



BENT CREEK GREENWAY FEASIBILITY STUDY

Brevard Road/191 Corridor

Prepared For:

Buncombe County Recreation Services

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INTRODUCTION

Overview and Study Area

Buncombe County Recreation Services initiated a feasibility study for the proposed Bent Creek Greenway (Brevard Road/191 Corridor). The study area for the project begins in the vicinity of the Brevard Road (NC 191) interchange on I-26 and generally encompasses land along Brevard Road north to the Hominy Creek Greenway and with another alignment to access the Hominy Creek River Park. The study area is split between the jurisdictional boundaries of the City of Asheville and Buncombe County. Most of the greenway construction will take place within the City of Asheville's jurisdiction (See Figure 1).

As noted in the Buncombe County *Greenways and Trails Master Plan* (Plan), Western North Carolina, generally, and Buncombe County, specifically, has been a destination for outdoor enthusiasts to enjoy the region's trails and other amenities for more than a century. Cities and towns within the County have invested considerable resources in planning and building greenway systems. Finishing in 2012, Buncombe County developed the Plan to provide a countywide, comprehensive approach to greenways and trails planning.

The Plan envisions a system of connected greenways and trails for pedestrians and bicyclists that promotes tourism, economic development, health, recreation, diverse and safe transportation options, and connects the communities in Buncombe County. The Bent Creek Corridor, one of eight priority corridors identified in the Plan, include approximately three miles of greenway that may provide access to locations including:

- Asheville Outlet Mall,
- Western North Carolina (WNC) Farmer's Market,
- Hominy Creek River Park,
- French Broad River,
- French Broad River Greenway,
- Hominy Creek Greenway,
- Hominy Creek.

Purpose and Methodology

The purpose of this study is to determine the feasibility of a multi-use/multi-modal, paved greenway in the vicinity of Brevard Road to extend the previously studied Bent Creek – Lake Julian Greenway to connect to the existing trail system. This study considers design constraints of the natural and human environment to determine alignment alternatives using publicly available information. The study was led by Buncombe County Recreation Services with the support of the Greenway Steering Committee. The study produced alignment segments for public input, three alternatives for further study, and a preferred alternative for the proposed greenway based on multiple design factors, a set of sketch plans (functional plans) for segments of the trail included in the three alternative alignments, and a planning level cost estimate for constructing the segments included in the alignments.

The feasibility study is a product of known factors and assumptions that were true at the time the assessments were engaged. The feasibility study does not represent an absolute plan or intent to proceed with the project, but creates the foundation for future efforts. Changes within the project environment including transitions in land ownership, permitting requirements, etc. will result in divergence from the presented plan.

DESIGN CONSIDERATIONS

This study considers natural environmental constraints including topography and waterways as well as human environmental constraints including right of way, bridges, and other infrastructure. Additionally, local, state and federal design guidelines were considered including Americans with Disabilities (ADA) standards.

Natural Environment

Topography

Since Buncombe County is located in Western North Carolina in the Appalachian Mountains, the topography of the region is mountainous and elevations range from 1,305 feet to 6,373 feet within the County. Due to the terrain, Buncombe County and the City of Asheville have implemented policies to manage development on steep slopes. These policies have been implemented to maintain slope stability and control erosion and stormwater.

The portion of the study area that falls within the City of Asheville is subject to its Steep Slope Ordinance. The Steep Slope Ordinance does not prevent development on these slopes, but provides guidelines to minimize impacts.

Floodplain/Floodway

Much of this project is within the Hominy Creek basin. Hominy Creek is a tributary of the French Broad River, a significant natural resource and community asset to Buncombe County and the City of Asheville. As such, Hominy Creek is an important contributor to the water quality of the French Broad River. The proposed greenway segments predominantly run along NC 191 before turning east to run along Hominy Creek and then cross the creek onto Hominy Creek Road ending in Hominy Creek River Park.

In some locations the portion of the greenway along Hominy Creek Road encroaches in the 100-year and 500-year Hominy Creek floodplain. In 1980, Buncombe County joined the National Flood Insurance Program (NFIP) and began regulating development within the 100-year floodplain (Zone AE). The Flood Damage Prevention Ordinance is found in Chapter 34 of the County Code of Ordinances.

The French Broad River Basin is part of the NC Division of Mitigation Services (DMS), formerly Ecosystem Enhancement Program (EEP), Watershed Restoration Plan. The study area is within the Targeted Local Watersheds of the French Broad River. DMS developed River Basin Restoration Priorities (updated 2009) to guide mitigation activities.

The French Broad River does not have a state Buffer Rule. However, it is Buncombe County's policy under Stormwater Management to require a minimum 30-foot buffer for all development activities along jurisdictional streams. Mr. Mike Goodson, Buncombe County Stormwater Manager, indicated that greenways are generally allowed in the buffer; however, a hydrologic study to determine the amount of additional runoff into drainages from the greenway would be required. The project would then need to avoid or minimize the impact using appropriate mitigative measures such as rain gardens. Education may also be used as part of the mitigation.

Cynthia Barcklow, Floodplain Administrator for Buncombe County, stated that any structure located within the floodway such as a drinking fountain, kiosk, signage, and even the trail itself, would require a no impact/ no-rise study. A greenway can be located in the floodplain with the submittal of a flood permit application, which requires a plan for the greenway, identification of structures to be located with the greenway, and the location of the floodplain and floodway.

Streams and Wetlands

“Waters of the United States” include surface waters and wetlands as defined in 33 CFR Part 328.3. Impacts to these waters fall under the jurisdiction of the U.S. Army Corps of Engineers through Section 404 of the Clean Water Act (33 U.S.C. 1344) and under the jurisdiction of the NC Department of Environment and Natural Resources Division of Water Resources through the Section 401 Water Quality Certification process (NC General Statutes Chapter 143 Article 21, Part 1). Due to the location of the greenway encroaching on the Hominy Creek floodplain, it is likely that it will cross either streams or wetlands that can be claimed as jurisdictional. Any of these jurisdictional waters that require fill, culverts, or bridge footings within those waters, will require a Section 404/401 Water Quality Certification. As part of the certification process, the design will need to show avoidance and minimization of impacts where practicable.

Best management practices for erosion control should be used to re-stabilize the disturbed area and prevent soil erosion.

Human Environment

Right of Way

In addition to placing greenways adjacent to waterways, it is also common to develop them in rights of way owned by public entities. In addition to private and publicly owned property, there is a large amount of right of way and parcels owned by NCDOT, the State of North Carolina and Buncombe County. The extent of right of way owned by NCDOT varies in width along the NC 191 Corridor. Coordination with both NCDOT and Buncombe County will be required to locate a greenway within their easements or right of way.

On-road connections may be required to link separate segments of the greenway system. These connections may result in re-striping of roadways, expanded shoulders, sidewalks or multi-use paths to protect greenway users and vehicular traffic. Again, coordination with NCDOT will be required.

Bridges

As previously discussed, Hominy Creek, I-26 and I-40 are found within the study area. Although the proposed alignment alternatives were designed to minimize the need for bridge crossings of the creek and interstates, it is not possible to avoid them completely and still connect the greenway to areas of interest. Four locations where the greenway alignment will require a new bridge structure or the reconfiguration of an existing bridge structure are:

- 1) Crossing I-26 along Brevard Road
- 2) Crossing I-40 along Brevard Road
- 3) Crossing Hominy Creek at existing Buncombe County Bridge (216) near Hominy Creek Greenway
- 4) Crossing Hominy Creek between the WNC Farmer’s Market and the Hominy Creek River Park



Buncombe County Bridge #216 is an existing historic bridge over Hominy Creek and under I-40.

The crossing of I-26 along Brevard Road is influenced by the future reconstruction of the interchange included in the NCDOT's I-5504 project. This project will include the construction of sidewalks and bike lanes across the new bridge over I-26. This Greenway Feasibility Study proposes to further study reconfiguring the bridge section to replace the bike lane with a wider (10') sidewalk section to accommodate the Greenway crossing over I-26. Each studied alternative must cross at this location either on the south or the north side of the proposed bridge. Positive protection in the form of a single faced concrete barrier wall should be provided to separate the greenway from the vehicular traffic. The ultimate selected alternative will determine which side of the roadway has the barrier wall and wider sidewalk. Close coordination with NCDOT will be required, including structural engineering and traffic studies. The I-5504 project is scheduled to begin in NCDOT Fiscal Year 2016.

The crossing of I-40 along Brevard Road will be accommodated on the existing NC 191 Bridge over I-40. To accommodate a 10' greenway, the existing vehicular traffic lanes across the bridge could potentially be reconfigured to reduce the number of southbound NC 191 left turn lanes from 2 lanes to 1. The additional area created by removing this one lane will accommodate the greenway on the existing bridge. NCDOT has indicated that this reduction in the number of left turn lanes could be accommodated if found acceptable by a traffic study. If the traffic study indicates that two left turn lanes are required, then the bridge will need to be widened to accommodate the Greenway. Given the uncertainty of future traffic

volumes at this bridge, this study assumes that the bridge must be widened. Each studied alternative must cross in this location on the west side of NC 191. In addition, NCDOT plans to begin construction of the I-2513 project in Fiscal Year 2021; however this should not affect the existing bridge.

