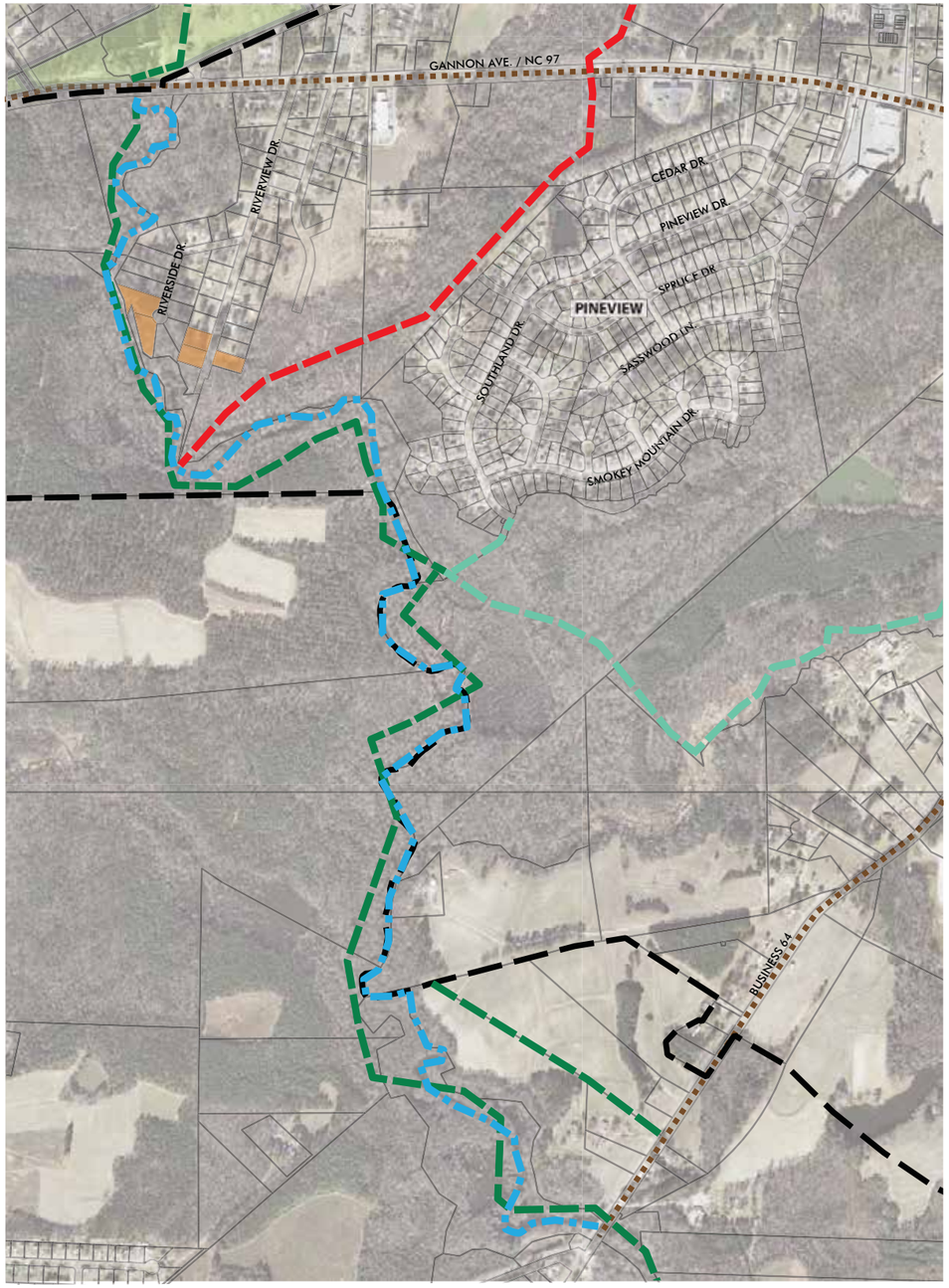
Little River Blueway Corridor

Little River Blueway Corridor

Little River Blueway Corridor

Little River Blueway Corridor

Example of a canoe/kayak launch.
Photo courtesy of NC Wildlife Commission



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May 7, 2015

BLUEWAY

Boating Corridor

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Town-Owned Property
- Bicycle / Pedestrian Improvements
- Blueway
- Corridor 8 - Trail
- Corridor 9 - Trail
- Little River Trail

DESCRIPTION:

Approximately 2.3 miles

Provides a recreational boating experience along the Little River

Put-in is at Little River Park

Blueway ends at Bus. 64 / Mack Todd Rd.

ZEBULON GREENWAY MASTER PLAN

7 Implementation Strategy

Trail Construction - Raleigh, NC

Trail Construction - Raleigh, NC

Introduction

The Zebulon Greenway Master Plan is an overall vision and foundation for implementation of the system illustrated. The town would be challenged to fund the system illustrated without financial partners and funding support. In the pursuit of funding for implementation, a master plan is typically required by granting agencies. It is important to these agencies and other funding sources that the town has a plan and a vision. The primary purpose of this master plan is to illustrate the town's vision for the greenway system.

Secondarily, the master plan provides a reasoned approach to implementation identifying priority corridors and projects that meet defined criteria and are likely to be active, successful and will build interest and momentum for continued implementation.

How to Use this Plan

The master plan will be used by town staff and the development community to answer the following questions:

- What are the benefits of greenways?
- Where are future trails, pedestrian and bicycle improvements going to occur?
- What is the scope of work associated with each corridor?
- How much do future trails, pedestrian and bicycle improvements cost?
- What are typical construction methods, details and amenities associated with greenways?
- What is involved in the maintenance and operations of a greenway trail?

Public Policy

The master plan is the basis of a town policy to require the dedication of land or easements for greenway implementation and / or the construction of greenway trails as well as other pedestrian and bicycle improvements as development projects come before the town for approval.

Other methods of implementation will be contingent upon town support and funding, as well as funding from grants (see chapter 8 for potential grant funding sources) and other sources public and private.

Partnerships between the town, the development community and other public agencies will be required to fulfill the vision illustrated by the master plan.

Priority Projects

Based on the evaluation criteria defined in chapter 3 of this report two greenway projects were identified for the evaluation of probable associated costs. Within a corridor, there can be several projects. These projects were part of Corridor 1 and Corridor 3.

The Corridor 1 project includes a paved greenway trail from the cul-de-sac of Spiderlily Court in the Taryn Meadows neighborhood to Pippin Road and including the trail around Hendricks Pond in the Weavers Pond neighborhood.

The Corridor 3 project connects the Wake County Branch Library and Eastern Regional Center to the Zebulon Elementary School and the Boys and Girls Club as well as adjacent residential development. This project includes a greenway trail, but also includes improvements along Proctor Street and Old Bunn Road and intersection improvements at the intersection with Shepard School Road.

In addition, an urban corridor connecting the Wakelon Heights neighborhood downtown to the Farmers Market also was evaluated in terms of pedestrian and bicycle improvements and probable costs associated.

Maps specific to these projects and an estimate of probable construction cost follow at the end of this chapter.

Implementation Process

Below is an outline of the general process for building a greenway. This may change slightly for each project based on site constraints, grant requirements, community process, etc.

Identify Funding Sources

One of the first steps for a greenway project is to identify funding sources. This can happen before easement acquisition or after depending on the project.

Funding sources may be within the Town budget, from grant sources, or from Public/Private partnerships. A project may be funding from one or a combination of these sources.

Shiloh Greenway in Morrisville under construction

The Town may choose to pursue these sources independently or they may hire a consultant to create and submit grant applications. This depends on the specific grant and the information required for the application. (Grants are covered in more detail in Chapter 8 - Funding Sources)

It is important to note that depending on the grant requirements, there may be additional review, permits, and approvals from the grant agency throughout the design and construction of a project. These requirements should be identified early in the process and noted to the consultant hired to design and perform construction administration services for the project.

Easement Acquisition

One of the first steps for any greenway project is greenway easement acquisition. This may vary from project to project based on whether easements will be required from private property owners or if a greenway easement overlay is needed on an existing utility easement. A typical greenway easement is anywhere from 30-50' depending on the area. This easement consists of a protected buffer as well as room for trail construction.

Survey

Easement acquisition and trail design will require detailed survey information of the corridor. At a minimum, the survey will need to include the following:

- Topographic information
- Location of any key features
- Stream Buffers including top of bank location
- Wetlands
- Any rock formations
- Boundary of the greenway easement
- Property lines

- Property owner information
- Location of any and all utility structures
- Roads and Rights of Way

Greenway Corridor Design

During this phase of the project the Town will need to hire a design consultant to further design the trail. This includes community involvement, trail layout, grading, erosion control, preliminary cost estimates, and specific details pertaining to the project.

This phase may also include reviews required by the grant source.

Construction Documents

Construction documents must be prepared to further detail and define a project for bidding and permitting and construction. The Town should also require a final cost estimate at the end of this phase in the project.

Permitting

Permitting requirements will vary per project. More detail can be found on permitting in the Design Guidelines section of this report (Chapter 9). Some of the typical permit agencies that may be required are:

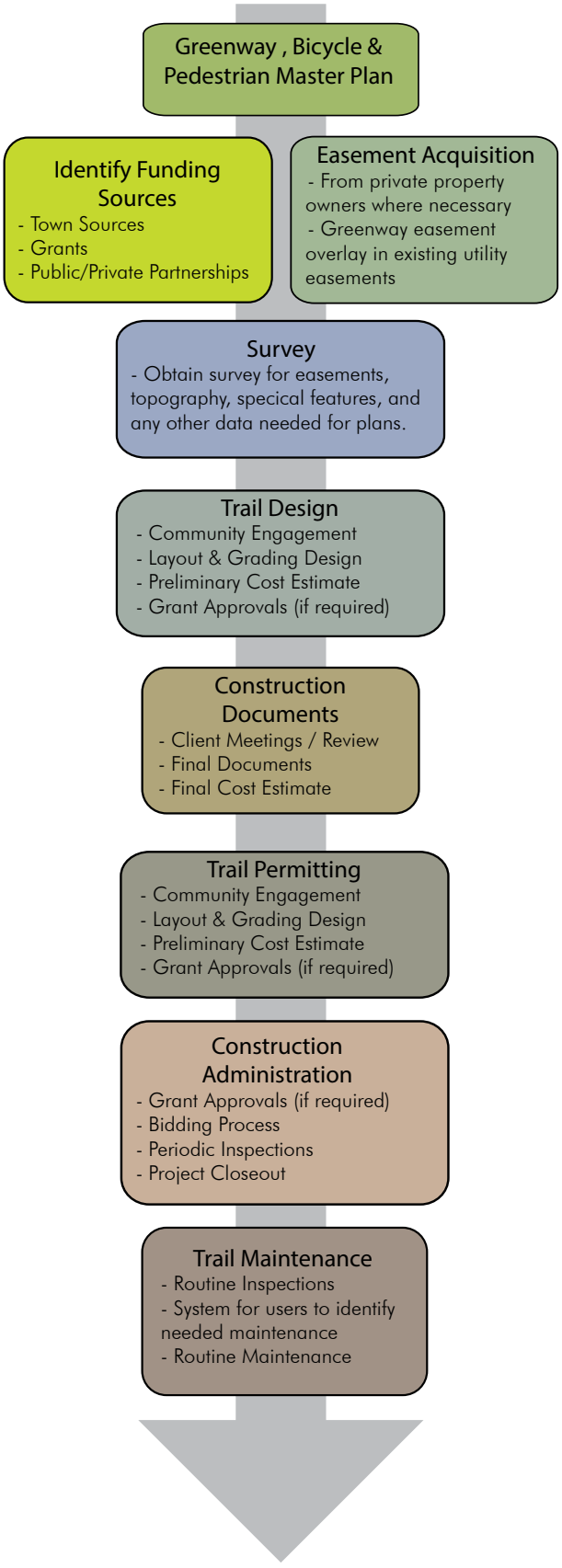
- North Carolina Department of Environment and Natural Resources
- Town of Zebulon
- In some cases Wake County
- NC Department of Transportation

Construction Administration

The Town will hire a consultant to work in conjunction with Town staff to manage the project during construction. Some grants may also require approvals during construction. For example, NCDOT funding requires that NCDOT work with a certified engineer to approve construction during the construction process.

