

CHAPTER 6: GREENWAY & TRAILS

A. Overview

The Town of Cary envisions its greenway network as an emerald necklace that ties together the community's parks, neighborhoods, schools, cultural sites, and business districts. In the nine years since the approval of the previous 2003 *Parks, Recreation and Cultural Resources Facilities Master Plan*, the Town has begun to achieve that vision of connectivity. The current greenway network has now grown to over 62 miles of trails. Where the Town's greenway program once consisted of a series of isolated segments, it is transforming into a system of trails.

The 2003 Master Plan also articulated the importance of environmental stewardship in the development of the trail network. Cary has applied sustainable design practice throughout all of its trail projects to maintain open space, wildlife corridors and habitat, use of native vegetation, and effective erosion control measures. Many of these practices have been incorporated into the Town's greenway design standards and will be implemented in future designs. With regard to design standards, this plan re-articulates Cary's commitment to the application of American Association of State Highway and Transportation Officials (AASHTO) and Americans with Disability Act (ADA) design standards.

Although the Town has shown a commitment to greenway construction that rivals any other community in North Carolina, the citizens of Cary continue to demand greater connectivity and linkage to other communities, as well as to other regionally important trail systems. This is due in large part to Cary being the central jurisdiction within the Triangle Area. As such, the Town of Cary plays a crucial role in connecting regional, statewide, and national trails.

Given the popularity and level of interest in greenways within Cary, considerable effort was made to provide opportunities for Cary citizens to assist with the update of the Greenways Plan. The 2012 ***Parks, Recreation, Cultural Resources (PRCR) Master Plan*** Update includes statistically-valid surveys, focus group meetings, a Greenway Summit meeting with adjacent jurisdictions, and close coordination with the Cary Greenway Committee to develop revisions and recommendations for the Greenway Plan.

These components are described in detail in the following sections:

- Summary Of Accomplishments of the 2003 *Greenways Plan*
- Key Findings
- Greenway Trail Network
- Greenway Trail Network Types and Standards
- Signage and Wayfinding
- Greenway Maintenance
- Special Facilities/Areas
- Public Art
- Recommendations

B. Summary of Accomplishments of the 2003 Greenways Plan

Following is a summary of accomplishments since the 2003 *Greenways Plan*.

- Completed approximately 50 miles of greenway and 8 grade-separated crossings.
- Near completion of the Black Creek Greenway. By the end of 2012 there will be a continuous trail from Bond Park to Crabtree Lake and Umstead State Park – a distance of approximately 7 miles.
- Completed the internal greenway connections within Bond Park, including the greenway kiosk “Hub” where both Black Creek and White Oak Creek Greenways intersect.
- Completed 5 miles of the ultimate 7 mile White Oak Creek Greenway. As part of this effort, have constructed or will be constructing important grade-separated crossings at NC 55, I-540, and at Green Level Church Road, and will be studying grade separations of the Durham-Southern RR and Davis Drive.
- Created a process to allow developers to receive credit for constructing greenways. To date, over 10 miles of greenway have been built at a value of over \$5 million. There are an additional 20 developer-built greenway projects that are to be constructed totaling 15 miles of greenway.
- Partnered with North Carolina Department of Transportation (NCDOT) on the construction of the 4.67 mile segment of the American Tobacco Trail within Chatham County.
- Town Council approved, in principle, support for use of Cary’s Greenways as part of the East Coast Greenway.
- Completed Cary’s first pedestrian crossing of a highway, with the installation of the Hinshaw Greenway pedestrian bridge over US 1/64 in 2007. It was also the first bridge structure to include public art.
- Successfully negotiated the construction of 4 greenway crossings of the I-540 Highway, currently under construction.
- Obtained over \$9.8 million in grant funding to assist the Town in designing and constructing greenways since 2003.
- The Town utilized some of the grant funding to complete the design of 5 greenway and stream restoration plans for major greenway corridors (White Oak Creek Ph V, Green Level, Swift Creek Greenway Ph III, Higgins Greenway Ph III, and Lower Williams Greenways).
- The Town was named a Bicycle Friendly Community (2003) and Pedestrian Friendly Community (2011)

C. Key Findings

The 2012 **PRCR Master Plan** update incorporates input from a statistically-valid survey, focus group meetings, a Greenway Summit meeting with adjacent jurisdictions, trail user counts, and close coordination with the Cary Greenway Committee to develop revisions and recommendations for the Greenway/Trails System section of the previous 2003 *Master Plan*. Most importantly, departmental staff along with input from Cary’s Greenway Committee reviewed the current process for developing greenways in Cary. The basic question, “What is working and what is not?” was asked. Below is a summary of those issues.

Key findings from the **Master Plan Survey** that may be used as guidance for the greenway program include:

- Adding new trails and expanding the greenway system was rated the top future funding priority across all infrastructure investment types.
- Greenways have the highest frequency of use at roughly 4 times a month versus 1.75 times per month for parks.
- 89% of the respondents indicated that the Town’s greenways and trails were the most important of current programs and facilities for their household. Trails also ranked 2nd in importance after parks.
- 84% of greenway users say that the current greenway system is completely meeting their needs.
- When asked what could be added, expanded, or improved over the next 5 to 10 years, 69% requested soft-surfaced trails and 65% requested hard surfaced trails.
- There were a number of comments regarding why respondents do not use parks, facilities, and greenways and one of the common comments was “*Many sections of trails/greenway are not connected.*”
- There is a strong desire for sustainable trail design, construction, and maintenance practices.
- In terms of specific areas within Town, respondents within the Downtown/Maynard Loop preferred hard surface trails (paved or concrete), Southern Cary (south of Highway 64 preferred soft surface trails (unpaved), and Central Cary (all other areas) preferred hard surface trails.
- In terms of importance, respondents rated the following:
 - Trail maintenance (83%)
 - Loop trails within parks (for fitness walking/jogging) (71%)
 - Trailheads (with parking, access to water, restrooms, etc.) (70%)
 - Trail connections within Cary (69%)
 - Signage and way finding on trails (69%)

Key findings from the **Greenway Summit** with Wake County and adjacent jurisdictions include:

- Surrounding jurisdictions have a variety of ways in which they categorize and prioritize their trails.
- Neighboring cities and towns are very interested in partnering to make regionally significant trail connections.
- Adjacent communities have had varying success and interest in placing trails along roadways.
- Most jurisdictions plan and build greenways along stream and river corridors.
- All jurisdictions defer to AASHTO standards for greenway trail design.
- Cost per mile for greenway construction ranges in these jurisdictions from \$500,000 to \$1.2 million.
- As greenway networks grow, parks and recreation departments are working closely with public safety departments to coordinate emergency response protocols.
- Funding remains the biggest challenge in completing municipal greenway networks.
- Maintenance of trails built within floodplains is challenging.
- Amenities like water, restrooms, and parking are becoming a higher priority now that large lengths of trail are on the ground.
- Cary is the only jurisdiction to use gates at greenway entrances; other jurisdictions use bollards or no barriers
- There is no consistency on the use of mile markers, with some jurisdictions marking some trails and not others and a variety of distance intervals in use. The ATT has two mile marking origination points, with Wake/Chatham mile markers originating at the southern end and Durham originating at the northern end.
- All jurisdictions want to coordinate connections across borders.