The crossing of Hominy Creek at the existing historic bridge (Buncombe County Bridge #216) will accommodate the Greenway's crossing of Hominy Creek as part of Segment 11 of the path, to connect to the Hominy Creek Trail. According to the State Historic Preservation Office the bridge was constructed in 1935 and consists of a reinforced concrete deck with a ribbed closed-spandrel arch. Although recently completed studies have determined that this bridge is not a 4(f) resource, it is still a potential historic asset and represents an opportunity to rehabilitate the structure to ensure its continuous preservation, as well as creating an attractive gateway for the Greenway. Additional structural analysis will be required to determine the necessary repairs to the bridge prior to its opening to pedestrian traffic. Given that this existing bridge was originally designed as a highway bridge, it is a more complex structure than typical pedestrian bridges. Therefore, maintenance costs will likely be higher to maintain this rehabilitated structure.

The crossing of Hominy Creek between the WNC Farmer's Market and Hominy Creek Road will require a new pedestrian bridge structure. The exact type of structure will be determined during the preliminary design phase of the project. This is the only new structure that will cross a body of water; therefore, additional studies will be required. For example, a no impact/no-rise to the floodway study will be required. On greenway and trail projects, a Federal Emergency Management Agency (FEMA) no-rise certification is needed whenever modifications are made in the floodway. Bridges over mapped streams, such as Hominy Creek, would trigger the need for a no-rise analysis and report at each crossing. The FEMA no-rise report demonstrates, using modeling of FEMA stream data to reflect proposed changes in the floodway, that there is no increase in the water depth during a 100-year storm event. If the disturbance does cause a rise in the 100-year storm stream flood level, then FEMA CLOMR (Conditional Letter of Map Revision prior to construction) and LOMR (Letter of Map Revision done post-construction) are required. Because of both the expense and project delay associated with CLOMR and LOMR, the detailed final designs for the greenway should endeavor to incorporate design elements that will meet the no-rise requirement and not trigger the more

expensive and lengthy CLOMR permitting process.

There has been interest among some Steering Committee Members and the public to provide a grade separation across the entire interchange of I-26 and NC 191, including the ramp tie-ins. In order to address this interest, preliminary layouts of grade separated pedestrian bridges were developed to determine the approximate length required and cost to accommodate this request. Unfavorable topography, and the configuration of the I-5504 interchange would require the pedestrian overpass to be over 1,500' long to accommodate vertical clearance issues and be ADA compliant. Bridges of this length typically cost upwards of \$5,500,000 and would likely be prohibitive to fund at this stage. It is possible that these pedestrian overpasses could be included as future projects.

Other Infrastructure

The greenway is largely designed within existing highway right of way, so it will encounter infrastructure. This additional infrastructure may include intersecting roads and driveways, water and sewer lines, drainage structures (culverts and pipes), electrical, fiber optic, cable, and telephone utility lines above and below ground. Coordination with the individual utilities and NCDOT will be necessary. This coordination should begin early in the design phase.

Design Criteria and Exceptions

The design criteria utilized for the design of the greenway are included in Appendix A. This criteria worksheet lists the minimum criteria used throughout the project. Among the criteria are curve radius and landing spacing, described below.

Curve Radius

The minimum radius per NCDOT Bicycle and Pedestrian Greenway Design Guidelines is 90 feet, which is recommended in the design criteria workbook. However, a 2013 Value Engineering Report recommended smaller radii be allowed in areas that are topographically and environmentally sensitive. The vertical geometric constraints included in Segment 7 create the need to make the alignment much longer than would normally be possible to keep a minimum grade of 5 percent. Therefore, much smaller horizontal curve radii must be used to accommodate generating the extra length required to minimize the grade between NC 191 and Segment 9/10.

Landing Spacing

Different design manuals outline the various requirements for providing level landings after areas with steep slopes. In general, the steepest slope allowed is 5 percent unless the path is parallel to an existing roadway with steeper slopes. In that instance, the slope may be as steep as, but not steeper than, the adjacent roadway.

Some manuals allow for steeper slopes with landings at different spacings depending on the slope used. However, it is understood that future ADA requirements, as outlined in the US Access Board's Supplemental Notice of Proposed Rulemaking (SNPRM), will only allow a 5 percent maximum slope unless parallel to a steeper roadway.

No landings are anticipated at this phase of the project's development.

ALIGNMENT ALTERNATIVES

Several alternative alignments were originally proposed that took different paths through the limits of this project. They were split into segments at each decision point to allow the stakeholders to have a broader range of possibilities to choose from. The following table describes the individual proposed segments that would make up the full length of the greenway as shown in Figure 2.

Table I. Segment Descriptions

Segment	Limits	Description	Comments
	Crosses from east to west side of NC 191, from south of I-26 to west of WNC Farmer's Market. Approx. 9,140'.	10' hard surface path mostly within the right of way of NC 191. Pedestrian improvements will be made at the intersection where the Greenway crosses NC 191 west of I-26 and at the WNC Farmer's Market.	All alternatives begin with either Segment 1 or Segment 2
	East side of NC 191 from south of I-26 to WNC Farmer's Market. Approx. 9,090'.	10' hard surface path within the right of way of NC 191.	All alternatives begin with either Segment 1 or Segment 2. Path width may be limited to 8' wide adjacent to an existing retaining wall.
	West Side of NC 191 from west of WNC Farmer's Market to south of Existing Hominy Creek Bridge. Approx. 2,940'.	10' hard surface path mostly within the right of way of NC 191 and the abandoned approach to the existing bridge over Hominy Creek.	Will require restriping overpass of I-40 to obtain width for greenway on west side of NC 191. The I-40 interchange project may affect this segment.
	Segment Not Advanced Enough For Further Studies.		
	East side of NC 191 from WNC Farmer's Market to North of I-40. Approx. 1,300'.	10' hard surface path crossing I-40. Mostly within the right of way of NC 191. This segment would also include an improved pedestrian crossing at South Bear Road.	Will require widening of overpass of I-40 to obtain width for greenway on east side of NC 191. Will also require crossing interstate ramps. Ped overpass of ramps is not feasible here. The I-40 interchange project may affect this segment.

Table I. Segment Descriptions

Segment	Limits	Description	Comments
	West side of NC 191 from WNC Farmer's Market to North of I-40. Approx. 1,300'.	10' hard surface path crossing I-40. Mostly within the right of way of NC 191. This segment would also include an improved pedestrian crossing at South Bear Road.	Will require widening of overpass of I-40 to obtain width for greenway on west side of NC 191. The I-40 interchange project may affect this segment.
	Segment Not Advanced Enough For Further Studies.		
	North of NC 191 interchange with I-40 from north of I-40 to Hominy Creek. Approx. 715'.	10' hard surface path on new alignment.	Follows I-40 Ramp right of way.
	Not Used.		
	Western bank of Hominy Creek from north of I-40 to south of NC 191 bridge over Hominy Creek. Approx. 1,100'.	10' hard surface path on new alignment adjacent to Hominy Creek.	Scenic view and potential creek access. Limited access points and isolated.
	Western bank of Hominy Creek from south of NC 191 bridge over Hominy Creek to south of I-26 bridge over Hominy Creek. Approx. 760'.	10' hard surface path on new alignment adjacent to Hominy Creek.	Scenic view and potential creek access. Limited access points and isolated.
	Existing historic bridge over Hominy Creek from south of Hominy Creek to Hominy Creek Trail. Approx. 250'.	10' hard surface path on existing abandoned roadway and bridge over Hominy Creek.	Opportunity to rehabilitate an existing historic bridge.
	Along Hominy Creek Road from Hominy Creek River Park to Buncombe County Vehicle Maintenance Building Drive. Approx. 1,365'.	10' hard surface path adjacent to Hominy Creek Road	This segment connects to the French Broad Greenway.

Table I. Segment Descriptions

Segment	Limits	Description	Comments
 21	Along Hominy Creek Road from Buncombe County Vehicle Maintenance Building Drive to Hominy Creek Trail. Approx. 2,630'.	10' hard surface path adjacent to Hominy Creek Road	This segment may not be constructible without reconstructing Hominy Creek Road.
 22	Bridge across Hominy Creek from Buncombe County Vehicle Maintenance Building Drive to south of I-40 bridge over Hominy Creek. Approx. 645'.	10' hard surface path and bridge over Hominy Creek.	Provides connection from French Broad Greenway to trail without vehicular conflicts.
 1*	Grade separated crossing of I-26 and interchange on west side of NC 191. Approx. 1,520' on structure.	10' hard surface path on structure over I-26.	Requires extremely long structure to tie back to existing grade to maintain ADA compliance. May be advantageous to submit this as separate project.
 2*	Grade separated crossing of I-26 and interchange on east side of NC 191. Approx. 1,690' on structure.	10' hard surface path on structure over I-26.	Requires extremely long structure to tie back to existing grade to maintain ADA compliance. May be advantageous to submit this as separate project.

PUBLIC INVOLVEMENT

A steering committee was developed to help guide the planning process of the greenway. The steering committee included members from the following organizations:

- Biltmore Estate
- Buncombe County (BC)
- City of Asheville
- Friends of Connect Buncombe (FOCB)
- NCDOT – Division I3
- Western North Carolina (WNC) Farmer's Market
- French Broad River MPO

Steering committee meeting #1, was held January 14, 2016. Members were introduced to the project and asked for input on draft greenway alignments. Issues concerning the proposed alignments included:

- Adding a greenway on the Biltmore property or on the Biltmore side of NC 191 may be difficult because it is a historic property and is a Section 106 and 4(f) resource.
- Several members expressed support for a greenway alignment utilizing the culvert at the Asheville Outlets.
- NCDOT STIP I-5504, Brevard Road Interchange typical section allows for bicycle and pedestrian use. However the typical section could be reconfigured to accommodate a shared use path.