Trail Maintenance

Each trail project will require maintenance after completion. Depending on the trail and its features, these maintenance costs will vary. The Town may want to request that the design team work with the Town to identify approximate maintenance costs for the first few projects.



Greenway Implementation Flow Chart

Zebulon Greenway Rough Order of Magnitude Cost Estimate **9/18/2015**

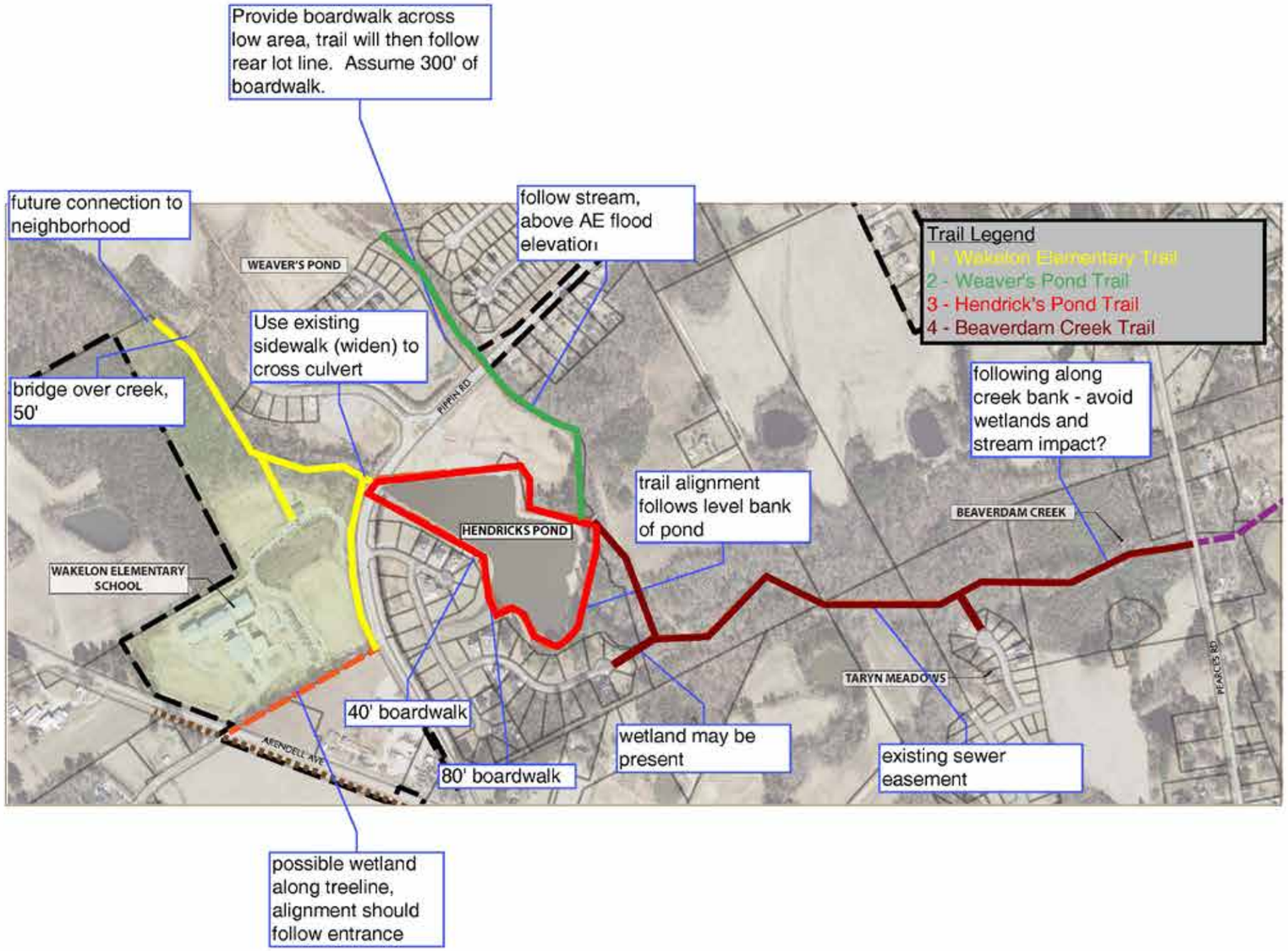
Corridor 1	Total Length, feet	Bridges or Boardwalk, feet	Property Acquisition	Difficultly to build	Design Estimate, $	Property Acquisition Estimate, $	Construction Estimate, $	Construction Inspection and Oversight, $	$ ROM/ linear foot	ROM Trail Cost, $
Wakelon Elementary Trail - New	2933	50	No	Some challenges, but fairly easy	$ 70,409.09	$ -	$ 328,575.76	$ 70,409.09	$ 152	$ 469,393.94
Wakelon Elementary Trail - 5' to 10'	942	0	No	Very easy	$ 10,597.50	$ -	$ 49,455.00	$ 10,597.50	$ 75	$ 70,650.00
Weaver's Pond Trail	2023	300	No	Could be tough if ditch has capacity volume	$ 68,477.27	$ -	$ 319,560.61	$ 68,477.27	$ 152	$ 456,515.15
Hendricks Pond Trail	3632	120	No	Very easy if use maintenance road	$ 66,781.82	$ -	$ 311,648.48	$ 66,781.82	$ 106	$ 445,212.12
Beaverdam Creek Trail	4403	0	Yes	Fairly easy, property easement may be needed to access utility easement alignment	$ 70,047.73	$ -	$ 326,889.39	$ 70,047.73	$ 106	$ 466,984.85
				Total Cost Corridor 1	$ 286,313.41		$ 1,336,129.24	$ 286,313.41		**$ 1,908,756.06**

Corridor 3	Total Length, feet	Bridges or Boardwalk, feet	Property Acquisition	Difficultly to build	Design Estimate, $	Property Acquisition Estimate, $	Construction Estimate, $	Construction Inspection and Oversight, $	$ ROM/ linear foot	ROM Trail Cost, $
Eastern Regional Library Trail	2505	40	Yes	Not so easy, ROW, utilities, wetland	$ 61,431.82	$ 10,000.00	$ 286,681.82	$ 43,002.27	$ 152	$ 409,545.45
Proctor Street Connector	3246	220	Yes	Deep roadside ditch, land needed, wetland, with an unsafe crossing	$ 90,027.27	$ 10,000.00	$ 420,127.27	$ 63,019.09	$ 182	$ 600,181.82
				Total Cost Corridor 3	$ 151,459.09	$ 20,000.00	$ 706,809.09	$ 106,021.36		**$ 1,009,727.27**

* Rough Order of Magnitude (ROM) cost is based on $800,000 per mile and is adjusted for each corridor based upon difficulty to construct
**$500/linear foot for boardwalk or bridge
** Design estimate includes geotechnical engineering, survey, permitting

Town of Zebulon - Urban Trail	Total Length, feet	Bridges or Boardwalk, feet	Property Acquisition	Difficultly to build	Design Estimate, $	Property Acquisition Estimate, $	Construction Estimate, $	Construction Inspection and Oversight, $	$ ROM/ linear foot	ROM Sidewalk Cost, $
(Whitley Park to Community Center)	5230	0	Yes	Approximately half of sidewalk exists	$ 45,000.00	$ 20,000.00	$ 247,552.13	$ 47,393.47	$ 69	**$ 359,945.60**

This trail is estimated based upon a 6' width, 4" concrete sidewalk. The total length of the trail is 5230 linear feet, and the estimate is for the construction of sidewalk only where existing sidewalk is not found



CORRIDOR 1

Wakelon School - Weaver's Pond - Taryn Meadows

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 1 - Trail
- Corridor 1 - Bicycle / Pedestrian Improvements
- Corridor 2 - Trail

DESCRIPTION:

Approximately 2.6 miles.

Provides a connection between the Taryn Meadows Community, the Weaver's Pond Community and Wakelon Elementary School and Park.

Provides a trail around Weaver's Pond (Hendricks Pond).

Continues along the proposed sewer easement to Pearces Road.

Connects to Bicycle and Pedestrian Improvements along Arendell Ave.

Greenway Access requires modifications to utility easement descriptions.

