



3 NETWORK RECOMMENDATIONS

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OVERVIEW

This chapter contains recommended changes to the Town of Boone's physical environment that will create a safe, accessible, and connected bicycle network. The network consists of existing and proposed on-road and off-road facilities such as bicycle lanes, signed routes, and greenways. Conceptually, the bicycle facility recommendations and the destinations they connect can be seen as a network of 'hubs and spokes'. Downtown Boone, shopping centers, parks, ASU, neighborhoods, schools, and other places where people bicycle to and from are the 'hubs', whereas bicycle lanes, trails, and other bicycle facilities are the 'spokes' that connect them (see below).

The following section covers the methodology for developing the bicycle network, describes the different types of bicyclists and different facility types that are necessary for a truly comprehensive network, and overall network maps showing short-term and long-term bicycle network recommendations.

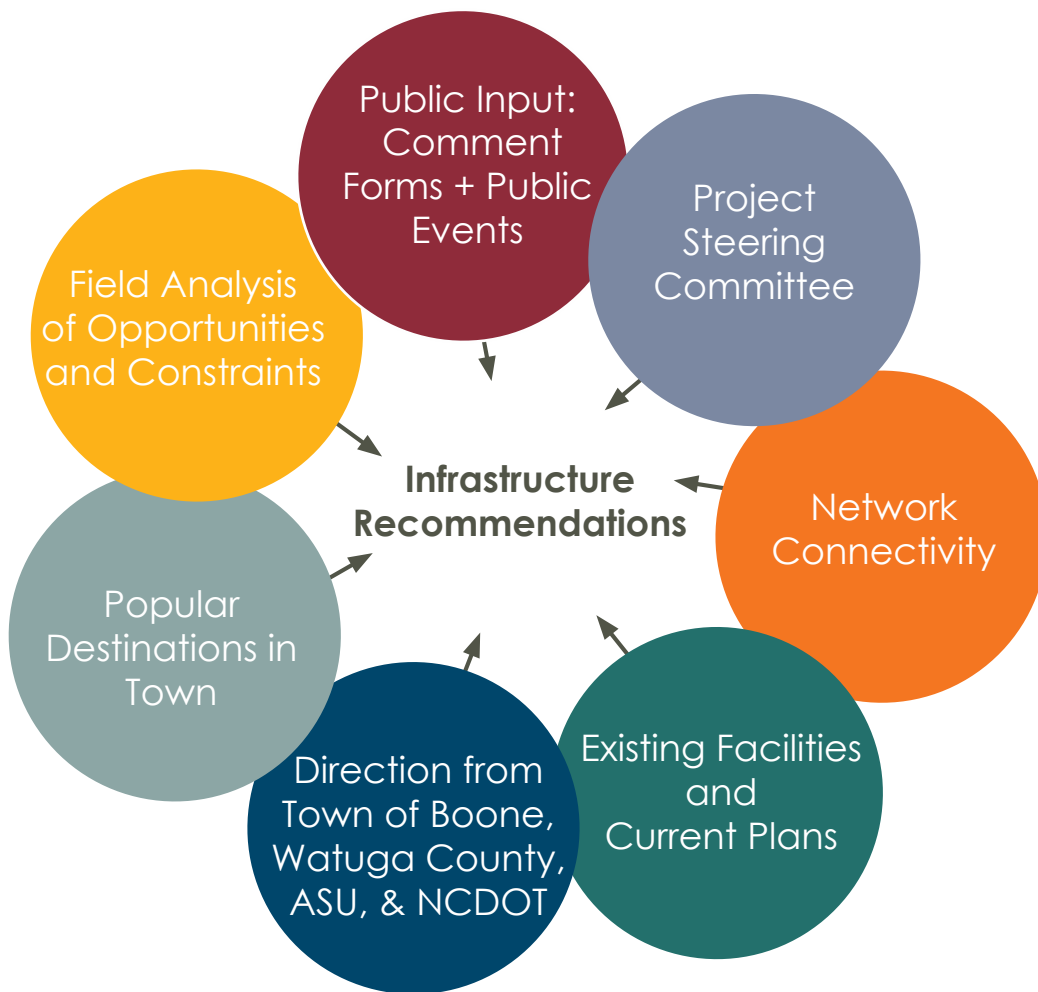


The 'hubs and spokes' model conceptually illustrates how destinations in Boone will be linked through various types of bicycle facilities.



METHODOLOGY FOR BICYCLE NETWORK DESIGN

The recommended bicycle network was developed based on information from several sources: input from the staff and Steering Committee, public input obtained through public comment forms and in-person workshops, previous plans and studies, review of existing bicycle facilities, noted bicycle destinations, and the consultant's field analysis. Field work examined the potential and need for bicycle facilities along key roadway corridors and to make connections between key destinations in Boone, as well as consideration of trail and greenway opportunities. Input sources for the plan are summarized by the diagram below.