- The WNC Farmer’s Market has future plans to expand on its current campus. Some alternatives that transgress their property to the south and north may be incompatible with that plan.
- FOCB outlined a desire to have a grade separated pedestrian crossing over I-26 and its ramps.
- NCDOT described adjacent projects near the greenway, such as I-5504 and I-2513. NCDOT also described the ability to potentially remove one southbound left turn lane at the I-40 interchange, which would allow for the greenway without additional bridge widening.
- There is an opportunity to utilize an existing potentially historic bridge over Hominy Creek.

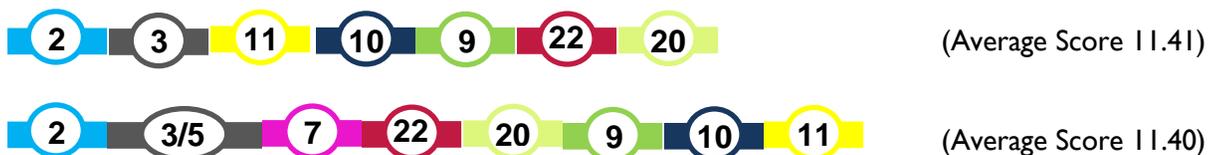
Steering committee meeting #2 was held on February 11, 2016. The segments were further described to the committee, and preparations were further discussed for the upcoming public involvement meeting to be held on March 24, 2016 from 4-7 pm at the WNC Farmer’s Market. Comments on the specific segments included:

- HNTB and BC explained that separate grade separated overpasses at I-26 would be prohibitively expensive. Those projects could be submitted separately.
- BC and WNC Farmer’s Market expressed concern with Segment 4’s impacts to business operations.
- The Biltmore Estate expressed concern that Segment 2 could have detrimental impacts to the historic property. In addition the property claimed to have experienced significant stormwater issues related to the widening of NC 191 and it fears that the greenway will add to the discharge. They also cited concerns about impacts to the Ananda House.
- HNTB explained that other alignments not in the NC 191 corridor, such as Pond Road would double the length of the greenway.
- City of Asheville commented that Segment 1 was not preferable because of the many driveways that create pedestrian/vehicular conflict.
- BC indicated that the number of transfer trucks coming out of the transfer station may soon double.
- BC asked for intersection redesigns to accommodate pedestrian activities at the WNC Farmer’s Market and the intersection north of I-40.

A **public meeting** was held for the project on March 24, 2016 from 4:00 p.m. to 7:00 p.m. The purpose of the meeting, which was led by Buncombe County staff, was to allow the public an opportunity to review the different alignment segments proposed for the study and provide feedback to help determine the overall preferred alignment. Approximately 93 citizens provided comments during and after the meeting. Materials provided at the meeting are included in Appendix B. 106 comments were received online during the comment period, ending on April 25, 2016. All comments are on file with Buncombe County and are summarized in Table 2. Commenters listed their preferred segment configuration and other concerns for the greenway. Common themes in the comments included:

- Safety, particularly when using the NC 191 corridor;
- Segments 1 and 7 receive little support and many are concerned with safety on these segments;
- Request for the fewest number of roadway crossings possible;
- Utilize grade separated crossings at I-26;
- Separate cyclists from pedestrians to the greatest extent practical.

The two most popular combinations of segments chosen in the comments were:



These two pathways were ranked significantly more favorably than the other possible combinations. Other potential combinations of segments were developed and ranked by favorability of the public. The sum of the scores included the average favorability given to each segment on the online comment tool. The average of each segment included in a complete path was added together to get the complete score.

Based on the analysis of these scores, it is clear that the public prefers alternatives that include Segment 2 given its lack of vehicular conflicts. To help select which three alternatives should advance for additional analysis, the project team determined that the top two scoring alignments be advanced for further consideration. The third alternative was selected based on the realization that any unknown fatal flaw with Segment 2 would not leave Buncombe County with future alternatives for additional study. Therefore, the highest ranking segment that included Segment 1 was selected as the third alternative. As the feasibility study progressed, the team learned that Segment 2 would not be supported by an adjacent property owner.

In addition, these three alternatives include nearly all of the segments studied. This will give Buncombe County the option of combining different series of segments to create different alignments if future studies provide different results. Only Segments 5 and 21 are not included in the three studied alternatives. These two segments have fatal flaws that limit their ability to be successfully implemented. Segment 5 requires crossing two sets of ramps at the NC 191 overpass of I-40, where Segment 3 provides the same crossing of I-40 with no conflicts with the ramps. Segment 21 would likely require the reconstruction of Hominy Creek Road and increasing conflicts with garbage trucks accessing the transfer station.

Table 2. Public Scoring of Different Segment Combinations*

Segment Combination Number	Segments/Public Scores			Combined Segments Score	Rank	Comments	Proposed Path Name
1	S1 3.02105	S3 3.463128	S11 (S21-S20) 3.347826	9.832004	11	Do not recommend (scored too low)	
2	S1 3.02105	S3 3.463128	S11 (S10-S9-S22-S20) 3.655914	10.140092	7	Recommend for Alternative Analysis	C
3	S1 3.02105	S3/5 Hyb 3.373626	S7 (S22-S20-S9-S10-S11) 3.736842	10.131518	8	Do not recommend (scored too low)	
4	S1 3.02105	S3/5 Hyb 3.373626	S7 (S22-S20) 3.617021	10.011697	9	Do not recommend (scored too low)	
5	S1 3.02105	S5 3.152174	S7 (S22-S20-S9-S10-S11) 3.736842	9.910066	10	Do not recommend (scored too low)	
6	S1 3.02105	S5 3.152174	S7 (S22-S20) 3.617021	9.790245	12	Do not recommend (scored too low)	
7	S2 4.291666	S3 3.463128	S11 (S21-S20) 3.347826	11.10262	5	Do not recommend (too similar to #1)	
8	S2 4.291666	S3 3.463128	S11 (S10-S9-S22-S20) 3.655914	11.410708	1	Recommend for Alternative Analysis	A
9	S2 4.291666	S3/5 Hyb 3.373626	S7 (S22-S20-S9-S10-S11) 3.736842	11.402134	2	Recommend for Alternative Analysis	B
10	S2 4.291666	S3/5 Hyb 3.373626	S7 (S22-S20) 3.617021	11.282313	3	Do not recommend (too similar to #2)	
11	S2 4.291666	S5 3.152174	S7 (S22-S20-S9-S10-S11) 3.736842	11.180682	4	Do not recommend (S5 is not desirable)	
12	S2 4.291666	S5 3.152174	S7 (S22-S20) 3.617021	11.060861	6	Do not recommend (S5 is not desirable)	

*Highlighted rows are advanced for further study.

Table 3. Complete Path Analysis Matrix

Path	Segments	Segment Combination	Description	Length of Path	Existing easements or right of way available	Public Support	Aesthetics	Topography	Floodplain Impacts	Public Access	Commercial Access/Economic Development	Vehicular Conflicts	Comment
A	Segments: 2, 3, 11, 10, 9, 22, 20	This alternative includes two paths, the first from the Biltmore Square Mall to the Hominy Creek Trail and the second from the Hominy Creek Trail to the Hominy Creek River Park. The first path begins on the east side of NC 191, from south of I-26 near the to the intersection of the WNC Farmer's Market, then crossing to the west side of NC 191 to the historic bridge over Hominy Creek, ending at the existing Hominy Creek Trail. The second path begins south of the historic bridge and proceeds south along the western bank of Hominy Creek, crossing under both I-26 and I-40. The path then crosses Hominy Creek using a bridge structure and proceeds south along Hominy Creek Road to the Hominy Creek River Park.	10' hard surface path.	Path 1: 2.48 mi Path 2: 0.79 mi Total Path: 3.27 mi	NC 191 and Hominy Creek Road public right of way available. Some opportunity to utilize publicly owned parcels. Right of way and easements would be required from Biltmore Farms, Inc.	Highest	High	Favorable	Few	Medium	Low	Few	This alternative received the most public support out of all combinations. However, Biltmore Company does not support the project on this side of the road due to potential impacts to the historic property.
B	Segments: 2, 3/5 hyb, 7, 22, 20, 9, 10, 11	This alternative includes two paths, the first from the Biltmore Square Mall to the Hominy Creek Trail and the second from the west bank of Hominy Creek north of I-40 to the Hominy Creek River Park. The first path begins on the east side of NC 191, from south of I-26 near the Biltmore Square Mall to the intersection of the WNC Farmer's Market, then crossing to the west side of NC 191 to cross I-40, then crossing back to the east side of NC 191 and following the I-40 exit ramp to the west bank of Hominy Creek, and then following Hominy Creek to the north to cross the historic bridge over Hominy Creek, ending at the existing Hominy Creek Trail. The second path begins at the western bank of Hominy Creek north of I-40 and proceeds south along the western bank of Hominy Creek, crossing under I-40. The path then crosses Hominy Creek using a bridge structure and then proceeds south along Hominy Creek Road to the Hominy Creek River Park.	10' hard surface path.	Path 1: 2.55 mi Path 2: 0.46 mi Total Path: 3.01 mi	NC 191 and Hominy Creek Road public right of way available. Some opportunity to utilize publicly owned parcels. Right of way and easements would be required from Biltmore Farms, Inc.	2nd Highest	High	Unfavorable	Few	Medium	Low	Medium	This alternative received the 2nd most public support and provides access to the same destinations with a slightly shorter project length. Segment 7 contains steep slopes, grades and sharp horizontal curvature.
C	Segments: 1, 3, 11, 10, 9, 22, 20	This alternative includes two paths, the first from the Biltmore Square Mall to the Hominy Creek Trail and the second from the Hominy Creek Trail to the Hominy Creek River Park. The first path begins on the west side of NC 191, from south of I-26 near the Biltmore Square Mall to the historic bridge over Hominy Creek, ending at the existing Hominy Creek Trail. The second path begins south of the historic bridge over Hominy Creek and proceeds south along the western bank of Hominy Creek, crossing under both I-26 and I-40. The path then crosses Hominy Creek using a bridge structure and then proceeds south along Hominy Creek Road to the Hominy Creek River Park.	10' hard surface path.	Path 1: 2.64 mi Path 2: 0.79 mi Total Path: 3.43 mi	NC 191 and Hominy Creek Road public right of way available. Some opportunity to utilize publicly owned parcels. Right of way and easements would be required from Biltmore Farms, Inc.	7th Highest	Medium	Moderate	Few	High	High	High	This path utilizes the western side of NC 191 south of the WNC Farmer's Market. This alternative would widen the existing sidewalk to 10', but would also require the reconstruction of many driveways and easements from multiple parcels along the west side of NC 191.
Color Coding:		Highly Favorable	Favorable	Potential Problem	Unfavorable								