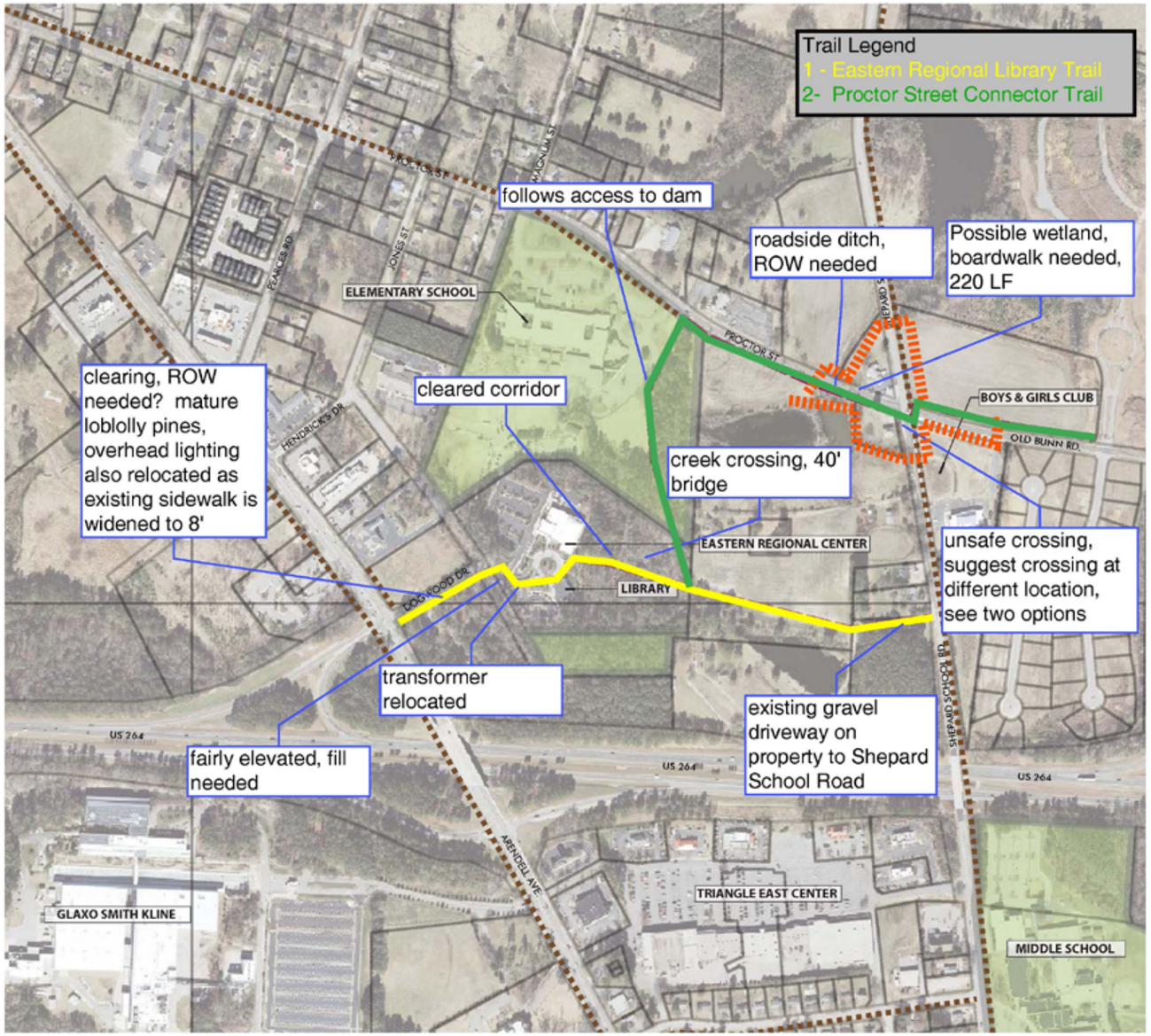
Requires new easement between Arendell Ave. and Pippin Rd. and around Hendricks Pond.

Road crossing at Pippin Rd.

Additional right-of-way or easement along Pippin might be needed for bicycle / pedestrian improvements.

ZEBULON GREENWAY MASTER PLAN

May 7, 2015



N

0 625' 1,250' 1,875' 2,500'

May 7, 2015

CORRIDOR 3

East Wake Library - Elementary School - Boys & Girls Club

LEGEND:

- Zebulon ETJ
- Existing Public Open Space
- Bicycle / Pedestrian Improvements
- Corridor 3 - Trail

DESCRIPTION:

Approximately 1.1 miles.

Provides a connection between the Elementary School, the Library, Eastern Regional Center, Boys & Girls Club and adjacent neighborhoods.

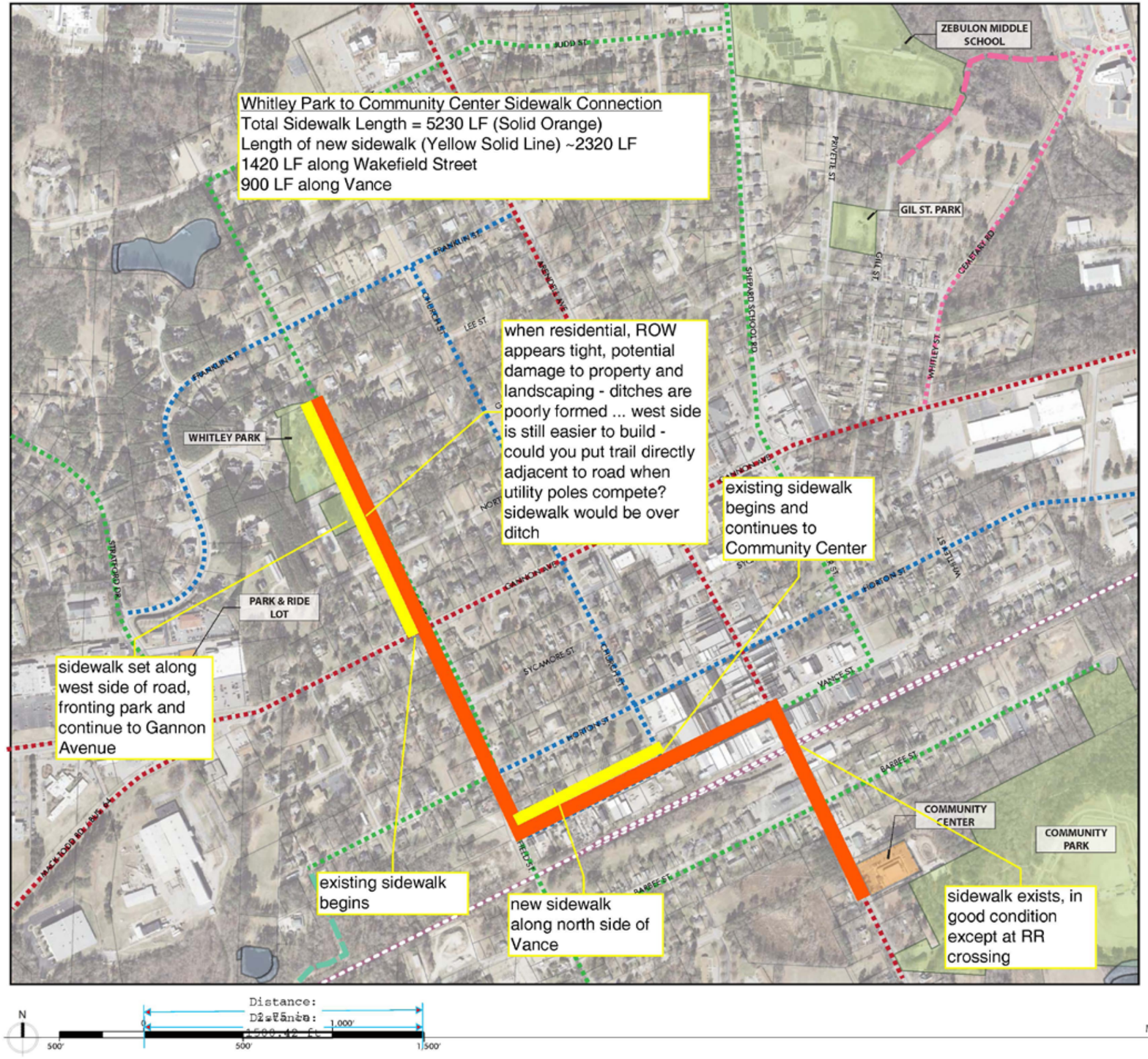
Ties into pedestrian / bicycle improvements along Proctor Street, completing a connection to the Boys & Girls Club.

Greenway connection is made along an existing sewer easement.

Greenway Access requires modifications to utility easement descriptions.

Road crossing at Shepard School Rd. and Proctor St.

ZEBULON GREENWAY MASTER PLAN



DOWNTOWN

Bike / Pedestrian Improvements

LEGEND:

- Downtown
- Land Parcel
- Existing Public Open Space
- Industry
- Corridor 8
- Corridor 4 - Bike/Ped Improvements
- Corridor 4 - Trail

Tiered Improvements:

TIER	BIKE LANES	SIDEWALK WIDTH	SIGNAGE
1	Yes	8'	Yes
2	Sharrow	5-8'	Yes
3	No	5-6'	No

Tier 1 Streets:
Arendell Ave.
Gannon Ave.
Mack-Todd Rd. / Bus. 64

Tier 2 Streets:
Barbee St.
Horton St.
Judd St.
Shepard School Rd. / Poplar St.
Stratford Rd.
Vance St.
Wakefield St.

Tier 3 Streets:
Church St.
Franklin Ave.
Horton St.
Vance St.

ZEBULON GREENWAY MASTER PLAN

May 7, 2015

obs landscape architects

AMT CONSULTING ENGINEERS

Urban Trails Opportunities and Constraints

8 Funding Sources

Introduction

The following sources for greenway and pedestrian / bicycle project funding are considered viable for those improvements identified by this master plan report.

Town Funding

There are several options available to the Town of Zebulon to fund greenway and bicycle / pedestrian improvements projects. These options include allocations from the annual town budget under transportation or parks and recreation, bond referendums dedicated to greenways and Recreation Project Fees. The town charter (section 8.32) allows the town to charge Recreation Project Fees which are kept in a separate trust fund and spent on community facilities, such as greenways within 10 years of their collection. Other sources include various public and private grant sources.

LAPP (Locally Administered Projects Program)

The Locally Administered Projects Program (LAPP) was adopted by the NC Capital Area Metropolitan Planning Organization (CAMPO) on October 20, 2010. The program is used by the CAMPO to prioritize and program all projects in the region that will utilize federal funding that is the responsibility of the CAMPO (such as Surface Transportation Program – Direct Allocation (STP-DA), Congestion Mitigation for Air Quality (CMAQ), etc.). This process will involve a once-a-year call for all local highway, transit, bicycle and pedestrian projects, and will result in an annual program of projects in the Metropolitan Transportation Improvement Program (MTIP).

The call for applications is typically in August with selections around the first of the year. This is an 80/20 grant program where the municipality agrees to pay for 20% of the entire project. Funds can be used for design, right-of-way acquisition, and construction. CAMPO uses a scoring system to assist in determining projects that receive funding. Priority is given to communities that have not had many projects administered under this program. The following funding types are included in LAPP:

- CMAQ (Congestion Mitigation and Air Quality)
- STP-DA (Surface Transportation Program - Federal Direct Allocation)
- STP-EB (Surface Transportation Program - Bike and Ped Federal Funding)

Park and Recreation Trust Fund (PARTF)

The North Carolina General Assembly established the Parks and Recreation Trust Fund (PARTF) on July 16, 1994 to fund improvements in the state's park system, to fund grants for local governments and to increase the public's access to the state's beaches. The Parks and Recreation Authority, a nine-member appointed board, was also created to allocate funds from PARTF to the state parks and to the grants program for local governments.

The PARTF program provides dollar-for-dollar grants to local governments. Recipients use the grants to acquire land and/or to develop parks and recreational projects that serve the general public. Applications are available each October and are typically due by the end of January of each year. The funding over the last few years has been more limited but still available. In 2014, PARTF awarded 17 grants to municipalities totaling about $4 million. The awards are announced from May through July.

NC Trails: Recreational Trails Program/Grant Program (Through NC Parks & Recreation Grant Manager)

The RTP is a federal grant program authorized by Congress in 2012 as Moving Ahead for Progress in the 21 Century (MAP-21). The intent of the RTP is to help fund trails and trail-related recreational needs at the State level. Funding for the RTP comes from federal gas taxes paid on non-highway fuel used in off-highway vehicles, and the program is administered at the Federal level by the Federal Highway Administration.

At the State level, the Secretary of the Department of Environment and Natural Resources (DENR) has assigned that responsibility to the Division of Parks and Recreation and its State Trails Program. The North Carolina Trails Committee is a seven member advisory committee who will review all applications and make recommendations for funding. The Secretary of DENR has the final approval authority for North Carolina.