- Future Potential connections include the following:
 - Raleigh – Interested in the following connections: Crabtree Creek via Umstead State Park, Reedy Creek via Umstead State Park, Swift Creek from Garner through Lake Wheeler, Walnut Creek via Buck Jones, and Briar Creek via RDU into Cary.
 - Morrisville – Best opportunity to connect will be through the grant funded Crabtree Creek Greenway project. (Scheduled to begin in 2013.)
 - Apex – Most interested in meaningful connection to American Tobacco Trail (ATT). Specifically working with Cary on the White Oak Creek Greenway. Future opportunity will be the Middle Creek Greenway into Holly Springs.
 - Wake County – Recommended using Crabtree Creek Greenway as a hub. The trailhead and parking issues at Old Reedy Creek Road need to be addressed. Future continuation of ATT should be considered to the south to connect to Raven Rock via Harris Lake.

Key feedback from the **Greenway Committee** includes:

- Continue to prioritize the “spine” of the greenway system which includes the Black Creek and White Oak Creek Greenways. Any projects that improve or link to these trails should be prioritized with available funding.
- Prioritize system connectivity, particularly for those greenways that are either regional in scope or provide direct connection to schools and parks. Prioritize those greenways that will impact the greatest number of citizens.
- Prioritize budgeting those greenways that are designed but require additional funding to be constructed.
- Connecting to the American Tobacco Trail is a very high priority.
- Creating safe crossings for greenway users is a high priority. Either construct more grade-separated crossings or install traffic control devices approved in the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) like Rapid Flash Beacons and Pedestrian Hybrid Beacons (HAWK) for at-grade greenway crossings.
- The term “multi-use trails” as designated in the previous plan (greenways that run parallel to roadways) need to be reviewed.
- There is a lack of system (mile markers, GPS coordinates) for emergency response.
- Redesign pinch points that may exist in the greenway system.
- More trailheads are needed to access the greenways.
- More greenway connections into downtown are needed.
- Greenways should be designed with positive drainage to avoid the sheet flow of water which can cause maintenance and safety issues.
- Information regarding existing greenways on the Town’s web site needs to be updated.
- Although the new signs that have been designed are excellent, most of the older greenways are still not well-signed.
- Additional amenities (benches, trash cans) are needed along the greenways
- (the lack of) Lighting, especially in tunnels may need to be reconsidered

Key Findings from the Trail User Counts

In 2007, the Town of Cary’s Greenway Committee (comprised of citizen volunteers and individuals serving both on the Committee and the Parks, Recreation, and Cultural Resources Advisory Board) launched a program to measure greenway use during weekends. Counts are based upon a random sample of all greenway segments, providing a statistically-valid set of results. A goal at the outset was that this information would increase support for the overall program and help the Committee and Town

staff identify which facilities were well-used and which were not attracting patrons. These baseline measurements have been valuable benchmarks for setting future goals since these facilities will eventually link together to form a transportation network throughout the Town and with adjacent jurisdictions.

- Throughout the system, the median number of weekend users per hour is 11.35. This amount is the median for all segments, all time periods, and all temperatures.
- Total estimated usage on any given Saturday or Sunday for this system is 10,756 users and 1,118,285 weekend users over the course of a year. Given Cary's population, approximately 8% of residents use a facility every weekend day, and the typical Cary resident uses a facility 8 times on weekends during a year. Weekday usage adds to these levels.
- Use of the trails can be grouped into two classes: *metro* facilities, which attract users from throughout Cary and surrounding towns; and *neighborhood* facilities, which are primarily used by those who live, work, or shop in close proximity, generally within walking distance. Greenways designated as *metro* segments have a much greater usage than do *neighborhood* segments, with 44.42 users per hour, compared to 8.40 users per hour.
- For both types of facilities, locating a facility along or around a lake dramatically increases use. Providing parking and other trailhead amenities also increases usage, as do connections to adjacent single- and multi-family developments.
- Overall, walking was the most prevalent mode of travel, recorded for 39% of the users. Biking was second most popular, with 24%, and traveling-with-pet and running were tied at 15% each. The type of travel mode varied somewhat by facility class. *Metro* segments had higher usage by runners and bicyclists, while *neighborhood* segments had higher usage by walkers and traveling-with-pet. The greatest usage differences between *metro* and *neighborhood* facilities was for walking (37% vs. 45%) and bicycling (29% vs. 17%).
- There is a clear central preference for people to use the trails when temperatures are in the 60's F, with a usage level of 18.69 users per hour. Usage shows a smooth drop-off as temperatures increased or decreased, down to a level of just 6 users per hour when the temperature was 30°F or 90°F.
- There is little variation by time period or day, with most showing a median usage near the overall median of 11.35 users per hour. The notable exception is Sunday evening, when the median usage level increases to 15.28 users per hour.
- In terms of the most popular trails based on trail counts, these include:
 - Apex Lake Greenway (managed by the Town of Apex) stands alone with the highest usage, at 124.47 users per hour. Likely due to several characteristics: the Apex Lake Greenway is a circumferential greenway around Apex Lake, and is contained within the Apex Community Park; ample parking is provided, along with direct connections to an adjacent apartment complex; and a gazebo is located on the lake shoreline.
 - American Tobacco Trail and another that is part of the Black Creek Greenway represent the second group with usage between 60 and 70 users per hour. Demand for the Black Creek Greenway may be constrained by the lack of adequate parking.
 - The greenways and trails within Bond Park represent the next group of popular greenways with usage of 30 to 45 users per hour. This park has a lake with a boathouse and ample parking. It has been designed to be the central hub for Cary's greenway system. The last segment is part of the other *metro* greenway, the White Oak Greenway.