PREFERRED ALTERNATIVE

Potentially Impacted Properties

Path C was selected by Buncombe County Recreation Services as the preferred alternative for further advancement. The Path C map in the attached figures illustrates the preferred alternative location. The driving factor behind selecting Path C as the preferred alternative was the lack of support from a major adjacent property owner, Biltmore Company/West Range, LLC, for Paths A and B. This property owner cited its status as a historic resource and incompatible land uses as reasons for not supporting alternatives that utilized Segment 2.

While every effort was made to design the greenway in public right of way, the topography and other factors necessitate it crossing private property. Fee simple purchase is recommended for acquiring right of way and temporary easements are recommended for the construction easements.

Cost Estimates

The cost of the greenway will be influenced by many different factors. These factors include the cost of petroleum products and other commodity costs, right of way costs, local market conditions, cost of professional services and other factors.

At this early phase of development, there are still many uncertainties that may influence cost. Major pay items that are quantifiable using the functional design such as grading, paving, drainage and structures are quantified and estimated using NCDOT or other local average unit prices. Other pay items, which are not included in the functional design, such as detailed drainage, erosion control, minor utilities, professional services are estimated as a percentage of construction cost and on the total number of impacted parcels. Contingencies of 15 percent on the structures costs and 45 percent on the roadway items costs capture some of these unquantifiable pay items and the general uncertainty associated with the project at this early phase of development.

The right of way and easement cost estimates begin with calculating the area of each parcel impacts. Since this project assumes that no buildings will be damaged, the percentage of the overall parcel impact is multiplied by the overall tax value of the land, based on the current tax value on the Buncombe County GIS website. The cost of right of way is assumed to be 2.5X the tax value of the impact parcel, and temporary construction easements are calculated as 0.6X the tax value of the parcel. These factors are approximations of the actual cost to acquire the right of way and easements. Other local factors can change these values. It is assumed that government owned parcels and right of way will be donated to the project; therefore, no cost was applied to City, County or State owned right of way or parcels.

All costs are in 2016 dollars. Detailed functional design level cost estimates are included in Appendix C for each segment included in the three studied alternatives.

The current cost estimate for the preferred alternative is \$5,960,820. This estimate is outlined in Tables 4, 5 and 6 by segment and cost components.

Table 4. Probable Cost Estimate by Segment*

Segment	Total \$	Calculated Cost per Mile by Segment
Segment 1	\$2,009,540	\$1,082,109
Segment 2	\$1,686,223	\$997,223
Segment 3	\$1,404,183	\$2,072,971
Segment 3/5 hyb	\$1,310,551	\$6,552,755
Segment 7	\$755,224	\$3,446,545
Segment 9/10	\$1,189,697	\$3,550,410
Segment 11	\$246,312	\$2,300,949
Segment 20	\$126,808	\$533,287
Segment 22	\$984,280	\$4,490,662

*Includes Right of way, easements, preliminary engineering, construction and contingencies.

Table 5. Construction Cost Estimate by Alternative*

Segment	Total \$	Calculated Cost per Mile by Segment
Path A	\$5,637,399	\$1,725,402
Path B	\$6,298,991	\$2,093,353
Path C	\$5,960,820	\$1,736,000

*Includes Right of way, easements, preliminary engineering, construction and contingencies.

Table 6. Construction Cost Estimate by Cost Component for Preferred Alternative (Path C)

Cost Components	Total \$	Calculated Cost per Mile (3.434 miles)
Construction Cost	\$3,839,000	\$1,117,938
Right of Way/Easements	\$749,247	\$281,185
Contingencies	\$541,893	\$157,802
Engineering & Construction Services	\$830,680	\$241,899
Total	\$5,960,820	\$1,736,000

The estimated cost and cost per mile of this greenway facility is higher than comparable facilities due to several factors. The most influential is the high cost of structures associated with the crossing of the I-26, I-40, Hominy Creek and retaining walls required to stabilize the slopes under the Interstate bridges. Other contributing factors include large amounts of earthwork and the pedestrian safety rail that are required due to the mountainous topography of the area.

As described in the next section, there may be opportunities to realize cost savings by coordinating with adjacent NCDOT projects. The bulk of those savings would be from a potential reduction in the cost of earthwork, safety rail and retaining wall structures.

To enhance the overall experience of the greenway, it is recommended that emergency services be added to the proposed greenway. Many greenways are currently adding mile marker signs placed at quarter-mile increments to allow greenway users to describe their location during an emergency call. This will allow responders to more quickly arrive at the location. The construction cost for this item was included in the per mile cost for Pavement Marking and Signing. In

more advanced stages of design, the cost will be split into its components.

Coordination Opportunities

The proposed greenway crosses other projects that are scheduled for planning, design or construction in the near future. The three most prominent projects include NCDOT's I-5504 (reconstruction of the NC 191 interchange with I-26), I-2513 (reconstruction of the I-26 interchange with I-40 and I-240), and the Buncombe County Bent Creek - Lake Julian Greenway.

The beginning of the greenway project, both Segments 1 and 2, crosses through the I-5504 project near the interchange with I-26. The functional plans included with this feasibility study were designed to accommodate the future I-5504 project, which should be let for construction in FY 2016. Through the I-5504 project's planning phase, its typical section was determined to include bike lanes and sidewalk on both sides of the roadway. This study includes the reconfiguration of the proposed bridge to convert the sidewalk into a greenway crossing of I-26 by widening the sidewalk and adding a concrete barrier between it and the adjacent travel lanes. Regardless of which alternative is selected, the greenway will cross at least one set of the ramps included in the I-5504 project.

Segments 3, 7, 9/10 and 22 could be affected by the future I-2513 project. It's likely that the I-2513 project will have the largest effect on Segment 7, and may require the realignment if Path B is chosen as the preferred alternative. The remaining segments will simply need to be coordinated with the I-2513 design and can likely be accommodated.

Coordination will be minimal with the Bent Creek – Lake Julian project. This current greenway feasibility study was design to tie directly to the northern terminus of that project. Any future coordination requirements would be the result of designing and/or constructing both projects together.

Unlike the Bent Creek – Lake Julian project, there is little opportunity to realize cost savings due to coordination. Much of the I-5504 project is already designed, and will be constructed soon. It is possible that some minor cost savings could occur if the I-2513 project acquires the entire Biltmore Farms parcel (PIN 9637072693). This would reduce the right of way costs associated with the construction of Segments 7 and 9/10.

CONCLUSION and NEXT STEPS

This feasibility study has determined that there is broad support for the greenway, both for recreation as well as transportation needs. The preferred alternative was chosen based on public preference, as well as analysis by the steering committee of the path that would best meet the needs of Buncombe County.

This project is not currently funded by either Buncombe County or any other entity and will likely take several years to complete. However, funding mechanisms to consider may include:

- public/private partnerships;
- adding on-street greenway access at the time of NCDOT roadway improvement projects;
- use of the FEMA buy-out program for properties within the floodplain; and
- other traditional government funding mechanisms, such as bonds.

The amount of funding available will depend on the priority level this project receives from the County. In the interim, the County may consider adopting an outreach strategy to land owners for property acquisition for the greenway.

As this project is advanced to future stages of design and construction, the following activities will need to be considered by Buncombe County to advance the project:

- NEPA Document if Federal funds are used
- SEPA Document if state funds are used
- Preliminary and Final Design
- 401/404 Permits

- No-Rise Certification
- NCDENR Erosion Control Permit
- NCDOT Right of Way Encroachment Permit
- Right of Way Acquisition
- Construction Administration
- Construction Inspection

SOURCES

- Barcklow, Cynthia. Buncombe County Floodplain Administrator. Personal communication June 2015.
- Barcklow, Cynthia. Buncombe County Floodplain Administrator. Personal communication April 2015.
- Buncombe County. *Buncombe County Greenways and Trails Master Plan*. August 2012.
- Buncombe County. Flood Damage Prevention Ordinance. County Code of Ordinances, Chapter 34. Accessed April 2015.
- City of Asheville. Steep Slope Ordinance. Municipal Code Ch. 8, Article XII, Sec. 7-12-4.
- Goodson, Mike. Buncombe County Stormwater Manager. Personal communication June 2015.
- NC Division of Mitigation Services. Local Watershed Plan for the French Broad River Basin. January 2006.
- North Carolina Bicycle Facilities Planning and Design Guidelines, NCDOT 1994
- Guide for the Planning, Design, and Operation of Pedestrian Facilities, American Association of State Highway Transportation Officials, July 2004