Federal Land and Water Conservation Fund (LWCF)

LWCF is a Federal grant program managed through the National Park Service and the NC Division of Parks and Recreation (DPR). The program began in 1965 and has funded 874 park projects in North Carolina providing more than $74,700,000 in Federal grant funds for outdoor recreation. This grant was used for about $32k for the Zebulon Community Park back in the mid-90s and most recently used for a total of $100k for the Town of Rolesville Main Street Park. Historically, North Carolina's LWCF annual allocation has been split 60/40 between local governments and state agencies. Applications must go through the state LWCF liasons.

NCDOT Bike and Ped Grants

The NCDOT Division of Bicycle and Pedestrian Transportation and the Transportation Planning Branch created an annual matching grant program – the Bicycle and Pedestrian Planning Grant Initiative – to encourage municipalities to develop comprehensive bicycle plans and pedestrian plans. This program was initiated in January 2004 and is currently administered through NCDOT-DBPT. To date, a total of $4.1 million has been allocated to 154 municipalities through this grant program.

Safe Routes to School/Active Routes to School

Since 2005, 79 projects totaling approximately $10 million have been selected for funding in North Carolina. There are two pots of federal dollars currently available for Safe Routes to School programs and projects. The first pot is from the old transportation law (SAFETEA-LU), and does not require matching funds. This pot is still available in many states, including North Carolina. The second pot of money is from the Transportation Alternatives Program, in the current transportation bill (MAP-21), and it requires local matching funds of 20%.

Active Routes to School is a NC Safe Routes to School Project supported by a partnership between the NC Department of Transportation and the NC Division of Public Health. Through this project there are ten Active Routes to School project coordinators working across North Carolina to make it easier for elementary and middle school students to safely walk and bike to school. The project coordinators work with partners in their communities to increase:

- One-time awareness events about the importance of Safe Routes to School.
- The number of ongoing programs that encourage walking and biking to or at school.
- The number of trainings on how to implement Safe Routes to School-related activities.
- The number of policies that support walking and biking to or at school.
- The number of safety features near schools.

In addition to working directly with schools, the project coordinators work within communities to identify opportunities for shared use of facilities and Complete Streets to improve access to physical activity.

Wake County Partnership Grant Program

The goal of Wake County's Open Space Program is to work in partnership with willing municipalities, nonprofit organizations and individual property owners to protect remaining open space in the county. The Partnership Grant Program was created to streamline protection of open spaces that are not located within the county's 11 priority acquisition corridors.

County policy states that protection of any property that lies outside of one of the county's 11 acquisition corridors must be funded as a partnership effort. The County will provide a 50% funding match to any partner who wants to collaboratively pursue land protection outside the 11 priority stream corridors. The Partnership Grant Program operates on a case-by-case basis. Usually, a landowner or organization interested in protecting a piece of land as open space will contact County staff and will engage in a pre-proposal discussion regarding whether or not this property will help the Open Space Program meet its goals. During the pre-proposal discussion, if County staff and the interested party agree that purchase of the particular property or easement will help the Open Space Program meet its goals, then a project proposal must be created.

If an organization or municipality is interested in participating in the partnership grant program and receiving matching funds to purchase property, then they must complete a project proposal form and provide necessary supplementary materials such as maps and property analysis documentation. Proposals are accepted on a year-round basis.

After the project proposal has been written, then County staff submit the proposal to LARC and OSAPAC for review and approval. Favorable proposals are then presented to the Wake County Board of Commissioners (BOC), which votes to either approve or reject the proposed acquisition. If the BOC approves expending County funds, then a series of legal and financial transactions are undertaken that include signing a legal agreement and exchanging funds.

NC Department of Public Health/ Federal Dollars for Public Health

Besides Active Routes to Schools, these two groups often advertise grant opportunities which are constantly changed each part of the year. Currently, there are no grants related to greenways, but that may change in the upcoming years. These sources should be checked with regularity.

North Carolina Community Transformation Grant: Part of the Center for Disease Control and Prevention Grant Program

The Community Transformation Grant (CTG) Program helps communities design and carry out local programs that prevent chronic diseases such as cancer, diabetes, and heart disease. In 2011, CDC gave $103 million to 61 state and local governments, tribes and territories, and nonprofit organizations in 36 states. CDC also gave nearly $4 million to 6 national networks of community-based organizations.

CTG awardees are working with partners from many sectors. Some partners include:

- Schools and school districts
- Transportation experts
- Businesses
- Faith-based organizations

In 2012, CTG added the Small Communities Program. More than $70 million went to 40 neighborhoods, school districts, villages, towns, cities, and counties with fewer than 500,000 people. These grants help smaller communities make lasting changes to reduce health gaps and expand services to prevent and manage chronic diseases. CTG Small Communities will help improve health for about 9.2 million more Americans.

Urban & Community Forestry Grant Program

This is a grant program through the North Carolina Forest Service. The intent is to protect trees within an urban environment, but the grant is not strictly for tree planting. It is to go to projects that will do their part to protect trees and the environment. It is a 50% match grant and the application process starts every January 1. The total grant can be up to $15k but can be increased for special projects to $30k that show an innovative approach or can be considered a regional or statewide program.

NC Department of Commerce

NC DOC has numerous grants that can be applied to infrastructure, such as the Community Development Block Grant (CDBG) and multiple job and economic development grants. A lot of their grant funded leans toward job creation, so it would have to be shown that any new greenway would develop jobs in the area.

Duke Energy Foundation Grants (can be used for stormwater as well) (Water Resources Fund)

In September 2014, the Duke Energy Foundation announced a $10 million fund for projects benefiting waterways in the Carolinas or immediately downstream of their operational facilities in Virginia, Tennessee and Georgia. The fund includes a $1.5 million designation for projects in the Dan River Basin Region that benefit waterways or help develop the economic and community vitality of the region.

Programs supported by the fund are science-based and research-supported and provide direct benefit to at least one of the following focus areas:

- Improve water quality, quantity and conservation
- Enhance fish and wildlife management habitats
- Expand public use and access to waterways
- Increase citizens' awareness about their roles in protecting water resources

Grants are for up to $100k and can be used for public use and access to waterways, as well as conservation of waterways. The grant Request For Proposals opens each fall.

John Rex Endowment

The John Rex Endowment supports an environment where children and families in greater Wake County live healthy lives. Guided by the belief that all children should reach their full potential, the John Rex Endowment works with the community to support the physical, mental, and emotional well-being of children.

The portion of funding that would be relevant to greenway development is the Healthy Foods and Active Living goal. The John Rex Endowment wants to assure Wake County children have opportunities for healthy eating and active living. Families need safe, reasonably priced, and convenient access to healthy foods and opportunities for physical activity.

Funding is awarded though a Request for Proposals process and Grants are awarded three times a year. Their website will be kept current with the dates for applications for grants. www.rexendowment.org

Blue Cross Blue Shield of NC Foundation

BCBSNC does not have a traditional grant cycle. They announce opportunities to apply for grant funding on a periodic basis. Their grants range from small-dollar equipment grants to larger, multi-year partnerships. They do not accept unsolicited applications and all applications must be submitted through their online system.

When grants are available, they will provide specific instructions and requirements.

Triangle Community Foundation (TCF)

This foundation has multiple grants that could be applicable to Zebulon. The Community Development grants are intended to improve access to opportunity for lower income families.

There is also a grant for Environmental Conservation. Triangle Community Foundation is investing in comprehensive and collaborative efforts to promote land conservation and sustainable land use. Specifically, the Foundation will provide funds to increase land conservation and its stewardship, build public awareness, understanding, and support of conservation through innovative programs.

TCF is using a web-based grant application. They have an online tutorial available for viewing.

GlaxoSmithKline's Ribbon of Hope

This is a one-time grant of $25,000 for projects that further science, health, and education in local communities. This grant can only be applied for by a community-based nonprofit group and it can not be used for construction.

Ribbon of Hope proposals will be considered that relate to the establishment and implementation of projects which:

- Tightly align with goals and objectives of local community agencies
- Demonstrate their sustainability after grant funds are expended
- Address critical community needs that have been identified through comprehensive needs assessment activities.

Applications are accepted in October and April. Applications are submitted through http://www2.mcrel.org/NCGSKFRibbonOfHope/index.asp

US Department of Agriculture (USDA) Rural Development Grants

There are multiple grants offered by the USDA that could be application to this master plan. One is the Economic Impact Initiative Grant. This grant can be used for street improvements. Grants of up to 75% of eligible project costs are available. The requirements of this grant are as follows:

- Applicants must be unable to finance the project from their own resources and/or through commercial credit at reasonable rates and terms
- Facilities must serve the rural area where they are/will be located
- Projects must demonstrate substantial community support
- Environmental review must be completed and determined to be acceptable
- Priorities are given to projects related to public health and safety, energy efficiency and education.

NC Wildlife Commission

As part of their mission, the North Carolina Wildlife Commission provides boating access across the state. The NC Wildlife Commission has experience building boat launches and access points of all different sizes, including kayak and canoe launches. These projects typically are funded by the state of North Carolina through fees collected from fishing permits and the sale of tackle.

The Wildlife Commission has partnered with communities in the past to help with the design and construction of boat launches and water access points. If after an evaluation it is determined that a specific project meets the goals and objectives of the Commission, they potentially could be in the position to provide design and/or construction assistance on the project.

Contact the NC Wildlife Commission Engineering Department at 919.707.0150

Summary

Depending on the specific project, one or a combination of funding sources may be needed to fund a project.

9 Design Guidelines

Photo-simulation of trail in sewer easement behind Weaver's Pond

Introduction

The Design Guidelines provide information for the following aspects of greenway implementation:

- General Design Considerations and Regulations
- Design Considerations in Special Areas
- Trail Design
- Trail Features
- Signage and Pavement Markings
- Amenities

Box Turtles along Trail in Cary, NC

General Design Considerations

In addition to connecting destinations, general design considerations for greenways include environmental protection, sustainability, permitting and compliance with Crime Prevention Through Environmental Design (CPTED).

Greenways as Environmental Protection

Greenways are used in environmentally sensitive areas as a protection or buffer, while also not endangering those areas. New greenway trails should not impact streams, endangered species, water supplies, forested areas, steep slopes or unique ecological features. As part of the trail system, the buffer that will be created will vary in size, but will mostly be in the 30-50 foot range. This gives enough of an area for the protection while also providing enough space for the trail user.

Sustainability

Stormwater management is an essential part of any trail design with the increase in impervious surface. Since the greenway acts a linear park, it is important to try and keep the stormwater management within the greenway buffer zone. Therefore, green techniques or low impact design (LID) features such as bio-retention, vegetated swales, or underground infiltration systems may be used to increase environmental sustainability while also increasing stormwater management awareness.