This diagram illustrates the inputs used to develop this plan's recommendations.



TYPES OF CYCLISTS

Bicyclists can be categorized into four distinct groups based on comfort level and riding skills. Bicyclists' skill levels greatly influence expected speeds and behavior, both in separated bikeways and on shared roadways. Each of these groups has different bicycle facility needs, so it is important to consider how a bicycle network will accommodate each type of cyclist when creating a non-motorized plan or project. The bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people. In the US population, people are generally categorized into one of four cyclist types. The characteristics, attitudes, and infrastructure preferences of each type are described below.



“Strong and Fearless”

STRONG AND FEARLESS

(Approximately 1% of population)

This cyclist type is characterized by the bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes, and will typically choose roadway connections even if shared with vehicles over separate bicycle facilities such as multi-use paths.

ENTHUSED AND CONFIDENT

(5-10% of population)

This user group includes bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or multi-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreational riders, racers, and utilitarian bicyclists.



“Enthusied and Confident”

INTERESTED BUT CONCERNED

(Approximately 60% of population)

This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or multi-use trails under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become “Enthusied & Confident” with encouragement, education, and experience.



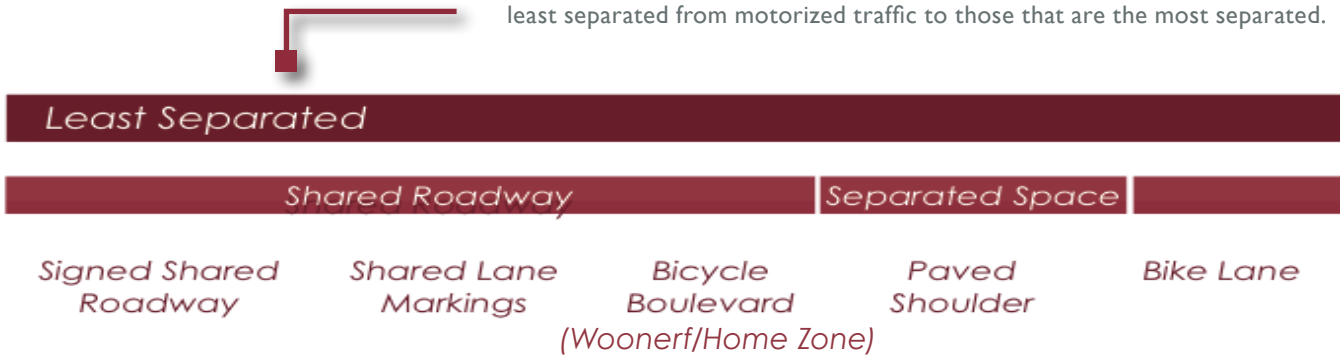
“Interested but Concerned”

NO WAY, NO HOW (NOT PICTURED HERE)

(Approximately 30% of population)

Persons in this category are not bicyclists and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will never ride a bicycle other than on rare occasions or under special circumstances (e.g., in a park, with a child).

This diagram illustrates the spectrum of bicycle facility types, from those that are least separated from motorized traffic to those that are the most separated.



BICYCLE FACILITY TYPES

The descriptions on this page offer a brief overview of the primary facility types recommended in this plan. For more information on facility design, please see Appendix A: Design Guidelines.

SHARED LANE MARKINGS (SHARROW)

Shared lane markings are pavement markings used to indicate shared space for bicyclists and motorists. Sharrows are used on roads where dedicated bicycle lanes are desirable but not possible due to constraints (roadway width, on-street parking, etc). Placed every 100 to 250 feet along a corridor, sharrows make motorists aware of the potential presence of cyclists, direct cyclists to ride in the proper direction, and remind cyclists to ride further from parked cars to avoid ‘dooring’ collisions.



Shared Lane Marking (Sharrow)

WOONERF/HOME ZONE

A street that uses traffic calming, low speed limits, and a shared space concept to give bicyclists and pedestrians priority, both legally and through the street’s design, is called a Woonerf or ‘home zone.’ The concept is similar to bicycle boulevards in the United States and was first developed and implemented in the Netherlands; the term “woonerf” is Dutch for “living street”. Rather than using signage to control and inform road user behavior, a woonerf or home zone is generally devoid of signage, and instead is negotiated through eye contact and human interaction between motorists, bicyclists, and pedestrians. A woonerf is ideal for neighborhood streets with low traffic volumes and for portions of commercial centers that wish to encourage a lively street life that is welcoming to and safe for pedestrians and bicyclists.



Woonerf/Home Zone
Wall Street, Asheville, NC
(image by Beth Meckley)

PAVED SHOULDERS

A paved shoulder is the part of a roadway that is contiguous to the travel lane, separated by a stripe. There is no minimum width for paved shoulders, although a width of at least four feet is preferred where possible. Paved shoulders are appropriate on rural roadways with low traffic volumes. Ideally, paved shoulders should be included in the construction of new roadways or the upgrade of existing roadways, especially where there is a need to safely accommodate bicycles.