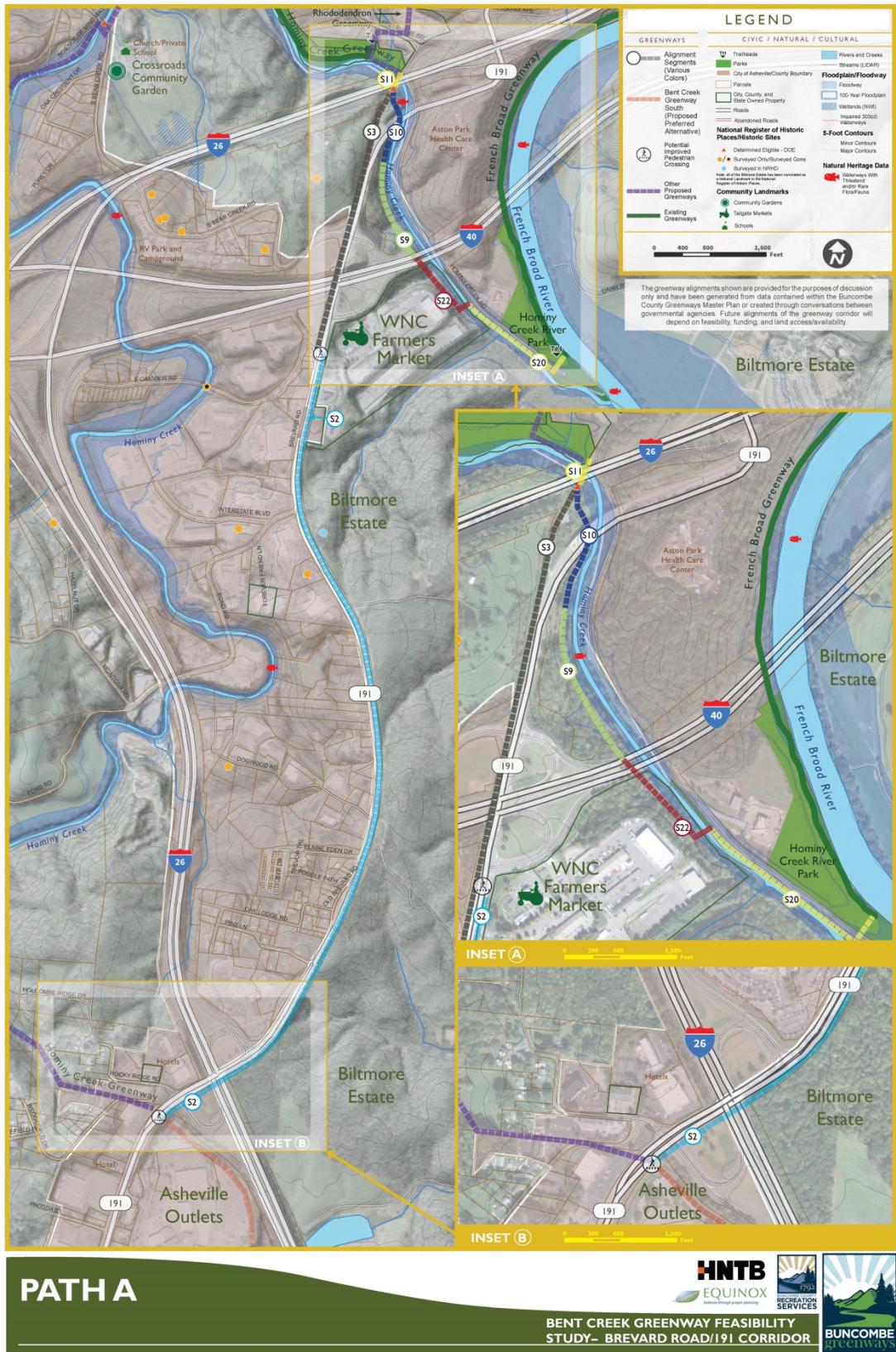
Figures

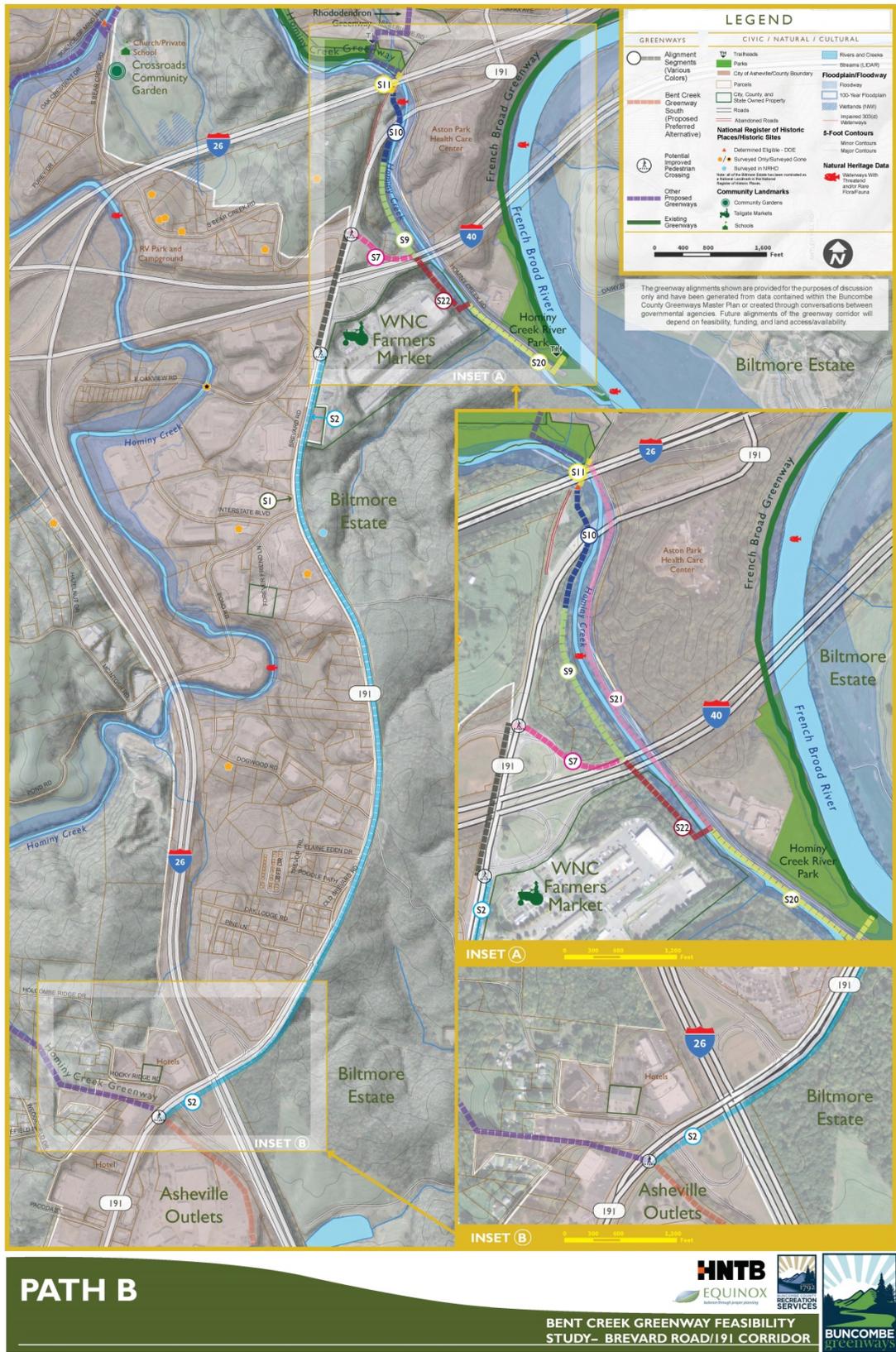
Existing Conditions

Path A Alignment

Path B Alignment

Path C Alignment (Preferred Alternative)







**PATH C
PREFERRED ALIGNMENT**

HNTB
EQUINOX
RECREATION SERVICES

BUNCOMBE greenways

BENT CREEK GREENWAY FEASIBILITY STUDY- BREVARD ROAD/191 CORRIDOR

Appendices

Appendix A: Design Criteria

Appendix B: Public Involvement (2 pages)

Appendix C: Cost Estimates

PROPOSED PATH DESIGN CRITERIA

COUNTY: Buncombe
 PROJECT DESCRIPTION: Multiuse Bike Path
 DIVISION: 13
 PREPARED BY: HNTB

TIP: NA
 PAGE: 1 of 1
 DATE: 6/1/2016

Line		Reference Notes
Classification	Paved Multiuse Path	
Design Speed Grade < 4% (mph)	20	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Design Speed Grade ≥ 4% (mph)	30	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Prop. R/W Width (ft)	Varies	
Lane Width (ft)	5', 10' Total	NC Bicycle Facilities Planning and Design Guidelines pg. 42
Shoulder Width (Total)		
Outside w/ Shoulder Slope < 3:1 (ft)	2'	NC Bicycle Facilities Planning and Design Guidelines pg. 43
Outside w/ Shoulder Slope ≥ 3:1 (ft)	5'	NC Bicycle Facilities Planning and Design Guidelines pg. 44
Landings		
Landing Spacings	NA	US Access Board SNPRM
Grade		
Max. (Des)	5%*	NC Bicycle Facilities Planning and Design Guidelines pg. 47
Min.	0.5% Des (0.3% Min)	AASHTO Bike Facility pg. 5-17
Safety Rail Criteria		
Criteria for Utilizing Safety Rail	Slope>3:1, fill>6'	NC Bicycle Facilities Planning and Design Guidelines pg. 52
	Slope>2:1, fill>4'	NC Bicycle Facilities Planning and Design Guidelines pg. 52
	Slope>1:1, fill>3'	NC Bicycle Facilities Planning and Design Guidelines pg. 52
Vertical Clearance		
Desirable (ft.)	10	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Min. (ft.)	8	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Min. Stopping Sight Distance		
Negative Grade < 4% (ft)	195	NC Bicycle Facilities Planning and Design Guidelines pg. 47
Negative Grade ≥ 4% (ft)	385	NC Bicycle Facilities Planning and Design Guidelines pg. 47
Positive Grade < 4% (ft)	140	NC Bicycle Facilities Planning and Design Guidelines pg. 47
Positive Slope Grade ≥ 4% (ft)	255	NC Bicycle Facilities Planning and Design Guidelines pg. 47
Horiz. Align.		
Max. Super	2%	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Min. Radius, Grade < 4% (ft)	95**	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Min. Radius, Grade ≥ 4% (ft)	250	NC Bicycle Facilities Planning and Design Guidelines pg. 45
Cross Slopes		
Pavement	2%	NC Bicycle Facilities Planning and Design Guidelines pg. 45