Stormwater Device along a trail

Permitting

All greenway trails will require permitting from multiple agencies such as:

- Wake County Stormwater Management (National Pollutant Discharge Elimination System General Permit)
- Wake County Floodplain Development Permit
- NC Division of Land Quality Erosion Control Permit
- Town Building Permit (for structures)
- North Carolina Department of Transportation Encroachment Permit (other agency encroachment agreement permit may be required)
- FEMA Conditional Letter of Map Revision (CLOMR)/FEMA Letter of Map Revision (LOMR)
- U.S. Army Corps of Engineers Section 401/404 Permit, Pre-Construction Notification (PCN) Permit
- NEPA Environmental Documentation (if federally funded project)

American Tobacco Trail - Durham, NC

Trail within Power Easement

NC55 Streetside Trail - Cary, NC

Design Considerations in Special areas

Stream buffers

The trails within stream buffers are located within hyper-sensitive environmental areas. Positive drainage must be kept and special NCDENR permits will be needed while meeting Neuse River buffer rules. The trail should try to follow contours as best as possible and vegetation removal should be minimized.

Trails within utility corridors

All trails located within utility easements must follow the utility's specific rules. These trails should be at least ten (10) feet to accommodate utility maintenance vehicles. Within sewer easements, the trail should be located at least ten (10) feet from any sewer manhole or equipment. Within power transmission line corridors, the trail must not be closer than 25 feet from any towers, poles, or guy wires.

Trail within Power Easement

Trails within Roadway Corridors

Trails will work best along roadways that have limited driveways. Trails should have a minimum width of ten (10) feet with at least six (6) feet between the trail and roadway. Any trail within NCDOT ROW will require an encroachment agreement. The location of the trail must follow the American Association of State Highway and Transportation Officials (AASHTO) Green Book requirements for roadside recovery.

Little River Park

Access points

The greenway trail system should provide adequate access from close-by neighborhoods, businesses, and industry. It is also important to include parking or congregation areas where users can enter the greenway trail system with ease. Trailheads and parking lots are good examples of well used access points. All access areas must follow Town of Zebulon standard planning and zoning guidelines.

Falls of Neuse Canoe Launch, Raleigh, NC - photo courtesy of Google Maps

Trail Design

Surfacing

Design practices for greenway trails include the type of surfacing for each project. Hard surfaces are used on trails to comply with the Americans Disabilities Act (ADA) guidelines for ease of access and use. Typically, greenway trails use asphalt surfacing. It is a smooth surface and easier on users than concrete. Asphalt requires more upkeep and maintenance than concrete, but far less than natural surface or grit trails. The life span of an asphalt trail is about 15 years and works well on areas with high slopes (over 3%).

Concrete may be a viable candidate in the more urban sections of the greenway system to keep the look and feel similar to other already established sidewalks. Concrete has a life span of almost 25 years, but is also more expensive than asphalt.

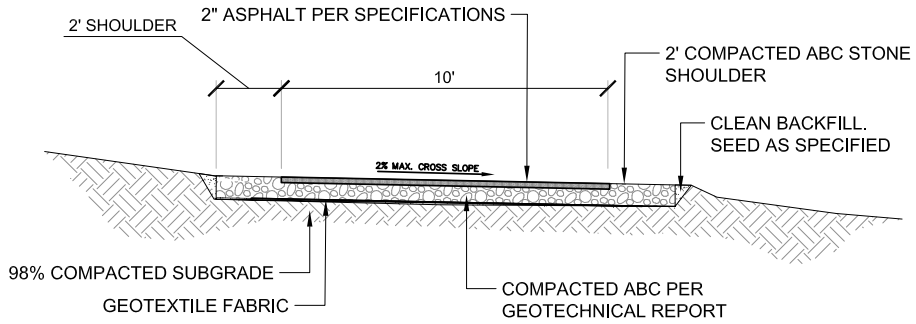
Gravel fines can be used for trails with a more stable slope. Natural surface or mulched trails are applicable if the intended use is mostly for walking or hiking. While less expensive to install, gravel, mulch, or natural surface trails require more maintenance and are more costly to maintain over time. These trails also have limitations of where they can be installed successfully.

All of these trails need to be installed in areas with very little slope and should not be installed in wet areas. If there is too much slope, the gravel, mulch, or natural surface material will wash away.

If the area is too wet, the trail will not provide a compact, safe surface for walking or riding bikes on and users will end up creating ruts that will require constant maintenance. If gravel, mulch, or natural surface trails are built, the detail should include geotextile fabric over a compacted subgrade to ensure stability and to limit maintenance.

Permeable paving also is an option, but does cost almost twice as much as asphalt and needs more maintenance (clean out trapped debris and erosion on a regular basis). On larger trail sections, a combination of materials can be used to provide both adequate facilities for bicyclists and walkers/runners.

Example of a grit path - Chapel Hill, NC



NOTES:
1. Cross slope direction varies. See grading / erosion control plans for direction of slope.
2. Shoulders to match cross slope of greenway trail.
3. Contractor is responsible for re-establishing all slopes disturbed by construction.
4. No utility surface covers/plates/manholes (ie. waterline valve covers, etc.) shall be located within trail and shall be a minimum of 2 feet from the edge of trail.
5. All trails shall be located minimum 5 feet from the back of curb.
6. Contractor responsible for performing a geo-technical investigation of trail corridor and modifying the above detail according to the direction of the report.

Typical Trail Section

Width

The width for any greenway trail should be a minimum of eight (8) feet and a maximum of twelve (12) feet depending on proposed traffic on the facility. Six to eight feet is typically used for smaller, neighborhood connections that are less in overall length, or to create a smaller section to use in an environmentally sensitive area. Ten (10) feet is recommended for most situations and is adequate for most trails and ADA compliant, as ADA would like to see at least five (5) feet in each direction.

Shoulders and Clearances

A minimum of two-foot (2 ft.) shoulders should be provided on each side of the trail. There should also be at least four (4) feet of clearance to any sign or obstruction. Clearance to overhead obstructions should be at least eight (8) feet while ten (10) feet is recommended.

Grades

Greenway trails should adhere to Americans with Disabilities Act Accessibility Guidelines (ADAAG) standards when possible.

The longitudinal slope should be a maximum of ten percent (10%). Cross slopes should be two percent (2%) to provide positive drainage. Safety railing of 48 inches should be provided where there are slopes of 3:1 or greater within 6 feet of the edge of pavement. On natural or mulched trails, the maximum slope shall be five percent (5%) and the minimum slope shall be two percent (2%) to allow for drainage.

Typical section

Trail foundation should be stable with a minimum of six (6) inches of stone base and two (2) inches of surface material. If vehicles may be used on the trail section, a stronger section will be needed.

Example of a grit trail - Cary, NC

ADA Compliance

It can be difficult sometimes to meet ADA requirements while designing and constructing greenway trails. The United State Access Board has approved ADA guidelines for greenways and outdoor routes. Prohibitive impacts include topography and slopes, environmental features, and local regulations. ADA compliance includes: hardened surface, clear tread width of 36 inches, cross slope of 2%, longitudinal slope of 5% (could be higher with resting areas), passing space every 1,000 feet where trail is less than eight (8) feet, pavement changes near curb ramps, accessible signage, and accessible facilities and amenities.

Crime Prevention through Environmental Design (CPTED)

It is the design intent to incorporate Crime Prevention Through Environmental Design (CPTED) principles into the design of any greenway trail. CPTED is a multi-disciplinary approach to deterring criminal behavior through environmental design. CPTED strategies rely on the ability to influence people's decisions prior to criminal acts being committed.

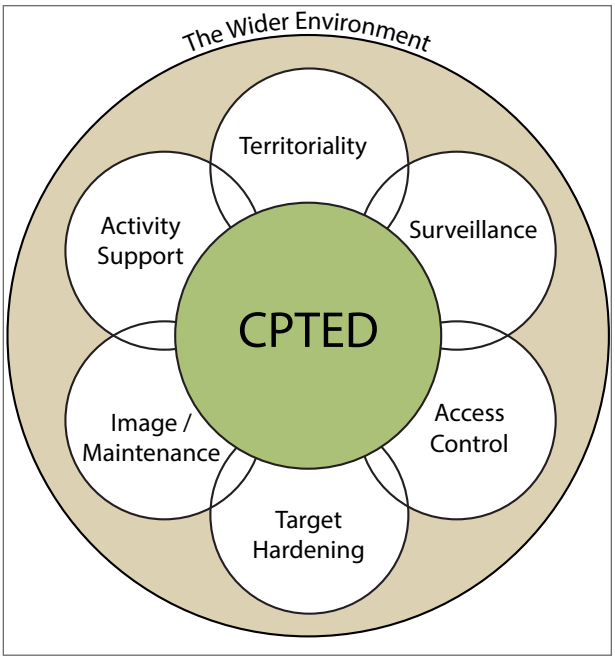
The design guide will be used where appropriate in this setting to further enhance the user experience and create a more safe condition. The four design strategies of CPTED- Natural Surveillance, Territorial Enforcement, Natural Access control, and Target Hardening - will be evaluated for applicability on any project.

Recommendations from staff, along with local citizens, law enforcement, and other relevant Town departments will be considered and incorporated into the design.

Natural Surveillance

This strategy is intended to increase the threat of apprehension by designing visible spaces and foster positive social interactions. It is also further developed by limiting access in order to create limited "escape routes". Some examples of design changes that reinforce this are:

- Design streets to increase pedestrian and bicycle traffic
- Create views of the trail from residences
- Use the landscape to highlight the trail
- Use passing vehicular traffic as a surveillance asset
- Use the shortest and least opaque fence possible



CPTED diagram

Territorial Enforcement

This translates to greenway design in creating a very clear delineation between public and private space. This promotes social control and creates a sense of ownership. Owners have a vested interest in spaces and are more likely to look after a space and report intruders to the police.

Natural Access Control

In order to reinforce natural access control, spaces should be designed to clearly differentiate between public space and private space. An example of a design concept is using a single and clearly identifiable public entrance.

Target Hardening

In greenway design, the element of target hardening most applicable is making sure the design does not create spaces for people to hide. For example, no large shrubbery or high fences are to be installed to hinder visibility.

Spur Trail along Speight Branch Greenway - Cary, NC

Lassiter Mill Historic Park Parking Lot - Raleigh, NC

Trail Features

Parking areas

For trails not located near existing public facilities (such as the Community Center), parking areas will be needed for users that do not live near the trails. Parking areas can be a multitude of surfaces with asphalt being the preferred standard and the areas should be well-lit.

Gravel or other non-hard surfaces can be used in locations with more environmental sensibility or lower expected use. These minor parking areas should have 5-10 parking spaces, with at least one (1) paved accessible space. The lots must meet ADA slope standards. Emergency access must be able to be maintained while vehicles are parked.

Trailheads

Trailheads are used for greenway trails that may have a larger population using the trail or are located in a dense area of use. Trailheads may include amenities such as bathrooms, bicycle parking spaces, trash receptacles, water fountains, dog waste stations, bicycle repair stations, and major greenway trail wayfinding signage. These areas should be well-lit. It will be typical for trailheads to have 10-30 parking spaces with at least two (2) handicap accessible spaces. Sidewalks should be provided from the edge of the lots to the greenway trail entrance.