Key Findings from a Review of Current Greenway Development

- While considerable progress has been made on the development of a greenway system within Cary and use of the greenways has increased exponentially, this has placed emphasis on the missing segments or gaps. These gaps need to be identified and prioritized. While extensive construction has taken place, the majority of facilities are short and not well-connected. This separation reflects the pace and location of new residential developments on former farmland. The Town is actively filling in the gaps between developer-built greenways and is extending the system into older areas of town. However, available funding levels and the lingering difficulties in securing new easements have slowed implementation of a unified system.
- In addition to path fragmentation, the Town faces the challenge of a lack of public awareness regarding the greenway system. Many of the constructed greenways, trails, and paths do not have signage.
- With the increase in trail mileage within Cary, trails are becoming increasingly challenging to maintain. The greenway system needs to be evaluated with regard to comprehensive renovation and maintenance requirements.
- The greenway system needs to be re-evaluated in the context of being a multi-modal compliment to the current transportation assets of the Town. This is particularly true with the development of street-side trails or trails adjacent to roadways. Issues with these include:
 - They are difficult and expensive to construct due to proximity to the roadway.
 - There is an issue regarding budgeting of sidewalks versus street-side trails. The current sidewalk budget does not include the cost to construct street side trails. If there is a request to construct a sidewalk along the same route as a street-side trail is proposed, then the Town will proceed with the sidewalk project. Street-side trails are wider than sidewalks, and consequently more expensive. A new budgeting process is needed to allow for the construction of street-side trails.
 - Given the proximity to roadways there is an issue how best to sign street-side trails as part of the overall greenway system.
- There is continued concern regarding the crossing of greenways on roadways and defining the type of crossing required (at-grade or grade-separated) and improving the process for how they are built.
- There is an issue with future segments of Cary greenways that extend outside the Town’s jurisdiction. In some cases, these segments are considered a high priority by the Town but will not likely be built by the adjacent community in the near future.
 - Continued coordination is needed with Raleigh, Apex, Holly Springs, Morrisville, Durham, and the Research Triangle Park to link to their respective trail systems.
 - There is a lack of trail connections to the American Tobacco Trail.
 - There are an insufficient number of trailheads at strategic locations around the growing greenway system forcing the general public to park alongside of roadways causing unsafe conditions.
- There is a lack of support systems in place along Cary greenways for emergency responders.

Key Level of Service Analysis Findings

The effectiveness of greenways can often be measured by the ability of community residents to access the facility. Access to greenways can be influenced by their geographical location, as well as design considerations which accommodate different user types (i.e., pedestrian, bicyclists, etc). Similarly, “walkability” can be described as the ability of Cary residents and visitors to access destinations in Town

by foot or by non-motorized transportation such as bikes. Various metrics used to quantify both accessibility and walkability of a greenway network can generally be summarized as a network's Level of Service (LOS). For the purpose of evaluating Cary's greenway LOS, the area within ½-mile of a greenway is defined as the **trailshed**.

- According to the Trail Access Analysis, Perspective Map E (see Chapter 4 and Appendix G):
 - 24 trail networks were identified totaling over 60 miles.
 - 63% of Cary's land area is within a trailshed (½-mile of a trail).
 - 73% of parks and recreation facilities and providers fall within a trailshed.
- Cary ranks 4th in number of trail miles per 1,000 residents in the benchmarking analysis. (See benchmarking section of **Chapter 3** for more information.)

The Greenway element of the PRCR Master Plan is one of a number of planning documents that contain language to support pedestrian activity in the Town. These documents recognize the value of a comprehensive pedestrian circulation system and address both the needs of walkers who are headed to a particular destination as well as creating destinations along pedestrian pathways. They also consider linkages within the system and the needs of the commuting pedestrian. The policy statements are clear in their intent. In addition, the plans collectively recognize the role of pedestrian facilities in establishing and supporting the desired land use patterns for Cary. Goals they have in common include:

- ◆ Planning for a multi-modal transportation system which includes automobile, pedestrian, bicyclist, handicapped, and transit
- ◆ Considering and taking advantage of opportunities to improve pedestrian facilities and access in concert with or at the same time as thoroughfare improvements
- ◆ Providing alternative transportation linkages among existing greenways, on-road bikeways, and sidewalks to key destinations within the Town
- ◆ Using greenways adjoining many roads in the area
- ◆ Developing a variety of trail types that reflect the current diversity of trail users
- ◆ Development should be pedestrian friendly with the ability to walk to transit connections
- ◆ Development should focus on mixed-use, higher density developments, and traditional neighborhood development (TND), all of which are enhanced by a well developed pedestrian access system

This chapter has been written to address these findings in planning, constructing, and maintaining a highly functioning greenway network.

D. Greenway Trail Network

The planned Greenway Trail Network has evolved since 2003 to include approximately 205 miles. This includes approximately 144 miles of greenways, 55 miles of street side trail, and eight miles of sidewalk connectors. This plan is the result of four years of progressive decision-making by the Town of Cary with regard to pedestrian planning.

Primary Corridors – **Table 9** details key trail connection corridors that link parks, schools, cultural and business centers, open space, other trails, and adjacent jurisdictions. The corridors have been identified to provide a vision and framework to guide the development of the overall greenway network. Each corridor has been defined by its beginning and ending destinations. The table illustrates the robust

number and diversity of connections each corridor provides. (Also see Greenway/Trails Recommendations Map at the end of this chapter.)

Table 9: Primary Greenway Corridors

Greenway Corridor	Length of Trail	% Complete	Parks	Schools	Neighbor-hoods	Other Trails	Open Space	Town Property
	(Miles)		Within 1/4 Mile	Within 1/4 Mile	Within 1/4 Mile	Within 100 Feet	Adjacent Parcels/ Acreage*	Adjacent Parcels/ Acreage*
1 - Umstead to ATT	14.06	78.0%	17	5	99	13	16 / 643.8 Acres	35 / 686.3 Acres
2 - RTP to Middle Branch	25.47	25.3%	16	7	116	27	6 / 24.3 Acres	20 / 693.2 Acres
3 - Umstead to Hemlock Bluffs	12.22	20.5%	9	1	69	9	5 / 45.4 Acres	22 / 125.1 Acres
4 - Downtown to Raleigh	4.29	7.7%	6	3	65	3	1 / 5.5 Acres	17 / 23.8 Acres
5 - Crabtree to ATT	12.96	7.7%	7	2	44	16	7 / 72.2 Acres	2 / 114.5 Acres
Combined Corridors	69.0	29.6%	34	16	340	57	35 / 777.8 Acres	93 / 1,329.9 Acres

Cary is the central jurisdiction within the Triangle Area. Cary also plays a crucial role in connecting regional, statewide, and national trails. Cary is bounded by Jordan Lake to the west, Durham to the north, Raleigh to the east, Research Triangle Park and Morrisville to the north, and Apex and Holly Springs to the south. Each of these jurisdictions has growing greenway networks themselves. Important connections include the following.

American Tobacco Trail – The American Tobacco Trail (ATT) is an over 22-mile trail that runs north/south from downtown Durham to New Hill. An important missing link in the trail, the ATT bridge over I-40, will be completed by winter of 2012. With this segment in place, one of the Triangle’s major bicycle and pedestrian corridors will be in place. The ATT has been designated as part of the East Coast Greenway, a vision for a 3,000 mile trail that links Maine to Florida. Cary’s planned connections to the ATT occur at White Oak Creek Trail (via Apex), Morrisville Parkway Trail, Montvale Greenway, and Panther Creek Greenway. However, at this time there is no direct connection between the Cary greenway network and the ATT.