Paved Shoulder



Buffered Bike Lane

Cycle Track: protected with parking

Cycle Track: curb separation or raised

Multi-Use Trail



Bicycle Lane

BIKEWAY LANES

Bicycle lanes are described as a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential and exclusive use of bicyclists. Bicycle lanes are always located on both sides of the road (except on one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is four feet; five- and six-foot bicycle lanes are typical for collector and arterial roads. As a general practice in the future, any local roadway that is widened or reconstructed with curb and gutter should incorporate bicycle lanes, with consideration for speed limit reductions. For additional design guidance on these methods, see the Appendix A: Design Guidelines section titled ‘Retrofitting Existing Streets to Add Bikeways.’



Buffered Bicycle Lane

BUFFERED BICYCLE LANE

Similar to regular bicycle lanes, buffered bicycle lanes have additional marked buffer space between the edge of the bicycle lanes and the automobile lanes. The purpose of a buffered bicycle lane is to increase the separation between motor vehicle traffic and bicyclists on high volume or high-speed roads, especially those with large-vehicle traffic, thereby improving bicyclist safety and comfort.



Shared-Use Trail

SHARED-USE TRAIL

A shared-use trail is a facility that is separated from the roadway designed for both bicycling and walking. Shared-use trails are the preferred facility for novice and average bicyclists. Shared-use trails located within the roadway corridor right-of-way, or adjacent to roads, are called ‘side paths.’ Those within or adjacent to railroad rights-of-way are called ‘Rail-Trails’, and shared-use trails within a greenspace corridor, utility corridor, or public use easement, are referred to as ‘greenway trails.’



THE BICYCLE NETWORK: SHORT-TERM

Map 3-1, titled “Short-Term Bicycle Network,” on page 3-9, shows the preliminary bicycle network recommendations for the Town of Boone. One facility type will not fit all roadways because of variations in roadway configurations and land use; thus a toolbox of facility types is used. The variety of bicycle facilities recommended in the short-term for Boone, account for the following conditions:

- 1) the range of skill and comfort levels involved in bicycling;
- 2) the range of existing conditions for bicycling in different landscapes and on different roadway environments.

The proposed short-term network facility recommendations include bicycle lanes, a bicycle lane transit bypass, paved shoulders, shared lane markings (sharrows), and a woonerf that together will make it possible for bicyclists to more safely and comfortably travel throughout town. The challenges of and opportunities for bicycling in Boone, as discussed in Chapter 2: Existing Conditions, were taken into account to draft recommendations that are tailored to Boone’s unique built and natural environment. The short-term recommended facility types and their role in the larger network for Boone are described below.

- **Bicycle lane (light blue lines):** Bicycle lanes are recommended on roads with moderate to heavy traffic that have sufficient corridor width for a separate bicycle facility. Hardin/US-321 from King/US-421 to Rivers Street is ideal for bicycle lanes, providing for more comfortable bicycle connections to schools, major commercial centers, parks, and neighborhoods. The NC 105 bicycle lanes will provide a cross-town connection to many shopping centers and residential areas. Extending the existing bicycle lanes on Rivers to South Water Street and north to King Street will provide a connection between ASU and downtown.
- **Bicycle Lane Transit Bypass (blue dashed lines):** The existing bicycle lanes, automobile travel lanes, and AppalCART transit stops on Rivers Street between Depot Street and Center Street create multiple conflict points between roadway users. This section of roadway should be the focus of a future detailed engineering study and solutions be developed through collaboration between the Town of Boone, ASU, and NCDOT. One potential solution to reduce conflict points between bicyclists and the AppalCART is to reconfigure the roadway corridor to reroute the bicycle lanes and effectively bypass the transit stop locations. Please refer to page A-21 of Appendix A, Design Guidelines for more information on the bicycle lane transit bypass.



Bicycle lanes on South Water Street will provide a key bicycle connection between Downtown Boone and the ASU Campus.