Neighborhood Access

Some of the accesses to the trail system will be directly from neighborhoods or business areas. These points must be clearly signed as entrances to the trails. Width of the trail will be at least six (6) feet and eight (8) to ten (10) feet is preferred. If the intent is to serve nearby citizens, "No Parking" signs may be installed to keep the entrance limited.

Speight Branch Greenway - Cary, NC

Shared Access

Access points to trails should be located in areas where shared uses can occur, such as schools and existing parks and Town facilities. Where this shared access occurs, time and day usage must be balanced between the existing use and the trail. The shared use also allows for more parking and shared amenities and will act as de facto trailheads. Signage will be important as greenway trail access should be clearly identified and not interfere with existing use signage.

White Oak Creek Spur Trail - Cary, NC

Example of grass plantings on top of a retaining wall - Chapel Hill, NC

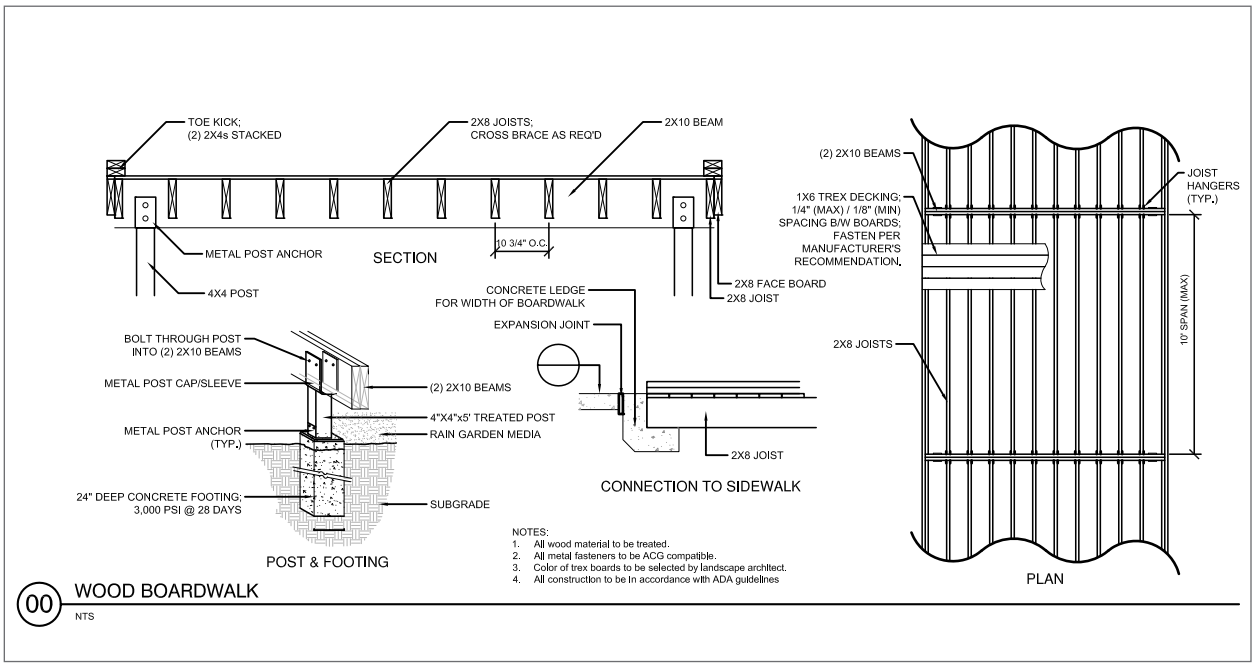
Vegetation and landscaping considerations

The removal of native vegetation should be limited within the greenway corridors. In highly forested areas, existing vegetation creates a balance to the corridor, preserves natural habitats, creates privacy screening, and stabilizes slopes and soils. Tree canopies also provide shade in warmer times of the year. Other vegetation can supplement the trail, but safety of the user must be a component of the design. Vegetation location must also meet all AASHTO sight distance requirements for trail usage, therefore, ground shrubs and tall grasses should be avoided.

Example of no-mow plantings - Chapel Hill, NC

Example of clear site lines - Durham, NC

Example of a planted stormwater feature - Chapel Hill, NC



Standard Boardwalk detail - this is one option for boardwalk design and is subject to change based on the specific project requirements. This detail is meant as a a basis for design. Where boardwalk height exceeds 30" a handrail will be required.

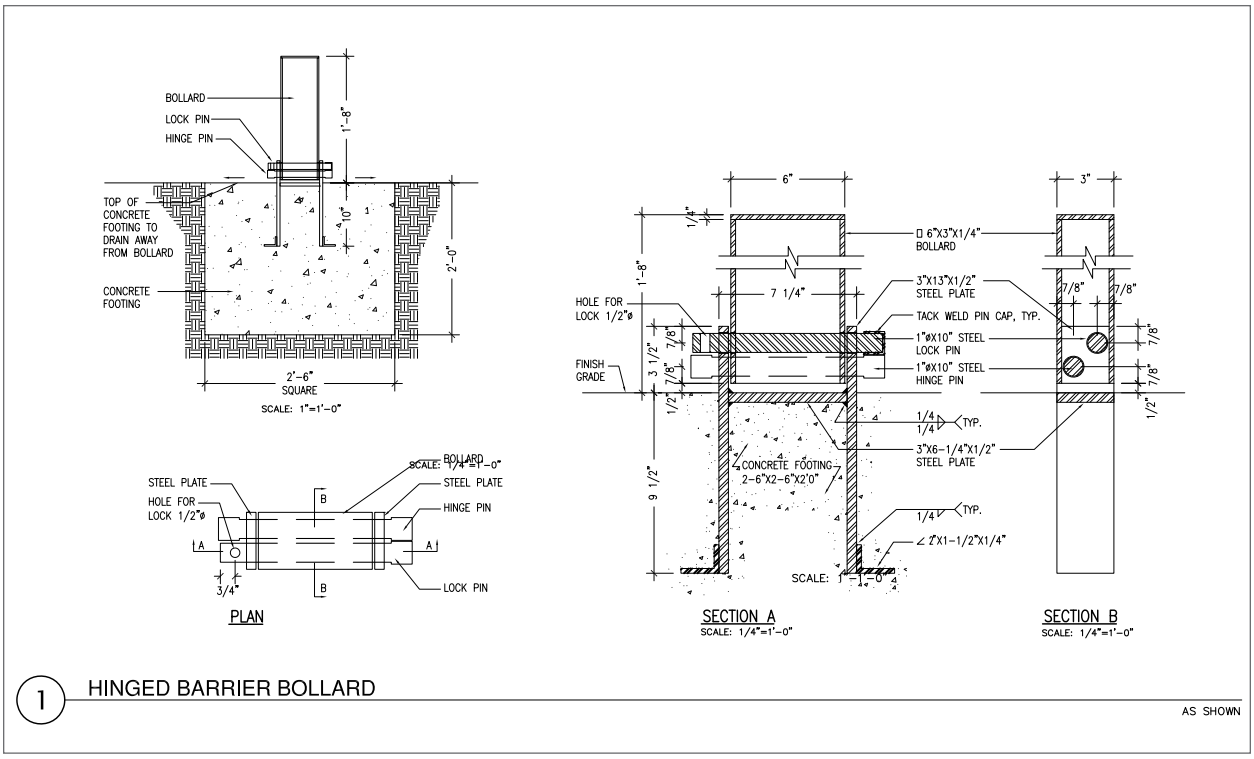
Boardwalks

Boardwalks are raised structures that should be used over environmentally sensitive or natural areas. These are typical for crossing smaller streams and wetland areas where the trail does not need to cross a floodway perpendicularly. The object is to reduce or keep flood elevations the same as before the trail was located there to create a no-rise situation. Boardwalks can be made of materials including wood, composite decking, or concrete. The material used depends on the up-front costs versus long term maintenance costs. Wood will be the lowest cost option at construction but the highest cost to maintain, while concrete will be a high cost at construction, but cost less cost to maintain.

Boardwalks should be at least 10 feet in width (where no railings are used) and up to 14 feet. Railings are required to be used on all boardwalk locations that are 30 inches above grade and the railings should be 42 inches in height. The minimum load capacity should be 15,000 lbs.

White Deer Park Greenway - Garner, NC

Bolin Creek Greenway Boardwalk - Chapel Hill, NC



1 HINGED BARRIER BOLLARD

AS SHOWN

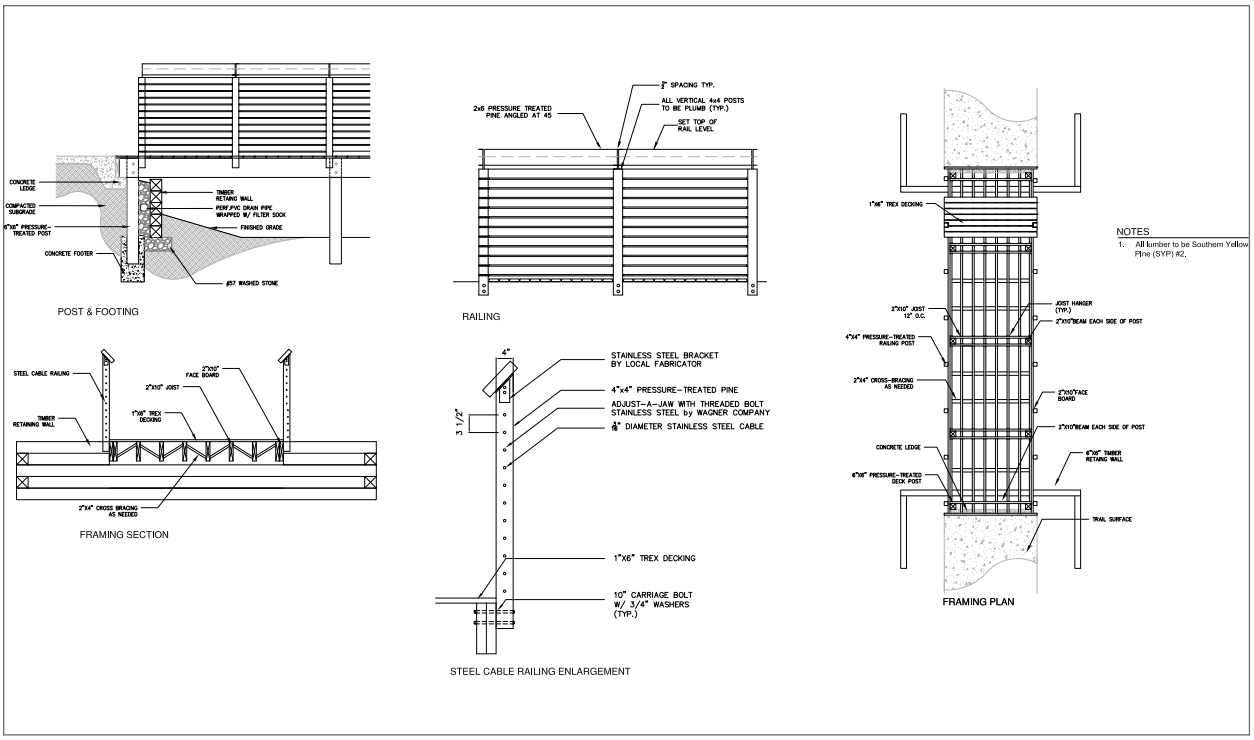
Standard Bollard detail - this is a minimum requirement and is subject to change based on the specific project. Drop bollard should be accompanied by additional stationary bollards or boulders to deter unauthorized vehicles from driving around it to access the trail.