East Coast Greenway – The East Coast Greenway is similar to the Appalachian Trail, but is envisioned to be a predominantly off-road trail suitable for bicycles and walkers. The routing of the East Coast Greenway leaves the ATT and connects with Cary’s White Oak Greenway. While Cary has invested in the design of this connector, the project is within Apex’s jurisdiction. Discussions are ongoing regarding this connector. Alternative connection points to the ATT should be investigated. These may include connecting from White Oak Trail north along Batchelor Branch Trail and selecting a route west to the ATT or designing a route from the terminus of White Oak Trail to connect with the planned trail through Raftery Park.

The East Coast Greenway Route follows White Oak Creek Greenway east to Black Creek Greenway, which continues north to Lake Crabtree and Umstead State Park. In addition to the Apex connection there are several other gaps in this “spine” route through Cary, including;

- White Oak Creek – MacArthur Segment – .37 Miles
- Black Creek Greenway – Hampstead Segments – .6 Miles (under construction)
- Black Creek Greenway, Phase V – Dynasty Segment – .25 Miles

With these gaps completed East Coast Greenway users from all of the country will be routed through Cary on their way through North Carolina. Ultimately this route may provide opportunities for businesses to support these visitors with hotels, restaurants, and outfitter services.

Mountains-to-Sea Trail – The Mountains-to-Sea trail runs from Murphy in the very western part of the state to Manteo on the coast. This trail is envisioned to be predominantly a hiking trail similar to the Appalachian Trail. Cary connections to the Raleigh greenway system will enable users to also connect to the Mountain to Sea trail.

E. Greenway Trail Network Types & Standards

Chapter 8 of the previous 2003 *Parks, Recreation, and Cultural Resources Facilities Master Plan*, on Greenway trails, included eight trails types. While these categories were certainly comprehensive, they led to confusion when describing the overall trail network. A point of particular confusion arose around the term “Multi-Use Trail” for trails that run parallel to streets. “Multi-Use Trail” is the term most commonly used by the Federal Highway Administration, bicycle and pedestrian professionals, and state departments of transportation for paved trails that accommodate a wide variety of trail user types. As the Town regularly seeks state and federal funding for trail projects, the use of the term “multi-use” should be consistent with common professional nomenclature. In order to simplify trail categories, the following three types will replace the previous seven designations.

- **Greenway Trail** – Refers to a 10’ wide, paved multi-use trail, typically located in a natural or green setting. “Greenway Trail” replaces “Secondary Greenway” and “Primary Greenway.”
- **Street-Side Trail** – Where greenway trails are not feasible, sidewalks and bicycle-friendly roadways are recommended as “Street-Side” trails, in order to preserve overall connectivity. These types of trails provide local residents with safe routes to connect to and from separate trail heads and other destinations not served by greenway trails. Street Side Trails include the previous categories of “Multi-use Trail” and “Sidewalk Connectors” from the 2003 Plan.

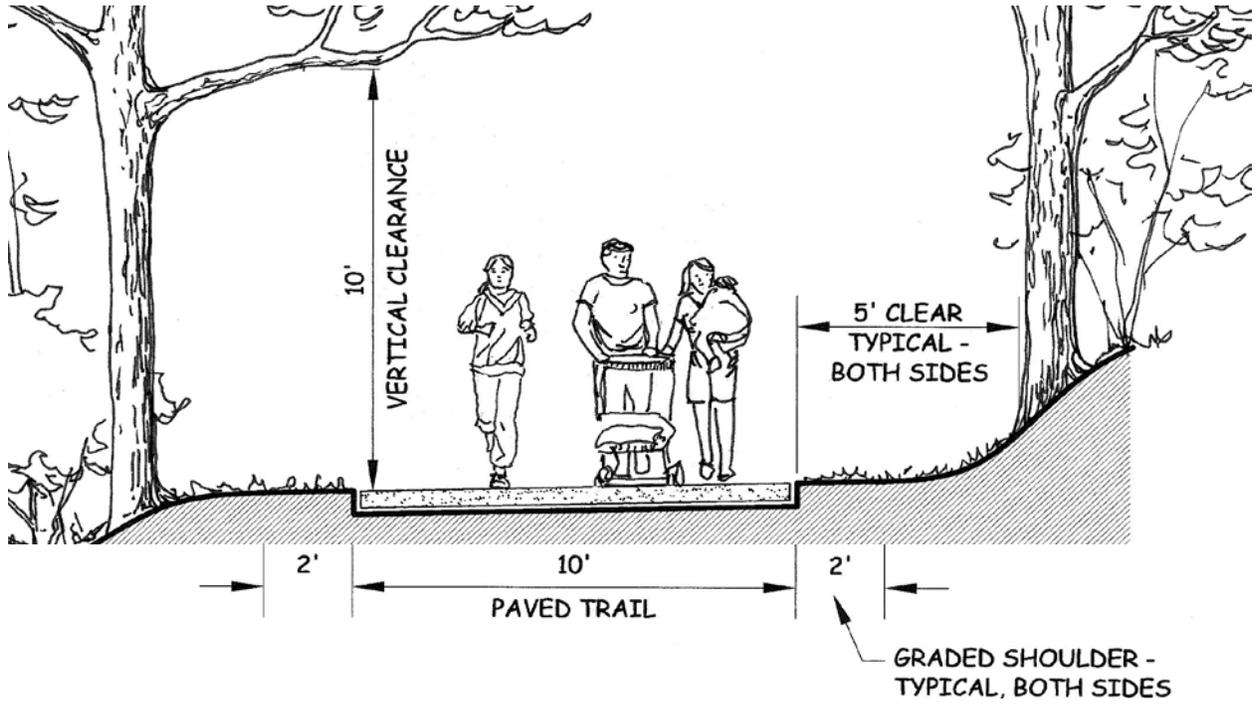
Greenway Trails – The Cary Greenway Trail is a 10’ wide paved trail that conforms to *1999 AASHTO Guidelines for Development of Bicycle Facilities* and *Section 0900 Cary Greenway Construction Standards*. As recommended by AASHTO the minimum width is 10’ but can be increased upwards to accommodate higher user volume and a variety of user types. The typical section below represents the common design application of the standards in Cary.

Care should be taken in the design of all trails, with specific attention to grades, curves, and drainage as these design decisions directly affect user safety and the lifespan of the trail. Reference to AASHTO design standards should be included in solicitations for designers and contract documents.

Multi-surface trails are becoming more popular and have been very well received by the public on those sections of the American Tobacco Trail (see photo). Multi-surface trails require additional corridor width, as the asphalt section should be no less than 10-feet wide. The alternate surface width recommendation is 6 to 8-feet wide and may be crushed stone or a rubberized surface.