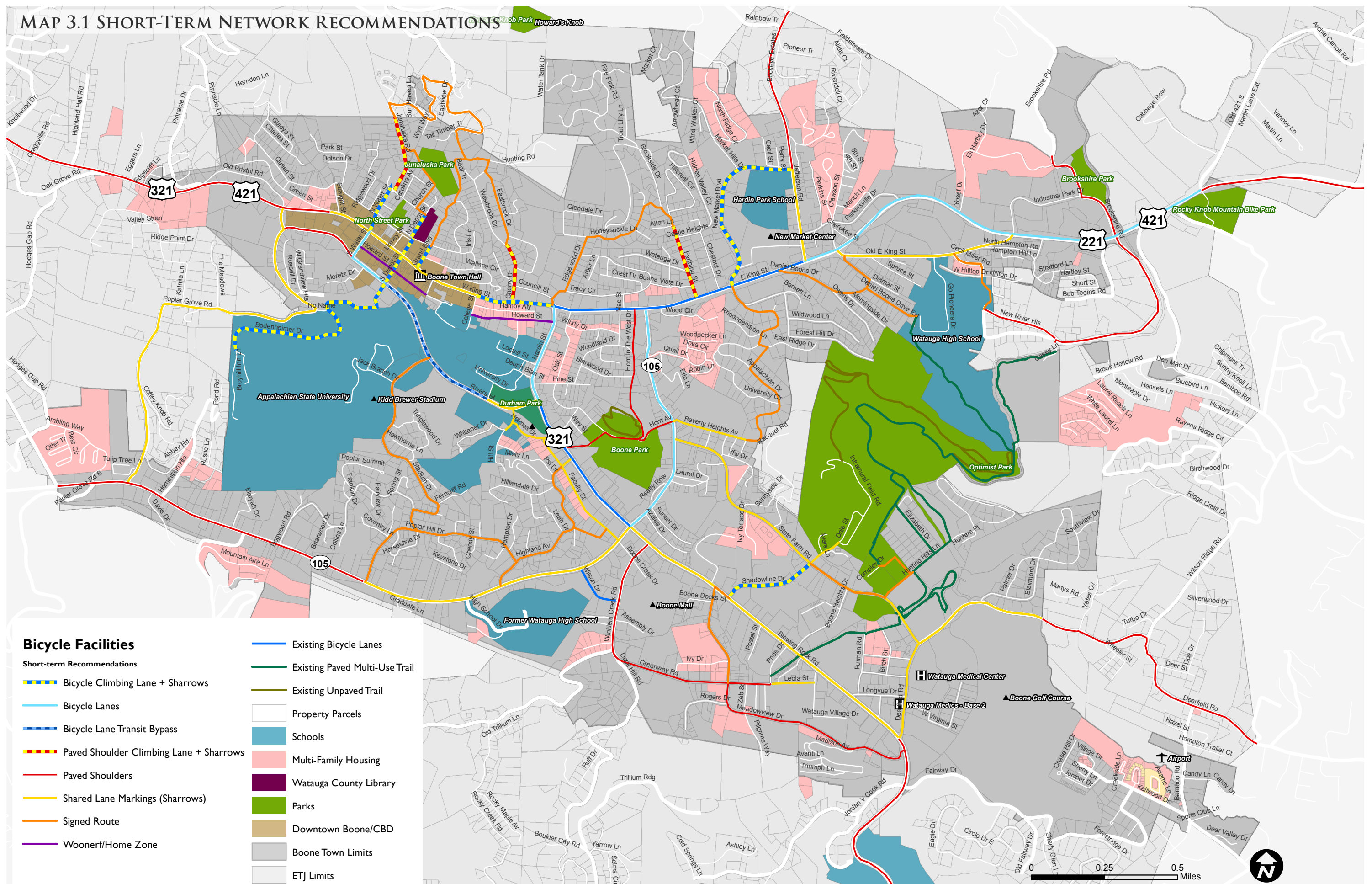
- **Bicycle climbing lane with downhill sharrows (blue and yellow dashed lines):** On narrow roads with steep terrain, low traffic volumes, and low automobile speeds, a bicycle climbing lane is recommended for the uphill side of the street, with sharrows on the downhill side where bicyclists will be able to more easily keep speed with traffic. These facilities will provide bicycle access to neighborhoods north of King Street, to downtown, to ASU, and to Optimist Park.
- **Paved shoulder climbing lane with downhill sharrows (red and yellow dashed lines):** Guidance obtained from NCDOT Division II engineers indicates that roads without curb and gutter should be treated as paved shoulders rather than marked bicycle lanes. On steep roads that lack curb and gutter and therefore do not meet guidance for bicycle lanes, a 4-foot paved shoulder climbing lane with downhill sharrows is recommended.
- **Paved shoulder (red lines):** Paved shoulders are recommended for regional connections or where the current roadway cannot accommodate bicycle lanes. A minimum of 4 feet is preferred for paved shoulders on roadways with speed limits below 45 MPH, but some roads will require a narrower shoulder until the road is widened or travel lanes are narrowed through resurfacing projects.
- **Shared lane facility/Sharrows (yellow lines):** Shared lane facilities are recommended in the short term on roadways that are currently too narrow to accommodate more separated facilities, or roads with low traffic volumes and speeds that do not required a separated facility. As the King Street bicycle lane approaches downtown from the east, the speed limit drops to 20 miles per hour, on-street parking begins, and pedestrian and bicycle traffic increases. All of these factors create a traffic calming effect that allows a shared lane facility to be an adequate facility recommendation for King Street downtown.
- **Signed Bike Route (orange lines):** Signed bike routes are recommended on low-volume roads that serve as connections to bicycle facilities and key destinations. While no pavement markings are recommended along these segments, bike route signage and wayfinding signage will help bicyclists navigate through Boone. These routes will be particularly important for those bicyclists who value comfort over travel time and are seeking low-volume route options throughout town. Signed bike routes on Stadium Drive provide a link into the ASU campus. Signed routes north of King Street link other recommended facilities and provide a guide for accessing the downtown from the northern neighborhoods. Neighborhoods directly west of Watauga High School could be better connected with signed routes linking to the high school and the Greenway Trail, as well as from the existing bicycle lanes on King Street to the proposed facility on Beverly Heights Avenue.
- **Woonerf (purple lines):** Upgrade Howard Street to a woonerf/home zone. A woonerf, or “living street” (see page 3-4), will give bicyclists and pedestrians priority on the roadway while also permitting low-speed motor vehicle traffic. The Town of Boone is currently conducting traffic studies along Howard Street and the surrounding area to determine the feasibility of implementing a Woonerf and traffic calming measures in downtown Boone.