Bollards

Bollards can be used as physical barriers to restrict motor vehicle access to the trails. These are typically used near roadway access and intersection curb cuts. Bollards should be used at all major access points, trailheads, parking areas, and shared use areas. Bollards should be a minimum of 40 inches tall and 4 inches wide. Setback from any roadway should be at least 20 feet and bollards should be at least 6 feet apart when more than one is used. Bollards should be a bright color such as yellow or bright orange. Locks should be used on bollards and only can be opened by authorized users, Town staff, and emergency staff.

Example of bollard with boulders - Raleigh, NC

Example of bollard - Chapel Hill, NC



Standard Wood Bridge Detail - this is subject to change based on project specific site requirements

Bridges

Bridges are used to traverse natural, wetland, and floodway areas where a culvert is not an option. They are also used to cross major highways.

The length and size of the bridges will depend on local conditions, such as FEMA floodway locations and elevations, environmental features, habitats, needed vehicle access, nearby connections, and highway width. There should be a smooth transition from the trail to the bridge, which may include the use of steel plates or a concrete approach.

Hinshaw Greenway Bridge over US1/64 - Cary, NC

Example of a low bridge - Chapel Hill, NC

Morgan Creek Greenway Bridge - Chapel Hill, NC

American Tobacco Trail Bridge - Durham, NC

Example of a wooden bridge - Garner, NC

Railing heights should be a minimum of 42 inches with a preference of 48 inches. Minimum overhead clearance is 10 feet and the opening between railing posts is 4 inches. All abutment and foundation designs should be completed and sealed by a licensed structural engineer. Bridges must meet all local and state permitting regulations, as well as FEMA where necessary.

Bridges also present a great opportunity for public art installations. These installations can create gateways and give corridors identity.

Potential locations for bridges that span highways in this master plan are US 64 at Parks Village Road and US 264 adjacent to the Walmart shopping center.

Example of a concrete bridge with corten steel handrails - Chapel Hill, NC

Example of a wood bridge with wood handrails - Chapel Hill, NC

Underpass - Chapel Hill, NC

Underpasses

Underpasses along a greenway trail require special attention. Without proper design and consideration, they can be seen as dark and scary places, resulting in limited use of that particular trail. The Zebulon system mostly has at-grade road crossings, but inevitably there will be the need for a safe passage under a road at some point in the system. With careful consideration, an underpass poses no additional safety risks relative to the rest of the trail. Ultimately, underpasses should be designed to feel as open and airy as possible, increasing the feeling of safety and comfort.

Underpasses shall be well lit. If possible, lights should be installed either on the walls or the ceiling of the underpass. The fixtures should cast enough light so as to avoid dark spots. If lighting is not a viable option, overhanging vegetation surrounding the underpass should be cleared in order to allow as much sunlight as possible to filter into the underpass.

In order to help with lighting in an underpass, walls and ceiling surfaces should be painted white or other light color, allowing light to reflect. Lighter colors also enhance the feeling of safety.

Underpasses should be a minimum of 10 feet wide and 12 feet tall, which allows for two people to pass comfortably. The larger an underpass, the more open and safe it feels. Each underpass will be different and should be designed on a case-by-case basis. During the planning process, underpass length, width and height should be studied in conjunction with lighting design to ensure the greatest sense of safety.

Trails should enter an underpass along a straight section of trail, rather than along a curve, in order to provide long sight distances. Being able to see the underpass from a short distance and being able to see through it as the user approaches enhances the safety and comfort of that underpass.

If a trail must have a curve at either or both ends of the passage, then large convex mirrors are recommended so that users can see what is in the underpass prior to entering it or beyond the underpass prior to or exiting it.

Maintenance is critical to the success of an underpass. Broken or burned-out lights are to be replaced immediately, trash should be picked up on a regular basis and graffiti should be removed as soon as possible. Light fixtures and other elements should incorporate vandalism-resistant materials. Light fixtures should be placed out of easy reach to discourage vandalism.

Underpasses are great opportunities for the inclusion of public art. Public art contributes to feeling of identity and ownership of the underpasses.

Underpass - Chapel Hill, NC

Underpass on Black Creek Greenway - Cary, NC

Underpass - Chapel Hill, NC

While most road crossings in the master plan will be at-grade, there will be a few places that may require an underpass. These areas include:

- Gannon Avenue at Little River Park (Wake County's proposed Little River Trail)
- US 264 at the Little River (Wake County's proposed Little River Trail)
- US 264 at Walmart (Corridor 2)
- US 64 at Parks Village Road (Corridor 2)
- Railroad bed near Five County Stadium and the sewage treatment plant (Corridor 5)

City of Raleigh Informational and Wayfinding Signage

Town of Chapel Hill Rules Signage

Signage

Signage is a key component to the success of a greenway system. It can play a variety of roles, including way finding, regulatory and interpretative. Signage also helps establish an identity for the greenway system, creating a familiarity for both new and regular users. System wide, signage should be consistent in both design and usage from trail to trail, including roadside implementations. To achieve this consistency, it is recommended that a signage master plan be developed prior to the installation of any signs. Consideration should be given to any town branding policy in effect.

Wayfinding

Way finding signs help to inform users about where they are in the system and how to get to specific destinations. These signs can take on many forms depending on the specific locations and objectives. Maps and identity signs can be used at entrances to the trails, while directional signage can be used along the route. Directional signage is extremely important for roadside routes that are not obvious (bike lanes, sharrows, sidewalks). Directional signage can take the form of arrows, text, simple symbology, or a combination of the three. Mile markers are another popular form of wayfinding signs.

Example of wayfinding signage - Chapel Hill, NC

Example of Wayfinding Signage - Cary, NC

Regulatory signage

This family of signage applies to traffic control along the greenway as well as along roads adjacent to greenway access points and crossings. Regulatory signs should be based on the Manual on Uniform Traffic Control Devices (MUTCD) standards. Regulatory signage also can be applied as pavement markings along the trail and at road crossings. These signs play a key role in the safety of users. Indicating to pedestrians and vehicles there is a road crossing, incorporating stop signs for greenway users, and indicating motorists are to share the road with cyclists are all examples of regulatory signage that increases the safety of all user groups.

Example of Interpretive Signage - Cary, NC

Informational signs

These signs communicate important information to greenway users. Types of information might include rules and regulations of the trails, hours of operation, safety guidelines or descriptions about points of interest along the trail. Informational signs should be installed at all trailheads, major access points, and at any specific features that the Town wants to highlight.

Interpretative signage

These signs are educational in nature and provide users with detailed information about special features of the landscape, environment, history or cultural significance of a particular site along the trail. Interpretative signs also can be combined with public art opportunities. Often times these signs are installed at overlooks or bump outs along the trail,

Example of Interpretative signage - Chapel Hill, NC

allowing trail users a clear path.

Design

All signage shall be constructed of durable, weather-resistant materials, chosen from a limited palette. Signs should be consistent in their design and color palette and they should complement each other. All signage shall be ADA accessible where appropriate, and no signs should impede movement along the trails. Special care should be taken to install signs at a pedestrian scale along trails and routes.

Example of concrete bike ramp/stairway - Chapel Hill, NC

Example of wood bike ramp/stairway - Chapel Hill, NC

Other Amenities

Greenways can also have additional amenities such as water fountains, benches, trash receptacles, recycling receptacles, bike racks, bike ramp/stairway at stairs, pet waste removal stations, and public art installations.

Site amenities such as pet waste stations, benches, trash receptacles, and recycling receptacles should be included at all trailhead locations at a minimum.

Bicycle ramps/stairways make it easier for users to walk their bicycles down stairwells. They can be as simple as a wood channel for bicycle wheels or channels can be formed into concrete stairs.

Public art can help with wayfinding, give an identity to a trail corridor, and foster ownership of a corridor by the community. Public art can be either completed by an artist or can be a joint effort between town staff and the community.

Examples of pet waste stations

Example of bench and trash receptacle - Cary, NC

Signage for retail areas

Example of Public Art - Chapel Hill, NC

10 Maintenance and Management

Rules Signage - Battle Branch Trail Chapel Hill, NC

Introduction

Greenway trails are public infrastructure and, similar to roads and sidewalks, have maintenance and management needs. These needs and the town's capabilities for maintenance should be considered during the planning and design phase. Greenway trails do not require daily ongoing management. As trails are built, funding to address maintenance should be included in town budget considerations.

Trails will require features in order to enhance the user experience, insure the safety of users, provide privacy and security to surrounding and adjacent properties, and/or improve the durability and life of the greenway trail. These features and associated maintenance will be considered during the design and planning process.

Gate rules signage - Cary, NC

Operational Rules and Regulations

The operational rules for the Zebulon Greenway are based on the rules for the City of Raleigh's Capital Area Greenway Trail System.

- Obey posted rules and regulations
- Trail hours are from dawn to dusk
- Speed limit on trails is 10 mph
- Consumption of alcoholic beverages is prohibited
- Motorized vehicles are prohibited on greenways
- Fires are prohibited on greenways
- It is prohibited to remove, destroy, or damage any plant life or property
- Pets must be on a leash no greater than 6 feet
- Owners must remove pet waste
- It is prohibited to kill, trap, or harm wildlife
- Swimming in Town ponds is prohibited
- Horses are prohibited on trails
- All trail users under the age of 16 are required to wear a safety helmet when using a bike, skates, scooters or any other non-motorized vehicle
- Smoking is prohibited in Town parks and greenways
- Weapons prohibited except those permitted in NCGS 14-415.23
- Camping is prohibited in Town parks and greenways
- Bicyclists, skaters, and skateboarders should approach pedestrians cautiously and pass on the left
- All users, including pets, should remain on the right side of the trail except when passing
- Bicyclists, skaters, and skateboarders must always yield the right of way to pedestrians
- Patrons should be aware of their surroundings on the trail
- The use of headphones is discouraged
- Patrons are encouraged to walk or jog with a companion
- Hide your belongings, lock your car, and take your keys

Maintenance Procedure and Implications

Neglecting routine maintenance eventually may render facilities unusable and such deteriorating facilities may become a liability to the Town . Users should be encouraged to report facilities that are in need of maintenance.

A central contact person who can authorize maintenance work should be designated to receive such reports. A smooth surface, free of potholes and debris, should be provided on all greenways, sidewalks, and bikeways. Glass, sand, litter and fallen leaves often accumulate on bike lanes, paved shoulders and shared use paths; therefore, regular debris removal is desirable. Pavement edges should be uniform and should not have abrupt drop-offs. Signs and pavement markings should be inspected regularly and kept in good condition and, if determined to be no longer necessary, promptly removed. Highways with bicycle traffic may require a more frequent and higher level of maintenance than other highways.