NOTES:

* 5% max grade utilized where possible. In areas where the alignment is parallel to an existing roadway, the Path grade is equal to the adjacent roadway grade.
 ** Smaller radii are allowed in areas that are topographically and environmentally sensitive



BUNCOMBE greenways

191 Greenway Corridor Public
Feedback, WNC Farmers
Market, March 24, 4pm - 7pm

Name:

Zip:

Email:

<p>How did you hear about this project and opportunity for input?</p> <ul style="list-style-type: none"> <input type="radio"/> Print Media <input type="radio"/> Online Advertising <input type="radio"/> Twitter <input type="radio"/> Facebook <input type="radio"/> Local News Program <input type="radio"/> An email list I am part of <input type="radio"/> Invite from friend <input type="radio"/> Other <input style="width: 150px; height: 20px;" type="text"/> 	<p>Would you like to be added to our mailing list for upcoming Buncombe Greenways information?</p> <ul style="list-style-type: none"> <input type="radio"/> YES! <input type="radio"/> No
--	---

I would not use this route ←————→ This is a preferred option



**THERE'S
MORE ON
THE BACK!**

	0	1	2	3	4	5
S1	<input type="radio"/>					
S2	<input type="radio"/>					
S3	<input type="radio"/>					
S5	<input type="radio"/>					
S3/S5 Hybrid	<input type="radio"/>					
S11 to S21 to S20	<input type="radio"/>					
S7 to S22 to S20	<input type="radio"/>					
S11 to S10 to S9 to S22 to S20	<input type="radio"/>					
S7 to S22 to S20 (with linkage to Hominy Creek Greenway via S9 to S10 to S11)	<input type="radio"/>					

What other issues or concerns do you have regarding the proposed greenway segments?

	Strongly Disagree					Strongly Agree
	0	1	2	3	4	5
I am supportive of greenways.	<input type="radio"/>					
Greenways are an important recreational element within the community.	<input type="radio"/>					
Greenways are an important transportation element within the community.	<input type="radio"/>					
Greenways are an important driver of tourism within the community.	<input type="radio"/>					
Greenways are an important driver of economic development within the community.	<input type="radio"/>					
Greenways can include sidewalks, sharrows, bike lines, and other elements as part of an overall connected network.	<input type="radio"/>					
Greenways should be completely separated from existing roadways.	<input type="radio"/>					
Our priority should be constructing greenways as quickly and efficiently as possible.	<input type="radio"/>					
Our priority should be creating a greenway system focused on a unique experience.	<input type="radio"/>					
When it comes to use of tax dollars, I highly prioritize greenway funding.	<input type="radio"/>					

TIP No.		<u>N/A</u>	Func		County:	Buncombe
Route		Bent Creek - NC 191 Segment 1				
From		NC 191 at Outlet Mall to WNC Farmer's Market West				CONSTR. COST
Typical Section		10' Wide Greenway (5' sidewalk widening)				\$1,101,000
Prepared By: EWS			Date		6/9/2016	
Requested By: JOC			Date		6/9/2016	

Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.3	Acre	\$ 10,000.00	\$ 3,200.00
			Earthwork (Fill)	6,221	CY	\$ 6.00	\$ 37,326.00
			Earthwork (Cut)	4,620	CY	\$ 8.00	\$ 36,960.00
			Drainage (Greenway)	1.86	Miles	\$ 20,000.00	\$ 37,200.00
			Fine Grading	2,769	SY	\$ 2.00	\$ 5,537.54
			Sidewalk Widening	3,610	SY	\$ 35.00	\$ 126,333.06
			New Pavement	2,769	SY	\$ 25.00	\$ 69,219.25
			Roadway Pedestrian Handrail	1,029	LF	\$ 60.00	\$ 61,742.40
			Single Face Concrete Barrier Wall	450	LF	\$ 85.00	\$ 38,229.60
			Concrete Driveway Construction	399	SY	\$ 50.00	\$ 19,942.77
			Fencing				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	3.2	Acres	\$ 12,000.00	\$ 38,998.05
			Guard Rail				
			Steel Beam Guard Rail	68.0	LF	\$ 15.00	\$ 1,020.30
			GRAU, Type 350	1.0	Each	\$ 1,800.00	\$ 1,800.00
			Guardrail Anchor, Type CAT-1	1.0	Each	\$ 600.00	\$ 600.00
			Guardrail Anchor, Type III	2.0	Each	\$ 1,400.00	\$ 2,800.00
			Upgrade Traffic Signal (ped/x-walks)	3	Each	\$ 17,500.00	\$ 52,500.00
			Traffic Control	1.9	Miles	\$ 25,000.00	\$ 46,426.47
			Pavement Marking/Signing	1.9	Miles	\$ 8,000.00	\$ 14,856.47
			Structures				
			Retaining Wall 87+00 - 89+00 LT	535.7	SF	\$ 30.00	\$ 16,072.50
			Retaining Wall 89+47 - 91+00 LT	382.4	SF		\$ -
			Retaining Wall 98+85 - 100+58 LT	345.8	SF	\$ 40.00	\$ 13,831.20
			Bridge Overlay I-26 Bridge	1,951.8	SF	\$ 40.00	\$ 78,073.20
			Misc. & Mob (15% Strs&Util)				\$ 16,196.54
			Misc. & Mob (45% Roadway)				\$ 237,876.76
Lgth	1.86 Mi.		Contract Cost				\$ 956,742.10
			E. & C. 15%				\$ 143,511.31
			Construction Cost				\$ 1,100,253.41

TIP No.		<u>N/A</u>	Func		County:	Buncombe
Route		Bent Creek - NC 191 Segment 2				
From		NC 191 at Outlet Mall to WNC Farmer's Market				CONSTR. COST
Typical Section		10' Wide Greenway				\$1,336,000
Prepared By: EWS			Date		6/9/2016	
Requested By: JOC			Date		6/9/2016	

Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.9	Acre	\$ 10,000.00	\$ 9,000.00
			Earthwork (Fill)	11,357	CY	\$ 6.00	\$ 68,142.00
			Earthwork (Cut)	3,252	CY	\$ 8.00	\$ 26,016.00
			Drainage (Greenway)	1.69	Miles	\$ 20,000.00	\$ 33,800.00
			Fine Grading	9,256	SY	\$ 2.00	\$ 18,512.38
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	9,256	SY	\$ 25.00	\$ 231,404.78
			Roadway Pedestrian Handrail	2,120	LF	\$ 60.00	\$ 127,179.00
			Single Face Concrete Barrier Wall	456	LF	\$ 85.00	\$ 38,793.15
			Fencing				
			Woven Wire (Remove and Replace)	7,168	LF	\$ 6.00	\$ 43,006.38
			Erosion Control	4.3	Acres	\$ 12,000.00	\$ 51,733.44
			Guard Rail				
			Steel Beam Guard Rail	2,729.2	LF	\$ 15.00	\$ 40,937.40
			GRAU, Type 350	7.0	Each	\$ 1,800.00	\$ 12,600.00
			Guardrail Anchor, Type CAT-1	7.0	Each	\$ 600.00	\$ 4,200.00
			Guardrail Anchor, Type III	2.0	Each	\$ 1,400.00	\$ 2,800.00
			Upgrade Traffic Signal	1	Each	\$ 17,500.00	\$ 17,500.00
			Traffic Control	1.7	Miles	\$ 25,000.00	\$ 42,270.36
			Pavement Marking/Signing	1.7	Miles	\$ 8,000.00	\$ 13,526.52
			Structures				
			Bridge Overlay	1,951.8	SF	\$ 30.00	\$ 58,554.90
			Misc. & Mob (15% Strs&Util)				\$ 8,783.24
			Misc. & Mob (45% Functional)				\$ 312,568.56
Lgth	1.69 Mi.		Contract Cost				\$ 1,161,328.11
			E. & C. 15%				\$ 174,199.22
			Construction Cost				\$ 1,335,527.32