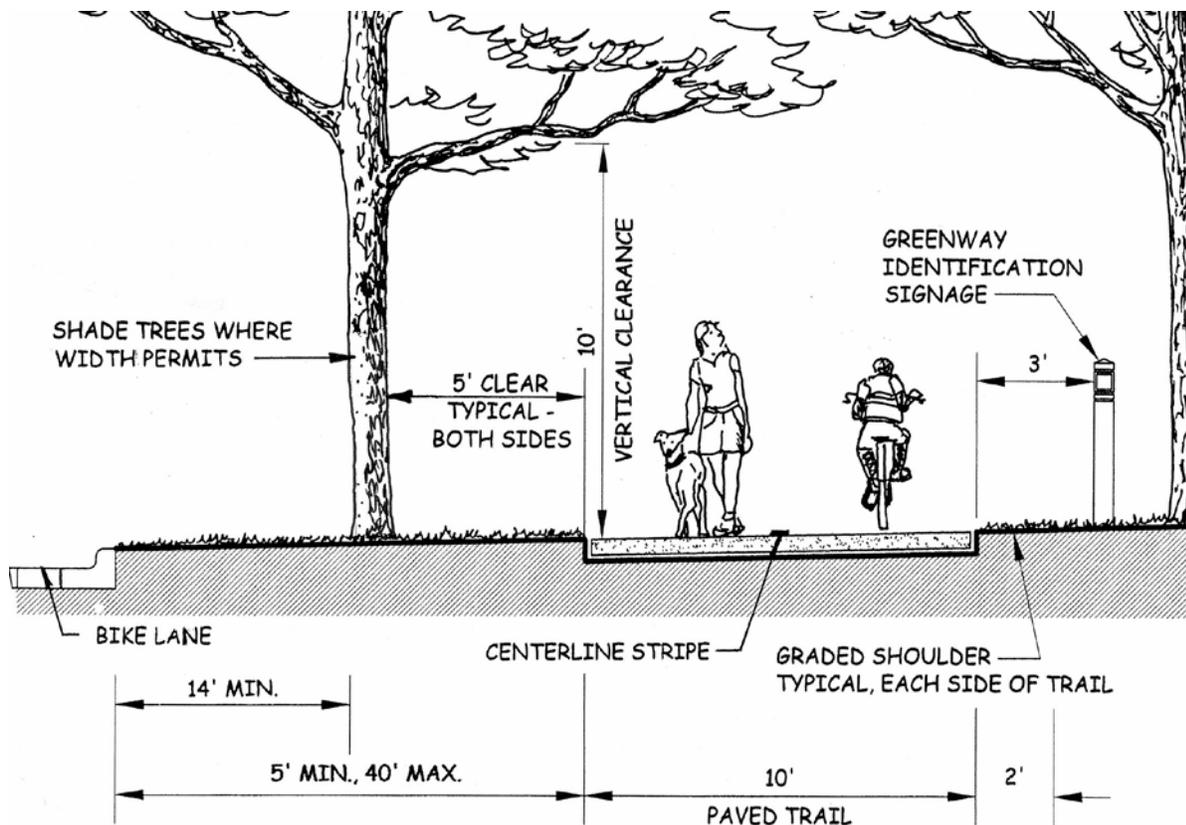
Figure 7: Greenway Trail Design Standard



Street-Side Trails are adjacent to roadways and pose a specific set of challenges, including coordination with utilities and light poles, narrow right-of-way constraints, curb cuts and driveways, potential conflicts with streetscape planting requirements and accommodation of future roadway widening plans. Given these factors, it is often difficult to achieve a design that is consistent with the character of Cary's greenways along natural corridors. In the design of trails parallel to roadways the following considerations are recommended (see 1999 AASHTO Guidelines for Development of Bicycle Facilities):

- The typical section here (**Figure 8**) details these design guidelines.
- Coordination with roadway planning, design, and construction – every effort should be made to coordinate the design and construction of trails parallel to roadways if improvements to the roadways are being made. This coordination should take place between Cary departments and with Capital Area Metropolitan Planning Organization (CAMPO) to maximize infrastructure investment dollars.
- Trails adjacent to roadways do not take the place of adequate bicycle accommodation on roadways. Most commuting or avid recreational cyclists will prefer riding on streets. The Town Parks, Recreation and Cultural Resources Department, Engineering and Planning Departments should coordinate on updates to bicycle and pedestrians plans in order that the greenway network and bike/pedestrian systems are complimentary.

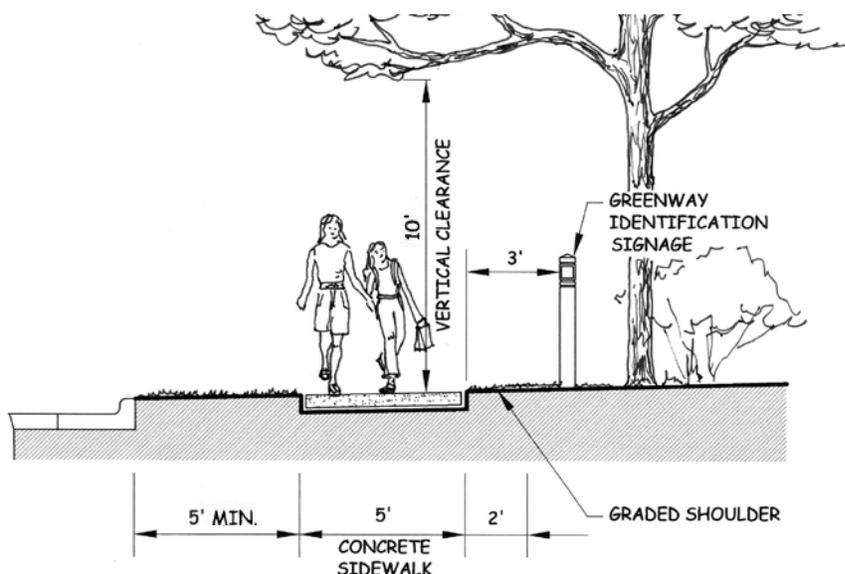
Figure 8: Side-Street Trail Design Standard



- Design Standards and Guidelines
 - Distance from edge of roadway shoulder to the edge of trail pavement should be maximized.
 - When the distance between edge of roadway shoulder and edge of trail pavement is less than 5' then a suitable physical barrier should be utilized. Physical barriers serve to reinforce the separation between trail and roadway. Barriers may be decorative in design but should 48" in height. Care should be taken in design to maintain sight distances for drivers.
 - Trail signage for trail users should be sized and placed to avoid confusion for drivers on adjacent roadways. Stop signs may be painted on the greenway trail itself (see typical section, below). If post mounted signs are used they should be sized for bicycle and pedestrian facilities per the 2009 MUTCD. All signage should be placed on the opposite side of the trail from the roadway.
 - Where trails running parallel to street end, particular design attention must be paid to the transition for cyclists continuing on surface streets. Wrong-way travel by cyclists is a leading cause of accidents between cars and cyclists.
 - Street-side trails should be designed to meander as much as the adjacent constraints will allow. Street-side trails that run precisely parallel with the adjacent roadway are highly undesirable.
 - Centerline striping is required for any curve that does not meet the AASHTO design criteria. Curve widening may also be required in these conditions.