For shared use paths, attention should be given to maintaining the full paved width and not allowing the edges to degrade. Trees, shrubs and other vegetation should be controlled to provide adequate clearances and sight distances. Trash receptacles should be placed and maintained at convenient locations. Seeded and sodded areas in the vicinity of shared use paths should be mowed regularly. Snow plowing should be used to remove snow from bikeways because de-icing agents and abrasives can damage bicycles. Also, enforcement is often necessary to prevent unauthorized motor vehicles from using a shared use path.

Fence along greenway - Cary, NC

Retaining Wall at the Art Museum - Raleigh, NC

Design Considerations

In addition to connecting destinations, design consideration for greenways as well as other bike and pedestrian improvements are dependent on existing conditions and potential use. Significant considerations include user safety, relationships to adjacent properties and impact on the environment. Design also will influence maintenance requirements.

Defining Edges

Important to the experience of the user and protection of adjacent properties is a clear demarcation of the trail edge or limits of the public greenway space. This can be accomplished through the use of built elements such as fences, walls and railings as well as vegetation, and the manipulation of topography. Defining this edge will help provide visual separation, discourage the creation of unauthorized trail connections, protect the user from drastic changes in grade, and preserve sensitive creek banks and other environmentally sensitive areas. Use of these features should not create obstacles to trail surveillance.

Chicanes may be designed separated from the curb face to create a bicycle bypass and/or to allow water to continue draining along a gutter pan, but this may require maintenance to remove leaf matter and other debris build up.

Consideration also can be given to adjusting lane widths and providing wider outside curb lanes for bicyclists during restriping operations. The addition of edge lines can better delineate a shoulder, especially at night.

Drainage and Erosion Control

Accommodating and managing natural drainage patterns and preventing erosion is critical to the management of a trail. Typically, drainage and erosion control features can include low impact solutions such as vegetated swales that encourage infiltration as well as engineered solutions and underground systems. Low Impact Development (LID) systems typically fit into the trail corridor seamlessly.

To minimize erosion and drainage concerns it is best for the trail to follow the contours of the land. Pipes conveying storm water under the trail should be adequately sized.

A cross slope of 2% across the trail surface is ideal with a 1:6 shoulder slope.

All facilities will need to be maintained as directed by the NCDENR manual. Grassed swales will need to be kept mowed and the compacted ABC shoulders replenished as necessary.

Paved Trails

Whether paved or unpaved, all trails will require regular maintenance practices to include removal of leaves and debris, mowing of lawns and pruning of vegetation to keep the trail clear. Any potholes, cracks, and bumps in the pavement will need to be repaired as necessary.

Mixed surface trail - Cary, NC

Black Creek Greenway - Cary, NC

Unpaved Trails

Unpaved trails typically require more maintenance. In additional to the typical maintenance required for paved trails, unpaved trails will need to be replenished frequently as the material moves or washes. The edges of the trail will need to be defined regularly. Storm water features are to be designed to divert the flow of water across the trail where possible in order to prevent the surface from washing.

Pavement

Maintaining smooth pavement surfaces make for a pleasant bike ride or walk. A street can have all the ideal characteristics of a bicycle boulevard, but miss on one important detail: pavement quality. Pavement in poor condition, including potholes, embedded objects such as abandoned railroad tracks, and debris, make for an uncomfortable and potentially dangerous journey. Inattention to pavement quality and debris can reduce the bicycle boulevard attractiveness and effectiveness. Bicycle boulevards must be kept in good condition, with a smooth riding surface. Many cities have maintenance schedules for resurfacing and rehabilitating road surfaces.

When possible and appropriate, prioritize these maintenance activities on the bicycle boulevards and trails. Pavement markings will wear over time and and should be accounted for in the maintenance budget.

Trailhead landscape - Cary, NC

Several communities with bicycle boulevards have partnered with local residents to help maintain these features. When shoulders are resurfaced, a smooth surface suitable for bicycle riding should be considered.

All facilities, including sidewalks and trails, require regular maintenance to reduce the damage caused over time by the effects of weather and use. However, many maintenance issues can be reduced if properly addressed in the planning and designing phases before construction even begins.

Maintainted lawn along Speight Branch Greenway - Cary, NC

Proper maintenance is essential to promote user safety, to ensure ease of access, and to encourage the use of a designated route. The implementation regulations under Title II of the Americans with Disabilities Act requires that all features and equipment are required to be accessible and to be maintained in operable working condition for use by individuals with disabilities (U.S. Department of Justice, 1991a).

Landscape

Native or other low maintenance plants are recommended to reduce maintenance.

Even low maintenance, native plant material may still occasionally require watering and/or sweeping, particularly as plants become established. Cooperative agreements may be formed with nearby residents and business owners to provide for minor maintenance activities such as watering and pruning.

Ensure that signs are not obscured by vegetation through regular monitoring and maintenance.

Maintenance Issues and Strategies

Accessible designs are useless if maintenance is neglected and sidewalks and trails are allowed to degrade to a state where they cannot be used or must be avoided during travel. Frequently identified roadway safety and sidewalk design problems include:

- Sidewalk and trail surfaces in poor repair, such as uneven or broken concrete and slabs uplifted by tree roots; and
- Lack of regular maintenance, including overhanging trees and excessive snow on sidewalks.

Maintenance strategies should be included in the preliminary planning stages of new construction and alterations. Maintenance plans should also address existing facilities. The extent and frequency of maintenance schedules will vary greatly depending on the location, amount of use, and resources available. It is recommended that a plan be developed that clearly specifies the frequency of maintenance activities and how reported maintenance concerns will be addressed.

Sidewalk - Cary, NC

Assessment techniques

In order to maintain passable conditions, current and potential problems must be identified through an objective assessment process. There are many methods available for identifying maintenance needs on existing sidewalks and trails. For example:

- The Sidewalk Assessment Process (SWAP) records and prioritizes maintenance needs on sidewalks
- Pedestrians may identify and report maintenance problems and
- A Town may establish an improvement program that identifies sites requiring improvements, access, or maintenance.

For a maintenance program to be effective, it must identify conditions that can impede pedestrian access and quickly respond with prompt repairs. Any citizen complaints reported should be given first consideration for improvement or repair if the reporting involves a safety or access issue.

Maintenance Issues

Inspectors should look for conditions likely to inhibit pedestrian access or cause injuries. The following list of common sidewalk and trail maintenance problems was generated from promotional material created for homeowners by the Bureau of Maintenance in the City of Portland, Oregon (1996) and the Division of Engineering for the Lexington-Fayette County Urban Government (1993):

- Step separation - A vertical displacement of 13 mm (0.5 in) or greater at any point on the walkway that could cause pedestrians to trip or prevent the wheels of a wheelchair or stroller from rolling smoothly;
- Badly cracked concrete - Holes and rough spots ranging from hairline cracks to indentations wider than 13 mm (0.5 in);
- Spalled areas - Fragments of concrete or other building material detached from larger structures;
- Settled areas that trap water - Sidewalk segments with depressions, reverse cross slopes, or other indentations that make the sidewalk path lower than the curb. These depressions trap silt and water on the sidewalk and reduce the slip resistant nature of the surface;
- Tree root damage - Roots from trees growing in adjacent landscaping that cause the walkway surface to buckle and crack;
- Vegetation overgrowth - Ground cover, trees, or shrubs on properties or setbacks adjacent to the path that have not been pruned can encroach onto the path and create obstacles;
- Obstacles - Objects located on the sidewalk, in setbacks, or on properties adjacent to the sidewalk that obstruct the passage space. Obstacles commonly include trash receptacles, utility poles, newspaper vending machines, and mailboxes;
- General Safety - Any safety issue that an inspector believes should merit attention;
- Blocked drainage inlets and inadequate flow planning;
- Temporary construction interruptions; and
- Inadequate patching after utility installation.

Crosswalk with standard MUTCD signage - Cary, NC

Example of a well maintained greenway - Cary, NC

Maintenance responsibilities

Although sidewalks and trails are usually elements of the public right-of-way, some Town charters assign the responsibility for upkeep to the owner of the adjacent property. Town charters commonly specify that the Town cannot be held liable for any accidents or injuries incurred due to sidewalk conditions.

When homeowners and businesses are responsible for sidewalk maintenance, they are allowed to decide whether to hire a contractor, perform repairs on their own, or have the Town do the repair. Homeowner associations in some neighborhoods address right-of-way maintenance as a group to minimize the cost to individual members. In some areas, the Town will subsidize property owners for sidewalk repairs. Local laws may also dictate whether or not a homeowner must hire a professional contractor to undertake sidewalk repair. Regardless of the approach for sidewalk maintenance, municipal inspectors should review and approve all repairs to guarantee that the improved sidewalk meets pedestrian access needs.

Information maintenance

In addition to maintaining the physical characteristics of sidewalks, agencies should also maintain signs, signals, and other information regarding crossing construction and general pedestrian facility conditions. Periodic reassessment of sidewalks should be conducted to verify that conditions have not changed. Assessment data should also be verified after a catastrophic event, such as a flood or a hurricane.

Signs should comply with Manual on Uniform Traffic Control Devices (MUTCD) and ADAAG specifications. In general, signs also should be re-evaluated periodically and replaced when age and weathering reduces legibility. The design of the sign and signal should consider the information that is being displayed, as well as actions taken to reduce theft or vandalism. Signs should be removed or replaced when messages are no longer needed, the content of the information has changed, or information is not being provided for people with visual impairments. Signage programs that use consistent designs throughout the bicycle/pedestrian network keep expenses for sign replacement at a minimum.

Citizen reporting

Those responsible for sidewalk maintenance should provide users with a convenient means to report sites in need of maintenance. The following techniques have been used successfully by a variety of municipalities to obtain maintenance input from users:

- Publishing a comprehensive maintenance guide with easy to follow guidelines that highlight the local maintenance goals and procedures;
- Using mass mailings for requesting a repair. For example, the Maine Department of Transportation's "Spot Me" program sends residents a postcard asking for small repair/improvement suggestions along bikeways. This type of a program could also be used to improve sidewalk access;
- Using additional signs or adhesive stickers with QR codes attached to existing signs, to instruct pedestrians on how to submit maintenance/improvement requests;
- Periodically placing information flyers in local newspapers; and

Example of SeeClickFix Application

There are also options for applications for smart phones where users can report a maintenance issue directly from their smart phones. Both the City of Raleigh and the Town of Wake Forest utilize the See Click Fix App for this purpose. This App is beneficial as it makes it even easier for the community to report issues.

Volunteer Programs

Greenway Volunteers are an excellent way to not only patrol the trail system, but also get citizens involved in the maintenance and management of each trail. The Zebulon Police Department can partner with the Parks and Recreation Department to coordinate a Volunteer Program for the safety, security, and protection of greenway users, park resources, and the surrounding natural areas.

Any citizen interested in helping keep a watchful eye on our growing greenway trails by reporting back to Parks officials any breach in safety, security or maintenance concerns is invited to apply to become a Greenway Volunteer. The Volunteers will also help guide users around the trail system and offer services to enhance the user experience.

To become a Greenway Volunteer, you must be:
- At least 18 years of age
- Have no felony or Class A misdemeanor convictions
- Submit to a criminal background check
- Have basic knowledge of the Greenway system

obs landscape architects

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