TIP No.			<u>N/A</u>	Func		County:	Buncombe
Route			Bent Creek - NC 191 Segment 3				
From			NC 191 at WNC Farmer's Market to HC Bridge				CONSTR. COST
Typical Section			10' Wide Greenway				\$1,080,000
Prepared By: EWS				Date		6/9/2016	
Requested By: JOC				Date		6/9/2016	
Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.4	Acre	\$ 10,000.00	\$ 4,482.09
			Earthwork (Fill)	515	CY	\$ 6.00	\$ 3,090.00
			Earthwork (Cut)	214	CY	\$ 8.00	\$ 1,712.00
			Drainage (Greenway)	0.68	Miles	\$ 15,000.00	\$ 10,200.00
			Fine Grading	2,186	SY	\$ 2.00	\$ 4,372.05
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	2,186	SY	\$ 25.00	\$ 54,650.68
			Roadway Pedestrian Handrail	98	LF	\$ 60.00	\$ 5,898.60
			Single Face Concrete Barrier Wall	80	LF	\$ 85.00	\$ 6,842.50
			<u>Fencing</u>				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	1.0	Acres	\$ 12,000.00	\$ 12,323.94
			<u>Guard Rail</u>				
			Steel Beam Guard Rail	52.8	LF	\$ 15.00	\$ 792.30
			GRAU, Type 350	1.0	Each	\$ 1,800.00	\$ 1,800.00
			Guardrail Anchor, Type CAT-1	1.0	Each	\$ 600.00	\$ 600.00
			Guardrail Anchor, Type III	2.0	Each	\$ 1,400.00	\$ 2,800.00
			Upgrade Traffic Signal	1	Each	\$ 17,500.00	\$ 17,500.00
			Traffic Control	0.6	Miles	\$ 15,000.00	\$ 8,554.94
			Pavement Marking/Signing	0.6	Miles	\$ 8,000.00	\$ 4,562.64
			<u>Structures</u>				
			Bridge Widening Sta 17+11 - 19+99 (16'x288')	4,614.1	SF	\$ 140.00	\$ 645,971.20
			Misc. & Mob (15% Strs&Util)				\$ 96,895.68
			Misc. & Mob (45% Functional)				\$ 56,072.70
Lgth	0.68 Mi.		Contract Cost .....	.....	.....	.....	\$ 939,121.33
			E. & C. 15% .....	.....	.....	.....	\$ 140,868.20
			Construction Cost .....	.....	.....	.....	\$ 1,079,989.53

TIP No.			<u>N/A</u>	Func		County:	Buncombe
Route			Bent Creek - NC 191 Segment 3-5 Hybrid				
From			NC 191 at WNC Farmer's Market to HC Bridge				CONSTR. COST
Typical Section			10' Wide Greenway				\$1,004,000
Prepared By: EWS				Date		6/9/2016	
Requested By: JOC				Date		6/9/2016	

Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.1	Acre	\$ 10,000.00	\$ 1,027.00
			Earthwork (Fill)	498	CY	\$ 6.00	\$ 2,988.00
			Earthwork (Cut)	206	CY	\$ 8.00	\$ 1,648.00
			Drainage (Greenway)	0.2	Miles	\$ 20,000.00	\$ 4,499.32
			Fine Grading	1,055	SY	\$ 2.00	\$ 2,109.69
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	1,055	SY	\$ 25.00	\$ 26,371.15
			Roadway Pedestrian Handrail	98	LF	\$ 60.00	\$ 5,898.60
			Single Face Concrete Barrier Wall	80	LF	\$ 85.00	\$ 6,842.50
			<u>Fencing</u>				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	1.0	Acres	\$ 12,000.00	\$ 12,323.94
			<u>Guard Rail</u>				
			Steel Beam Guard Rail	52.8	LF	\$ 15.00	\$ 792.30
			GRAU, Type 350	1.0	Each	\$ 1,800.00	\$ 1,800.00
			Guardrail Anchor, Type CAT-1	1.0	Each	\$ 600.00	\$ 600.00
			Guardrail Anchor, Type III	2.0	Each	\$ 1,400.00	\$ 2,800.00
			Upgrade Traffic Signal	1	Each	\$ 17,500.00	\$ 17,500.00
			Traffic Control	0.2	Miles	\$ 15,000.00	\$ 3,374.49
			Pavement Marking/Signing	0.2	Miles	\$ 8,000.00	\$ 1,799.73
			<u>Structures</u>				
			Bridge Widening Sta 17+11 - 19+99 (16'x288')	4,614.1	SF	\$ 140.00	\$ 645,971.20
			Misc. & Mob (15% Strs&Util)				\$ 96,895.68
			Misc. & Mob (45% Functional)				\$ 36,949.88
Lgth	0.20	Mi.	Contract Cost .....	.....	.....	.....	\$ 872,191.47
			E. & C. 15% .....	.....	.....	.....	\$ 130,828.72
			Construction Cost .....	.....	.....	.....	\$ 1,003,020.20

TIP No.		<u>N/A</u>	Func		County:	Buncombe	
Route		Bent Creek - NC 191 Segment 7					
From		NC 191 at I-40 to Seg 9/10				CONSTR. COST	
Typical Section		10' Wide Greenway				\$420,000	
Prepared By: EWS			Date		6/9/2016		
Requested By: JOC			Date		6/9/2016		
Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.9	Acre	\$ 10,000.00	\$ 9,046.08
			Earthwork (Fill)	19,361	CY	\$ 6.00	\$ 116,166.00
			Earthwork (Cut)	3,339	CY	\$ 8.00	\$ 26,712.00
			Drainage (Greenway)	0.22	Miles	\$ 16,000.00	\$ 3,520.00
			Fine Grading	1,104	SY	\$ 2.00	\$ 2,207.93
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	1,104	SY	\$ 25.00	\$ 27,599.08
			Roadway Pedestrian Handrail	807	LF	\$ 60.00	\$ 48,418.80
			Single Face Concrete Barrier Wall	0	LF	\$ 85.00	\$ -
			<u>Fencing</u>				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	0.9	Acres	\$ 12,000.00	\$ 10,855.29
							\$ -
			<u>Guard Rail</u>				
			Steel Beam Guard Rail	0.0	LF	\$ 15.00	\$ -
			GRAU, Type 350	0.0	Each	\$ 1,800.00	\$ -
			Guardrail Anchor, Type CAT-1	0.0	Each	\$ 600.00	\$ -
			Guardrail Anchor, Type III	0.0	Each	\$ 1,400.00	\$ -
			Upgrade Traffic Signal	0.0	Each	\$ 17,500.00	\$ -
			Traffic Control	0.2	Miles	\$ 25,000.00	\$ 5,478.13
			Pavement Marking/Signing	0.2	Miles	\$ 8,000.00	\$ 1,753.00
			Misc. & Mob (15% Strs&Util)				\$ -
			Misc. & Mob (45% Functional)				\$ 113,290.34
Lgth	0.22	Mi.	Contract Cost .....	.....	.....	.....	\$ 365,046.65
			E. & C. 15% .....	.....	.....	.....	\$ 54,757.00
			Construction Cost .....	.....	.....	.....	\$ 419,803.64

TIP No.			N/A	Func		County:	Buncombe
Route			Bent Creek - NC 191 Segment 9/10				
From			I-40 underpass to Seg 3				CONSTR. COST
Typical Section			10' Wide Greenway				\$583,000
Prepared By: EWS				Date		6/9/2016	
Requested By: JOC				Date		6/9/2016	

Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	1.3	Acre	\$ 10,000.00	\$ 13,041.68
			Earthwork (Fill)	21,647	CY	\$ 6.00	\$ 129,882.00
			Earthwork (Cut)	1,562	CY	\$ 8.00	\$ 12,496.00
			Drainage (Greenway)	0.34	Miles	\$ 16,000.00	\$ 5,440.00
			Fine Grading	1,959	SY	\$ 2.00	\$ 3,917.71
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	1,959	SY	\$ 25.00	\$ 48,971.34
			Roadway Pedestrian Handrail	1,850	LF	\$ 60.00	\$ 111,000.00
			Single Face Concrete Barrier Wall	0	LF	\$ 85.00	\$ -
			Fencing				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	1.8	Acres	\$ 12,000.00	\$ 22,188.81
			Guard Rail				
			Steal Beam Guard Rail	0.0	LF	\$ 15.00	\$ -
			GRAU, Type 350	0.0	Each	\$ 1,600.00	\$ -
			Guardrail Anchor, Type CAT-1	0.0	Each	\$ 800.00	\$ -
			Guardrail Anchor, Type III	0.0	Each	\$ 1,400.00	\$ -
			Upgrade Traffic Signal	0.0	Each	\$ 17,500.00	\$ -
			Traffic Control	0.0	Miles	\$ 25,000.00	\$ -
			Pavement Marking/Signing	0.3	Miles	\$ 8,000.00	\$ 2,680.70
			Misc. & Mob (15% Strs&Util)				\$ -
			Misc. & Mob (45% Functional)				\$ 157,328.21
Lgth	0.34 Mi.		Contract Cost				\$ 506,946.45
			E. & C. 15%				\$ 76,041.97
			Construction Cost				\$ 582,988.41