Sidewalk connectors are also an important element in the Cary greenway system and part of the Street-Side Trail category. Sidewalk design should comply with Cary Standards. Sidewalk width should be maximized wherever feasible connections to greenways exist in order to reduce the potential for user conflicts. Although not encouraged, since bicycles are allowed on Cary sidewalks, sidewalk widths greater than 5' are highly desirable. The Parks, Recreation and Cultural Resources, Planning and Engineering Departments are all providers of sidewalks for the Town. These departments have taken steps to coordinate these efforts that should be highly effective in providing Cary residents with a seamless bicycle and pedestrian network.

Figure 9: Sidewalk Connector Design Standard



Natural Surface Trails and Mountain Bike Trails – These types of trails are discussed in Chapter 5 in more detail. Natural surface trails do not meet the requirements for developers in providing greenway connectivity.

GREENWAY CROSSING DESIGN

Midblock Trail Crossings – Trail crossings serve two functions. The first, and overwhelmingly most important, is greenway user safety. The second function is identification of the greenway corridors at those locations where they cross roadways. Meetings with the Town engineering and transportation planning staff were held to seek their input regarding crossing safety, particularly related to mid-block crossings. The trail crossing types described below are for mid-block crossing situations. Mid-block crossings are those that occur solely for the purpose of a greenway trail crossing a surface street. At locations where a trail crosses at an existing street intersection Town of Cary and NCDOT signal warrants apply for the application of pedestrian signage, pavement markings or signals. Descriptions of the trail crossing types are as follows:

Midblock Trail Crossing, 2- and 3-Lane Roads

- Warning and stop signs at trail approaches to road
- Change of pavement surface on the approach of the crossing
- 10' wide longitudinal crosswalk, across road with curb ramps at each end
- Fluorescent yellow-green warning signs along road at approaches to trail crossing

Recommended 35 mph or less / Required over 35 mph

- Distinctive markers at approach to trail – boulders, plantings, etc.
- Alternative pavement surface
- Rumble strips (in non-residential areas), speed tables (in residential areas) or pavement markings at approaches
- Pedestrian-activated rectangular rapid flashing beacons (all) or traffic signals (only over 35 mph)

Required if median present and 6+ feet in width

- Planted median in place of center lane; +/- 200 ft. long (each side of trail crossing)
- Trail crossing – striped or imprinted asphalt; flush through median
- Angle crosswalk in median to orient pedestrian toward on-coming traffic

Midblock Trail Crossing, 4- and 5-Lane Roads (45 mph or Less)

- Warning and stop signs at trail approaches to road
- 10' wide longitudinal crosswalk, across road with curb ramps at each end
- Fluorescent yellow-green warning signs along road at approaches to trail crossing
- Distinctive markers at approach to trail – boulders, plantings, etc.
- Alternative pavement surface
- Rumble strips (in non-residential areas) or pavement markings at approaches
- Pedestrian-activated rectangular rapid flashing beacons (all) or traffic signals (only over 35 mph)

Required If median present and 6+ feet in width

- Planted median in place of center lane; +/- 200 ft. long (each side of trail crossing)

- Trail crossing – striped or imprinted asphalt; flush through median
- Angle crosswalk in median to orient pedestrian toward on-coming traffic

New Signal Types

In some cases, significant user activity along a greenway trail or corridor which intersects a high-use road at-grade may necessitate enhanced signalization for safe crossings. Two such enhanced signals which have been shown to effectively increase pedestrian safety at intersections are High-Intensity Activated Crosswalk (HAWK) and Rapid Rectangular Rapid Flashing Beacon (RRFB) signals. RRFBs are currently being employed at multiple crossings within Town of Cary limits, and their expanded use is recommended.

Rectangular Rapid Flashing Beacons (RRFB)

RRFB's – granted Interim Approval by the Federal Highway Administration in 2008 – are a relatively new and innovative treatment for enhancing safety and awareness at road crossings. RRFBs are solar-powered, user-actuated (similar to existing pedestrian crossing signals) amber LED lights which are used to supplement approved pedestrian and school crossing signs. The RRFB employs an irregular flash pattern, similar to flashers on emergency vehicles. RRFBs are an ideal tool in that they are a low-cost alternative to both traffic signals and HAWK signals, and in testing, have led to comparable vehicular yield rates while requiring lessened traffic warrants. RRFBs can be an ideal solution at school crossings due to the presence of existing school crossing signs and pavement markings, and need for increased driver awareness in the vicinity of children.



RRFB, St. Petersburg, FL
 Photo courtesy of Michael Frederick. www.pedbikeimages.org

Crossing Locations – In effect, crossing locations are designed meeting points for both pedestrian and motor vehicle traffic. Most two-lane roadways present at least two potential conflict points for crossing bicyclists or pedestrians (conflicts from both the left and right directions). Roads with higher numbers of travel lanes present increased potential conflicts. Increases in vehicle speed, vehicle traffic, or greenway user traffic can add to the potential for danger. Analysis of current greenway-roadway crossings has yielded recommendations for 197 crossings and/or grade separations. In developing mid-block crossing recommendations, the speed limit of the road, number of vehicle travel lanes, and context of the area have been taken into account, incorporating Town of Cary *Street Crossing Standards*.

Grade Separated Crossings – Grade separated crossings such as pedestrian tunnels and bridges are required when crossing Controlled Access Facilities such as interstates and highways and are strongly recommended when the crossing involves following conditions:

- A significant greenway corridor with high user volumes.
- Crossing of any facility with a design speed higher than 45 miles per hour.
- Crossing four lanes or more.
- Crossing a road with poor horizontal or vertical site distances.

The following are the most common types of grade separated crossings and design criteria:

Pedestrian Tunnel

- Vertical clearance: 10' minimum,
- Width: 12' required
- Provide both drainage and lighting
- Design to allow for wildlife crossing if in natural area
- Roadway Bridge spanning trail is most desirable solution
- Requires NCDOT encroachment agreement (if crossing state-maintained road)

Pedestrian Bridge

- Width: 10' required, 12' preferred
- 54" guard rail on both sides
- Fenced cover where trail crosses highways/busy streets
- Requires NCDOT encroachment agreement (if crossing state-maintained road)

Routing Trail Beneath Roadway Alongside Existing Streams Crossing

- Vertical Clearance: 8' minimum, 10' desired
- May require hydraulic analysis
- Requires NCDOT encroachment agreement (if crossing state-maintained road)
- Modification to bench must not impact structure
- Concrete surface recommended to extend life of trail in regularly flooded location.