The proposed woonerf for Howard Street would provide a high level of comfort for pedestrians and bicyclists and create a lively streetscape.



MAP 3.1 SHORT-TERM NETWORK RECOMMENDATIONS



Bicycle Facilities

Short-term Recommendations

- Bicycle Climbing Lane + Sharrows
- Bicycle Lanes
- Bicycle Lane Transit Bypass
- Paved Shoulder Climbing Lane + Sharrows
- Paved Shoulders
- Shared Lane Markings (Sharrows)
- Signed Route
- Woonerf/Home Zone

- Existing Bicycle Lanes
- Existing Paved Multi-Use Trail
- Existing Unpaved Trail
- Property Parcels
- Schools
- Multi-Family Housing
- Watauga County Library
- Parks
- Downtown Boone/CBD
- Boone Town Limits
- ETJ Limits





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THE BICYCLE NETWORK: LONGER-TERM

Many of the projects recommended in the preliminary bicycle network above could be improved upon with greater investment. As Boone continues to grow, roads will be widened and development density will increase. These are ideal opportunities to ensure that safe and adequate bicycle facilities are included in the re-design of current roadways and in all future development. These recommendations include and build upon recommendations from previous plans, including the Watauga County Transportation Plan and the Boone 2030 Land Use Plan, which propose significant changes to some roads in Boone. Town staff should work closely with NCDOT on these longer-term recommendations to ensure that they are incorporated into the early planning, design, and programming of road improvement projects.

- **Shared-use Trail:** Shared-use trails are recommended along roads with high traffic volume and/or speed, including portions of US-321, NC 105, US-421, and Deerfield Road. These facilities are also recommended for connecting residential areas to parks (Horn in the West, Deerfield, US-421) and to schools (Brookshire). Shared-use trails can be constructed by the Town of Boone, or through updates to local development policies that require shared-use trail construction with new development or redevelopment.
- **Buffered Bicycle Lane:** As road improvements are designed for NC 105, upgrade the short-term bicycle lanes between the NC 105 “Extension” which runs from King/US-421 to Blowing Rock Rd/US-321 to buffered bicycle lanes for increased bicyclist safety and comfort along this busy corridor.
- **Bicycle Lane:** As road widening projects are planned with curb and gutter, upgrade paved shoulders, climbing lanes, and sharrows to bicycle lanes. Upgraded bicycle lanes are recommended on Jefferson/NC 194 and sections of King Street, as well as downtown corridors, streets within or adjacent to ASU campus, and other connecting roadways such as Winklers Creek Road and Greenway Road.
- **Paved Shoulder:** Upgrade sharrows on Poplar Grove and climbing lanes throughout town to two-way paved shoulder to improve the separation between bicyclists and motor vehicle traffic. Construct paved shoulders on King/US-421 from where the proposed shared-use trail ends at Rocky Knob Park east to the town limits, providing an improved regional connection out of Boone.
- **Shared lane facility/Sharrows (yellow lines):** Add shared lane markings to Poplar Hill Drive and Highland Avenue to make motorists aware that bicyclists may use the full lane, and to make bicyclists aware that these are good connecting routes to Faculty Street and US-321, as well as to Stadium Drive into ASU.