TIP No.			<u>N/A</u>	Func		County:	Buncombe
Route			Bent Creek - NC 191 Segment 11				
From			HC Bridge to HC Trail				CONSTR. COST
Typical Section			10' Wide Greenway				\$191,000
Prepared By: EWS				Date		6/9/2016	
Requested By: JOC				Date		6/9/2016	
Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.3	Acre	\$ 10,000.00	\$ 2,668.82
			Earthwork (Fill)	1,339	CY	\$ 6.00	\$ 8,034.00
			Earthwork (Cut)	446	CY	\$ 8.00	\$ 3,568.00
			Drainage (Greenway)	0.11	Miles	\$ 20,000.00	\$ 2,200.00
			Fine Grading	479	SY	\$ 2.00	\$ 958.66
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	479	SY	\$ 25.00	\$ 11,983.24
			Roadway Pedestrian Handrail	100	LF	\$ 60.00	\$ 6,000.00
			Single Face Concrete Barrier Wall	0	LF	\$ -	\$ -
			Fencing				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	0.3	Acres	\$ 12,000.00	\$ 3,202.59
			Guard Rail				
			Steal Beam Guard Rail	0.0	LF	\$ 15.00	\$ -
			GRAU, Type 350	0.0	Each	\$ 1,800.00	\$ -
			Guardrail Anchor, Type CAT-1	0.0	Each	\$ 600.00	\$ -
			Guardrail Anchor, Type III	0.0	Each	\$ 1,400.00	\$ -
			Upgrade Traffic Signal	0.0	Each	\$ 17,500.00	\$ -
			Traffic Control	0.0	Miles	\$ 25,000.00	\$ -
			Pavement Marking/Signing	0.1	Miles	\$ 8,000.00	\$ 856.38
			Structures				
			Rehabilitate Historic Bridge 134'x24'	3,211.4	SF	\$ 30.00	\$ 96,343.20
			Misc. & Mob (15% Strs&Util)				\$ 14,451.48
			Misc. & Mob (45% Functional)				\$ 15,788.68
Lgth	0.11 Mi.		Contract Cost .....	.....	.....	.....	\$ 166,055.05
			E. & C. 15% .....	.....	.....	.....	\$ 24,908.26
			Construction Cost .....	.....	.....	.....	\$ 190,963.30

TIP No.		<u>N/A</u>	Func		County:	Buncombe
Route		Bent Creek - NC 191 Segment 20				
From		River Trail to Seg 22				CONSTR. COST
Typical Section		10' Wide Greenway				\$94,000
Prepared By: EWS			Date		6/9/2016	
Requested By: JOC			Date		6/9/2016	

Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.1	Acre	\$ 10,000.00	\$ 1,000.00
			Earthwork (Fill)	133	CY	\$ 6.00	\$ 798.00
			Earthwork (Cut)	668	CY	\$ 8.00	\$ 5,344.00
			Drainage (Greenway)	0.24	Miles	\$ 16,000.00	\$ 3,840.00
			Fine Grading	1,173	SY	\$ 2.00	\$ 2,345.59
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	1,173	SY	\$ 25.00	\$ 29,319.82
			Roadway Pedestrian Handrail	0	LF	\$ 60.00	\$ -
			Single Face Concrete Barrier Wall	0	LF	\$ 85.00	\$ -
			Fencing				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	0.6	Acres	\$ 12,000.00	\$ 7,075.81
			Guard Rail				
			Steal Beam Guard Rail	0.0	LF	\$ 15.00	\$ -
			GRAU, Type 350	0	Each	\$ 1,600.00	\$ -
			Guardrail Anchor, Type CAT-1	0	Each	\$ 800.00	\$ -
			Guardrail Anchor, Type III	0	Each	\$ 1,400.00	\$ -
			Upgrade Traffic Signal	0.0	Each	\$ 17,500.00	\$ -
			Traffic Control	0.2	Miles	\$ 25,000.00	\$ 4,997.68
			Pavement Marking/Signing	0.2	Miles	\$ 8,000.00	\$ 1,599.26
			Misc. & Mob (15% Strs&Util)				\$ -
			Misc. & Mob (45% Functional)				\$ 25,344.07
Lgth	0.24 Mi.		Contract Cost				\$ 81,664.23
			E. & C. 15%				\$ 12,249.63
			Construction Cost				\$ 93,913.86

TIP No.		<u>N/A</u>	Func		County:	Buncombe	
Route		Bent Creek - NC 191 Segment 22					
From		HC Drive to Seg 9/10					
Typical Section		10' Wide Greenway					
						CONSTR. COST	
						\$790,000	
Prepared By: EWS			Date		6/9/2016		
Requested By: JOC			Date		6/9/2016		
Line Item	Des	Sec No.	Description	Quantity	Unit	Price	Amount
			Clearing and Grubbing	0.9	Acre	\$ 10,000.00	\$ 9,064.06
			Earthwork (Fill)	11,774	CY	\$ 6.00	\$ 70,644.00
			Earthwork (Cut)	969	CY	\$ 8.00	\$ 7,752.00
			Drainage (Greenway)	0.22	Miles	\$ 16,000.00	\$ 3,520.00
			Fine Grading	1,163	SY	\$ 2.00	\$ 2,326.40
			Pavement Widening	0	SY	\$ -	\$ -
			New Pavement	1,163	SY	\$ 25.00	\$ 29,080.00
			Roadway Pedestrian Handrail	1,050	LF	\$ 60.00	\$ 63,000.00
			Single Face Concrete Barrier Wall	0	LF	\$ 85.00	\$ -
			<u>Fencing</u>				
			Woven Wire (Remove and Replace)	0	LF	\$ 6.00	\$ -
			Erosion Control	0.9	Acres	\$ 12,000.00	\$ 10,876.87
			<u>Guard Rail</u>				
			Steal Beam Guard Rail	0.0	LF	\$ 15.00	\$ -
			GRAU, Type 350	0.0	Each	\$ 1,800.00	\$ -
			Guardrail Anchor, Type CAT-1	0.0	Each	\$ 600.00	\$ -
			Guardrail Anchor, Type III	0.0	Each	\$ 1,400.00	\$ -
			Upgrade Traffic Signal	0.0	Each	\$ 17,500.00	\$ -
			Traffic Control	0.0	Miles	\$ 25,000.00	\$ -
			Pavement Marking/Signing	0.2	Miles	\$ 8,000.00	\$ 1,753.92
			<u>Structures</u>				
			Retaining Wall 19+72 - 21+29 LT	2,197.6	SF	\$ 30.00	\$ 65,927.40
			Hominy Creek Bridge 110'x17'	1,877.0	SF	\$ 150.00	\$ 281,545.50
			Misc. & Mob (15% Strs&Util)				\$ 52,120.94
			Misc. & Mob (45% Functional)				\$ 89,107.76
Lgth	0.22 Mi.		Contract Cost				\$ 686,718.85
			E. & C. 15%				\$ 103,007.83
			Construction Cost				\$ 789,726.68

Cost Estimate Components

Segment Summary											
Segment Number	Segment Length (mi)	Number of Impacted Parcels	Construction Cost	Tax Value of Impacted Parcels (ROW)	Tax Value of Impacted Parcels (easements)	ROW and Easement Costs	Preliminary Engineering and Professional Services Cost	Overall Contingency	Total Cost in 2016 \$	Cost per Mile	Cost Drivers
1	1.86	30	\$ 1,101,000	\$ 46,042	\$ 297,714	\$ 293,734	\$ 432,120	\$ 182,685	\$ 2,009,540	\$ 1,082,108.82	
2	1.69	2	\$ 1,336,000	\$ 7	\$ 27,495	\$ 16,516	\$ 180,320	\$ 153,284	\$ 1,686,119	\$ 997,223.11	
3	0.68	3	\$ 1,080,000	\$ 3,763	\$ 45,869	\$ 36,930	\$ 159,600	\$ 127,653	\$ 1,404,183	\$ 2,072,971.36	Significant portion is bridge
3/5 Hyb	0.20	3	\$ 1,004,000	\$ 3,763	\$ 45,869	\$ 36,930	\$ 150,480	\$ 119,141	\$ 1,310,551	\$ 6,552,754.52	Mostly bridge
7	0.22	1	\$ 420,000	\$ 82,467	\$ -	\$ 206,168	\$ 60,400	\$ 68,657	\$ 755,224	\$ 3,446,545.35	Large amounts of fill required
9/10	0.34	1	\$ 583,000	\$ 167,433	\$ -	\$ 418,583	\$ 79,960	\$ 108,154	\$ 1,189,697	\$ 3,550,410.25	Large amounts of fill required
11	0.11	1	\$ 191,000	\$ -	\$ -	\$ -	\$ 32,920	\$ 22,392	\$ 246,312	\$ 2,300,949.27	Bridge rehabilitation
20	0.24	1	\$ 94,000	\$ -	\$ -	\$ -	\$ 21,280	\$ 11,528	\$ 126,808	\$ 533,286.27	
22	0.22	1	\$ 790,000	\$ -	\$ -	\$ -	\$ 104,800	\$ 89,480	\$ 984,280	\$ 4,490,662.15	Significant portion is bridge

Alternative Summary									
Alternative	Segments	Total Length	Construction Cost	ROW and Easement Costs	Preliminary Engineering and Professional Services Cost	Overall Contingency	Total Cost in 2016 \$	Cost per Mile	
Alternative 1 (Path A)	2, 3, 11, 20, 22, 9/10	3.267	\$ 4,074,000	\$ 472,028	\$ 578,880	\$ 512,491	\$ 5,637,399	\$ 1,725,402	
Alternative 2 (Path B)	2, 3/5 Hyb, 7, 11, 20, 22, 9/10	3.009	\$ 4,418,000	\$ 678,196	\$ 630,160	\$ 572,636	\$ 6,298,991	\$ 2,093,353	
Alternative 3 (Path C)	1, 3, 11, 20, 22, 9/10	3.434	\$ 3,839,000	\$ 749,247	\$ 830,680	\$ 541,893	\$ 5,960,819	\$ 1,736,056	

Pedestrian Bridge Summary							
Segment	Construction Cost	ROW and Easement Costs	Preliminary Engineering and Professional Services Cost	Overall Contingency	Total Cost in 2016 \$	Cost per Mile	
Segment 1: I-26 Pedestrian Overpass	\$ 4,462,500		\$ 585,500	\$ 504,800	\$ 5,552,800	\$ 19,288,674	
Segment 2: I-26 Pedestrian Overpass	\$ 4,462,500		\$ 555,500	\$ 501,800	\$ 5,519,800	\$ 19,174,042	



BUNCOMBE COUNTY
**RECREATION
SERVICES**

HNTB