The trail crossing matrices, *displayed in Appendix K*, identify trail crossings at locations other than roadway intersections. Also see *Appendix M Recommendations Map*, which has been provided as part of a separate document, for *Recommended Crossings & Grade Separations*.

[What do we recommend for locations where trail volumes are higher than roadway? In particular, this exists on ATT where trail users far exceed the rural traffic volumes. We may run into this in other outlying locations, or even some of the inner city locations. Is it unreasonable to propose a stop sign for roadway users?

F. Signage and Wayfinding

In 2007, Cary commissioned a *Comprehensive Sign Plan* that includes design specification for greenway signage and wayfinding. The design of the trailhead markers helps both trail users and drivers on adjacent roadways identify trail locations. The continued application of this plan will increase recognition of the Cary greenway system and make it easier for new users to navigate their first trail experience.



In addition to trailhead and wayfinding signage greenways should be signed to increase user safety. These signs should be designed and located per the most recent version of the *MUTCD*.

G. Trailheads

The Town of Cary greenway system is expansive (currently 62 miles, including major street side trail corridors) and growing rapidly. In order to provide an appropriate level of access and way-finding for greenway users, it is recommended that the Town establish trailheads at key locations throughout the greenway system. Trailheads should include a paved parking area (The size of the trailhead will be based on the location of the trailhead, the size of the trailhead lot and the popularity of the trail being served.), signage, restrooms and a water fountain. Trailheads are an essential component of an effective greenway system in that they serve multiple purposes: way-finding for individual trails and the larger greenway system; disseminating applicable greenway information and rules; and providing convenient access and parking for greenway users.

Analysis of current and planned greenway corridors has yielded an inventory of **22 recommended trailhead locations**, sited in conjunction with key Town of Cary park locations (both existing and planned). In developing the proposed inventory, consideration was given to: park locations which intersect significant cross-town greenways, park locations which intersect *multiple* greenways and community trails, and locations which effectively serve the full Cary planning area. See **Trail Recommendation Map** at the end of this chapter for *Recommended Trailhead Locations*.

H. Greenway Maintenance

As the Town of Cary greenway system has evolved over time, greenway and trail maintenance has emerged as a significant issue with the public, the Town of Cary Greenway Committee, and Town staff. Public feedback during the **PRCR Master Plan** update process has yielded “*greenway and trail maintenance*” as one of the three most important aspects of open space management.

As greenway maintenance continues to increase in importance, it is beneficial to consider the maintenance experiences of communities with greenway systems of similar size and scale to that of Cary. The table below compares the greenway/trail maintenance approaches of several comparable communities.

Table 10: Greenway/Trail Maintenance Comparisons

Maintenance Topic	Charlotte, NC	Greensboro, NC	Durham, NC	Scottsdale, AZ
Greenway Maintenance Responsibility	Parks & Recreation	Parks & Recreation	Parks & Recreation, General Services	Parks & Recreation Streets (Public Works)
Specific Duties of Individual Departments (If Shared Responsibility)	N/A	N/A	Parks & Rec: Empty Trash Gen Svcs: Mowing, trimming vegetation, maintain amenities	Parks & Rec: Landscaping Streets: Surface Sweeping
Maintenance Contracted Out or "In-House:"	Contracted	In-House	In-House	Both
Level of Maintenance Completed "In-House"	Soft Surface	Hard & Soft Surface	Hard Surface	Hard Surface
Paving Equipment Owned by Community	No	No	Equipment owned by Street Maintenance Department	Equipment Owned
Re-paving Contracted Out or "In-House"	Contracted	N/A	Contracted	Contracted
Hours/Week Spent on Greenway Maintenance	9 Hours (3 Regions, 3 Hrs/Region)	3 Full-Time Staff Positions	Not Specified	Not Specified

As the greenway network continues to mature, the needs and resources of the Town will also change. A cost/benefit analysis should be performed every three years to evaluate maintenance protocols for efficiency. This analysis should review:

- Yearly contract amount for external services.
- Yearly service required by type, mileage, and/or amount.
- Public feedback.
- Coordination with other departments employing internal or external maintenance forces to identify opportunities to increase buying power.
- Yearly needs assessment that projects the coming year's maintenance needs. Should be based on staff knowledge of resurfacing and repair needs.

I. Special Facilities

Cary's Black Creek is currently classified as an impaired stream by the NC Division of Water Quality. In 2006, the Black Creek Watershed Association (BCWA), comprised of neighborhood representatives and civic groups, with technical support from the Town, was established to oversee watershed management and community involvement for Black Creek, and protect the character of the Black Creek Greenway. North Carolina State University, in partnership with the Town of Cary, is currently coordinating restoration efforts for Black Creek with funding from US EPA grants and a NC Clean Water Management Trust Fund grant.

The ***Black Creek Watershed Assessment, Monitoring, & Planning*** watershed plan, adopted in 2009, outlines strategies to address the causes and sources of Black Creek stream impairment, and to protect the greenway corridor. The following *Goals* and subsequent *Strategies* (excerpts) relate to the Black Creek Greenway. See **Appendix J** for a full list of adopted watershed goals and strategies.

Recreation Goals

Goal 5: Maintain pleasant pedestrian and bicycle recreation and travel

Goal 6: Recreation in Lake Crabtree is improved

Goal 7: Bird watching opportunities are maintained or improved

Strategies Applicable to Recreation

C. Install pet waste stations and education along the Black Creek Greenway.

F. Conserve the TOC property that is bound by Black Creek Greenway and Cary Parkway (adjacent to North Cary Park) as natural area and use as a natural resource education site.

H. Improve Black Creek Greenway

- *Camouflage and improve sewer manholes to reduce smells and make more attractive.*
- *Remove exotic, invasive vegetation; plant native vegetation.*

I. Consider establishing Black Creek Greenway as a linear park (similar to American Tobacco Trail).

J. Provide or partner with organizations on recreational events along Black Creek Greenway (e.g. bird & amphibian counts, runs/races).

K. Control sedimentation and erosion from any development sites, including parks and greenway facilities.

- L. *Control sedimentation and erosion from any development sites, including parks and greenway facilities.*
- M. *Remove exotic invasive vegetation and manage for native vegetation.*
- N. *Maintain forested corridors of >150 feet wide.*

J. Public Art

Public art should be an integral part of greenways. Public art can be used to enliven any trail within the system and to identify greenway corridors or serve as a destination. Public Art can be functional, practical, whimsical, permanent, or temporary. Opportunities are as numerous as the imagination is endless and present many partnership opportunities. (See Public Art Guidelines and Opportunities section of **Chapter 5** for more information on public art with greenways.)