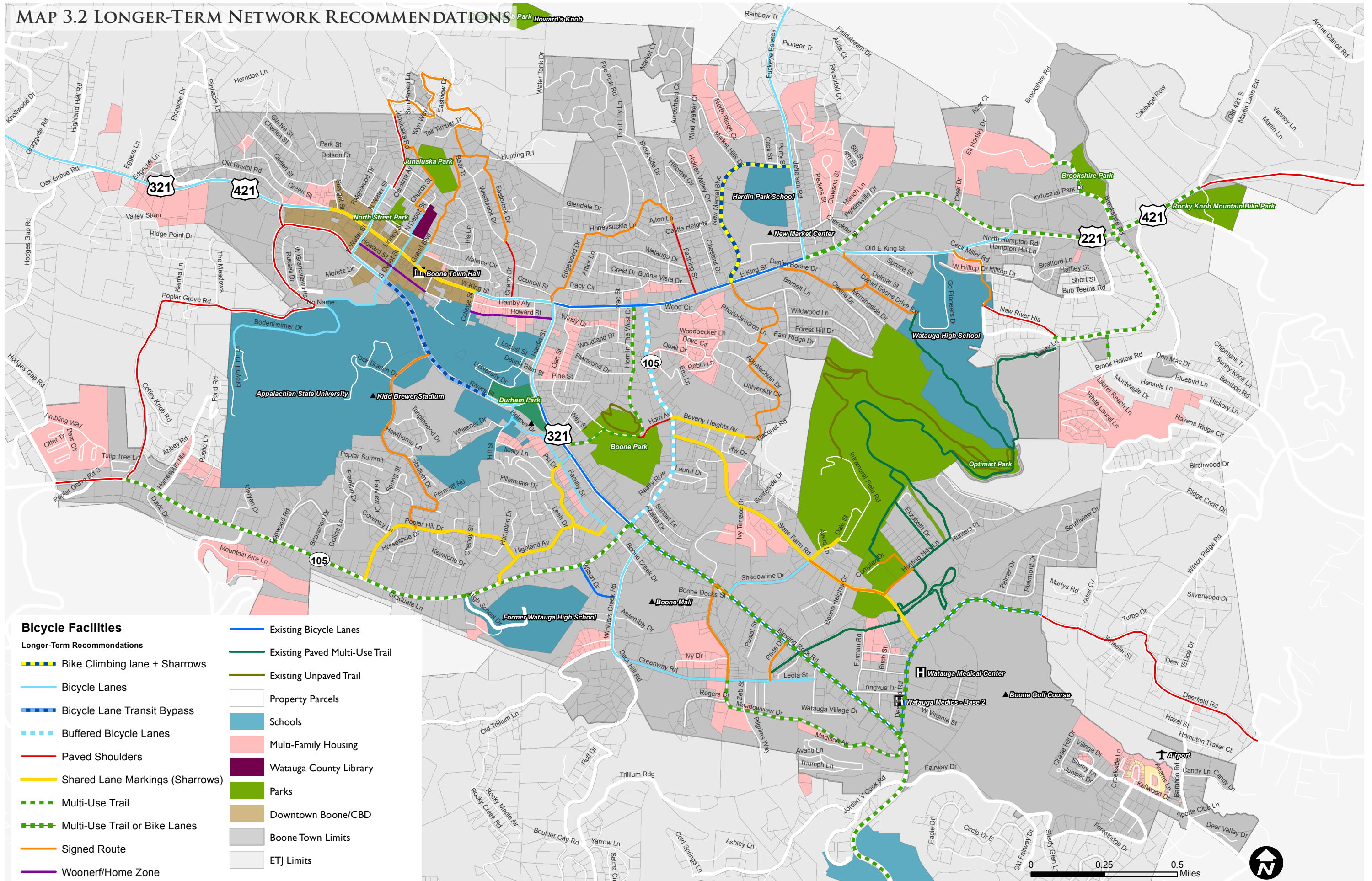


TABLE 3.1 BICYCLE NETWORK SUMMARY TABLE

Existing Facility Type	Length (Miles)
Bicycle Lanes	~2.15 miles
Multi-Use Trails/Greenway Paths	~6.51 miles
Proposed Facility Type (short-term recommendations)	Length (Miles)
Bicycle Lanes	2.89
Uphill Bicycle Climbing Lane with Downhill Shared-lane Facilities “Sharrows”	2.53
Uphill Paved Shoulder with Downhill Shared-lane Facilities “Sharrows”	0.72
Paved Shoulders	9.73
Shared-lane Markings “Sharrows”	8.71
Woonerf/Home Zone	0.55
Signed Bicycle Route	6.39
Proposed Facility Type (longer-term recommendations)	Length (Miles)
Uphill Bicycle Climbing Lane with Downhill Shared-lane Facilities “Sharrows”	0.63
Bicycle Lanes	7.19
Buffered Bicycle Lanes	0.81
Paved Shoulders	4.76
Shared-lane Facilities “Sharrows”	3.52
Shared-Use Trail	9.26