K. Recommendations

GOAL 2: Provide Cary citizens with a highly functional, safe, well-maintained greenway network that provides recreation, transportation, and education opportunities and wildlife benefits.

Objectives:

2.1. Improve community awareness and use of trail network.

Actions:

- a. *Regularly update Town webpage on Greenways.*
- b. *Continue implementation of Comprehensive Facility Sign Plan.*
- c. *Per the approved Pedestrian Element of the Comprehensive Transportation Plan, Incorporate wayfinding signage on bike routes with time/distance information, including proximity to greenway trailheads and connections.*
- d. *Develop prioritized schedule for deploying signage on existing greenways.*
- e. *Develop system of mile markers and coordinate locations to assist emergency responders.*
- f. *Develop parks and recreation programming that exposes children and adults to greenway network.*
- g. *Market Bond Park as the “hub” of the greenway system.*
- h. *Regularly update the “Bike & Hike Cary Map.”*
- i. *Utilize regional online trip planning resources to increase awareness of Cary greenway/trail resources and connectivity.*
- j. *Pursue marketing opportunities for greenways as alternative means of transportation, such as integrating mapping of transit lines, transit stops and park and ride lots with paved greenways, street side trails, bike lanes, and sidewalks.*
- k. *Integrate bike route and transit connections into trail user awareness. (Both of these modes can and will serve as a means of access by local and regional trail users.)*

2.2. Complete a system of trails that serve the entire Cary community by linking parks, open space, schools, and other public facilities to residential, commercial, and employment areas.

Actions:

- a. *Deploy new trail type designations in plans, UDO, GIS, and departmental documentation. The term “multi-use” in reference to trails adjacent to streets should no longer be used. Trail types include:*
 - *Greenway Trail*
 - *Street-side Trail*
- b. *Increase connections to:*
 - *Adjacent Jurisdictions*
 - *American Tobacco Trail*
 - *Bond Park*
 - *Apex Lake Greenway*
 - *Downtown Cary*
 - *Transit Hubs*
- c. *Develop a plan that prioritizes greenway design, funding, and construction objectives, specifically for:*
 - *Trailhead Priorities*
 - *Trail Priorities*
 - *Primary Routes*
 - *Neighborhood, School, and Park Connections*
 - *Trail Gaps*
 - *Loop trails*
 - *Bike Routes and Transit*
 - *Sidewalks*
 - *This activity should result in a prioritized list of projects for design and a prioritized list of projects with design complete that are ready for construction.*
- d. *Prioritize sustainability and environmental stewardship in trail design and greenway corridors.*
 - *Address sustainability in trail and trail amenity designs.*
 - *Work with other governmental environmental bodies in addressing environmental issues along greenway corridors such as planting to narrow gaps in tree canopy due to trail construction.*
 - *Address environmental issues in plantings along greenway corridors such as supplementing native species, controlling invasive plants and planting fruit-bearing or other wildlife-sustaining vegetation.*
 - *Address wildlife habitat along corridors in design and vegetation.*

2.3. Fund greenway/trail network expansion.

Actions:

- a. *Continue goal of budgeting the construction of a minimum of two miles of greenway per year.*
- b. *Prioritize the design of greenways to develop “shovel ready” greenways and better position the Town to receive State and/or Federal funding.*
- c. *Continue to work with State Parks, NCDOT, Wake County, USDA and CAMPO to identify funding partnerships that will enable the further expansion of the trail network.*
- d. *Continue to coordinate with other Town departments on project feasibility and funding.*
- e. *Continue to consider allowing developers to construct Town greenway if they occur within the network.*

2.4. Connect to national, regional, and adjacent jurisdiction trail networks.

Actions:

- a. Obtain consensus on developing prioritized trail segments on the edge of Cary's jurisdiction.*
- b. Complete the spine route of White Oak Creek Greenway and Black Creek Greenway to connect to the American Tobacco Trail (ATT) and complete the East Coast Greenway route through Cary.*
- c. Investigate alternative connections between White Oak Creek Greenway and the ATT.*
- d. Participate in future planning efforts with Wake, Durham and Chatham Counties, Triangle Rails to Trails, and NCDOT to discuss the possible future extension of the ATT southward to connect to Raven Rock via Harris Lake.*
- e. Participate in any future planning efforts between adjacent jurisdictions to coordinate connections and share lessons learned. Continue to coordinate with Raleigh, Apex, Holly Springs, Durham, Morrisville, and Research Triangle Park to link to their respective trail systems.*
- f. Participate in development of a "Triangle" Greenway Plan to better position region to obtain Federal grants.*
- g. Collaborate with Triangle J Council of Governments (TJCOG) on the update of the Center of the Region Enterprise (CORE) Plan.*
- h. Work with Wake County, NCDOT and RDU to locate and develop a trailhead parking area in proximity to Lake Crabtree and Umstead State Park.*

2.5. Provide well maintained and safe trails.

Actions:

- a. With the extensive growth of the Town's Greenway System, review current maintenance standards to determine the appropriate level of service.*
- b. Utilizing the Town's "Spruce" program, develop an Adopt-A-Trail program for HOA's to assist the Town in maintaining greenways.*
- c. Institute locational approach (mile markers) to provide wayfinding for emergency responders.*

2.6. Provide a seamless and safe trail user experience across the entire greenway network.

Actions:

- a. Continue to coordinate with Cary Planning and Engineering Departments in the planning and design of sidewalks and street side trails.*
- b. Meet quarterly with Planning and Engineering Departments on bicycle and pedestrian facility design, funding, construction, and maintenance. An integrated approach to budgeting should be adopted where project boundaries overlap.*
- c. Remove gates from the Cary Greenway Design Standards and replace with drop bollard.*
- d. Retrofit drop bollards at existing gate locations.*
- e. Add curve widening to Cary Greenway Design standards for sub-standard curve radii, and retrofit existing sub-standard curve radii.*
- f. Apply the most recent version of the MUTCD for trail crossings and signage.*
- g. Develop criteria and plans for all at-grade and grade separated crossings.*

- h. Amend Policy 128 to reference the Parks, Recreation, and Cultural Resources Facility Master Plan for greenway crossings.*
- i. Improve interdepartmental coordination in the design and construction of grade-separated crossings.*
- j. Consider costs to retrofit existing pedestrian tunnels that do not meet current standards.*
- k. Define lighting standards for those pedestrian tunnels designated to be lit.*
- l. Coordinate with Planning Department on bike safety programs, such as the "Share the Trail" campaign (bicycle etiquette, safe passing, etc.), to educate the public on the benefits and importance of bike helmet use on greenway*
- m. Maintain compliance with any Federal and/or State-mandated ADA requirements for trails.*

Insert Greenways Map