MAP 3.2 LONGER-TERM NETWORK RECOMMENDATIONS



Bicycle Facilities

Longer-Term Recommendations

- Bike Climbing lane + Sharrows
- Bicycle Lanes
- Bicycle Lane Transit Bypass
- Buffered Bicycle Lanes
- Paved Shoulders
- Shared Lane Markings (Sharrows)
- Multi-Use Trail
- Multi-Use Trail or Bike Lanes
- Signed Route
- Woonerf/Home Zone
- Existing Bicycle Lanes
- Existing Paved Multi-Use Trail
- Existing Unpaved Trail
- Property Parcels
- Schools
- Multi-Family Housing
- Watauga County Library
- Parks
- Downtown Boone/CBD
- Boone Town Limits
- ETJ Limits





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PROJECT PRIORITIZATION PROCESS

The project prioritization process began with making a list of all of the bicycle network recommendations proposed in this Plan. The segments were broken down at logical points, such as at major crossings and at connections to existing facilities. Criteria (shown in Table 3.2 below) were then used to rank each segment. These criteria were custom designed for Boone, based on public input, committee input, and available GIS data.

TABLE 3.2 PROJECT PRIORITIZATION CRITERIA

Prioritization Criteria
Top Recommendation from 2013 Public Comment Form
Town of Boone 2013 Greenway Priority List
Watauga County CTP Priority Project
High County Council of Governments Regional Bike Plan Priority Project
Boone 2030 Land Use Plan Priority Project
Bicycle Crash Location
Connection to a School or Library
Connection to Appalachian State University
Serves Downtown Boone
Connection to a Park
Connection to an Existing Trail or Facility (at least one end is connected)
Regional / Longer Connectivity to other facilities and/or communities
Connection to Commercial Centers, Retail Centers, Medical Centers
Connection to Multi-Family/High-Density Residential Areas
Connection to AppalCART Stop(s)
Repaving Schedules

PRIORITY PROJECT CUT-SHEETS

The cut-sheets on the following pages illustrate and describe the priority bicycle projects recommended in this plan. These project cut-sheets provide a planning-level of analysis only. Actual development of facilities may differ according to specific site conditions, project funding, and factors unforeseen at the time this plan was developed. These cut-sheets can be used to communicate the individual projects to stakeholders involved in implementation, such as local staff and officials, NCDOT staff, potential funding agencies, and interested citizens.

PLANNING-LEVEL COST ESTIMATES

Each project cut-sheet offers a planning level cost estimate for the priority project. The cost estimates are based on the most recently available per unit cost information obtained from NCDOT District II Engineering staff. Project costs vary over time and by geography. Further evaluation during project design will be needed to determine exact project costs. A summary table (Table 3.4) of cost estimates for the top priority projects is included at the end of this chapter.



1

Hardin Street/US-321 Bicycle Lanes

From: King Street/US-421

To: Rivers Street

Distance: ~700 feet (0.13 miles)

Speed Limit: 35 mph

Prioritization score: 14 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- High motor vehicle volume necessitates a separate facility for bicyclists
- Serves Downtown Boone, ASU, Durham Park, Boone Park, and many shops and restaurants along the corridor
- Connects to existing bicycle lane on Hardin Street/US-321 from Rivers to NC 105, and to recommended bicycle facilities on King Street, Rivers Street, and NC 105

- Serves multiple AppalCART stops
- Multiple bicycle crashes reported
- Connects to existing bicycle lanes on Hardin Street/US-321
- Identified as a priority in the Boone 2030 Land Use Plan, the Watauga County CTP, and the High Country COG Bike Plan

Short-term Recommendation

Provide 4-foot bicycle lanes on both sides of the street to separate bicyclists from high volume and high speed auto traffic. Intersection treatments should include clear pavement markings and signage to guide bicyclists safely along the corridor and to alert right-turning drivers of bicycle traffic. Investigate access management opportunities to minimize driveways.

Long-term Recommendation

Extend bicycle lanes southeast past NC 105 and implement access management strategies to minimize the number of bicycle/motor vehicle conflict points (see priority recommendations #7 and #10).



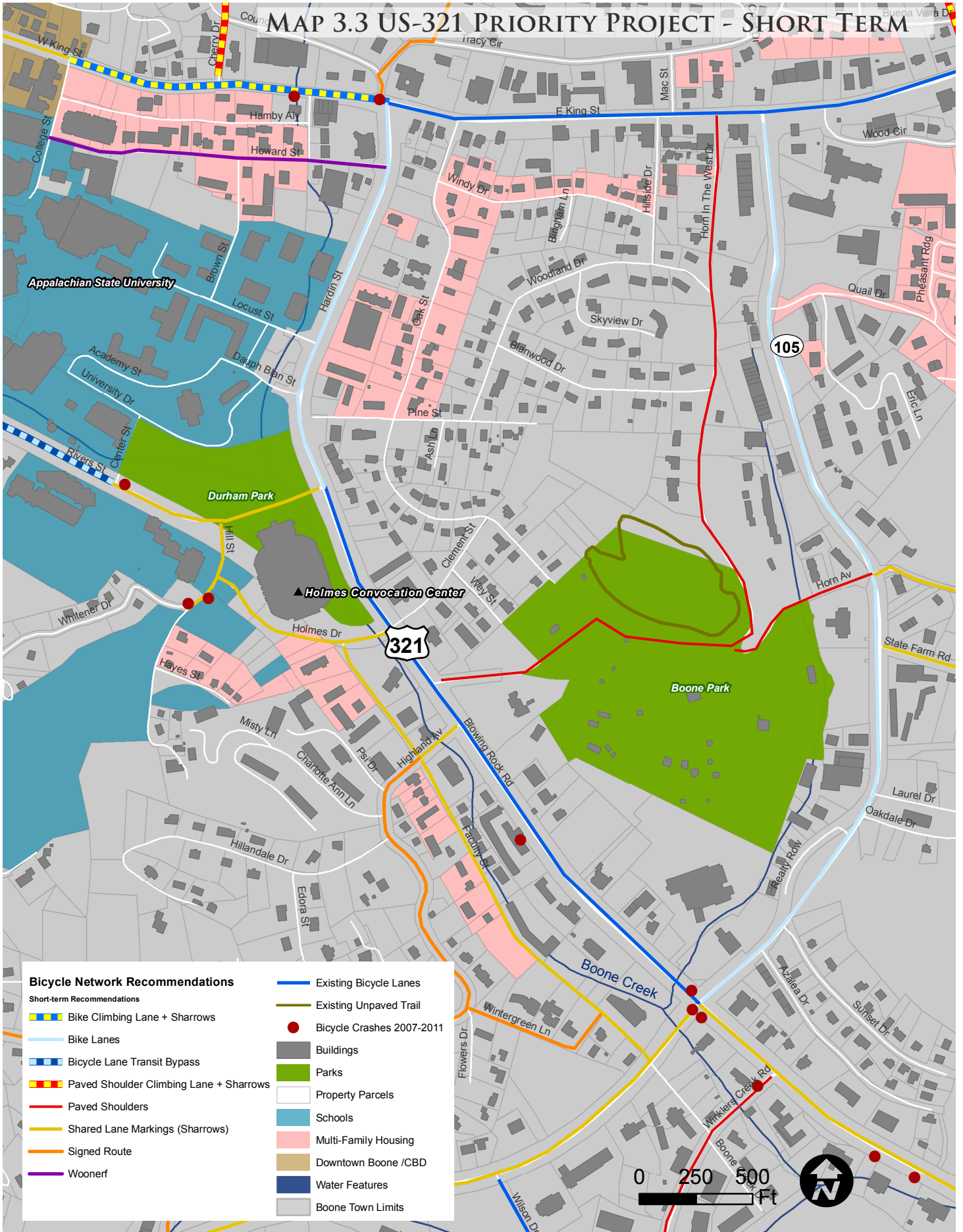
Left: Existing roadway conditions on US-321.



Below: Proposed roadway conditions with bicycle lanes.



MAP 3.3 US-321 PRIORITY PROJECT - SHORT TERM



Bicycle Network Recommendations	
Short-term Recommendations	
	Bike Climbing Lane + Sharrows
	Bike Lanes
	Bicycle Lane Transit Bypass
	Paved Shoulder Climbing Lane + Sharrows
	Paved Shoulders
	Shared Lane Markings (Sharrows)
	Signed Route
	Woonerf
	Existing Bicycle Lanes
	Existing Unpaved Trail
	Bicycle Crashes 2007-2011
	Buildings
	Parks
	Property Parcels
	Schools
	Multi-Family Housing
	Downtown Boone / CBD
	Water Features
	Boone Town Limits



2

King Street/US-421 Climbing Lane and Shared Lane

From: Hardin Street / US-321

To: College Street

Distance: 1,432 feet (0.27 miles)

Speed Limit: 25 mph

Prioritization score: 13 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to the existing bicycle lanes on King Street to Downtown Boone and to recommended shared lanes on King
- Connects bicyclists to ASU and downtown shops and restaurants
- Multiple bicycle crashes reported
- Provides a separate facility for bicyclists traveling uphill at slower speeds than automobile traffic

- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a climbing lane for westbound cyclists on King to provide for safer, more comfortable bicycle travel uphill towards downtown. Include dashed transition markings before the left turn stall begins at the College Street intersection, with signage to indicate that the bicycle lane ends, so that bicyclists can safely merge with motorized traffic at the intersection. Provide shared lane markings (sharrows) on the eastbound side to inform bicyclists and drivers that bicyclists may use the full lane. The downhill slope of this section will make it easier for bicyclists to keep pace with motor vehicle traffic, which makes sharrows a sufficient recommendation in the short-term. Provide “Bicyclists May Use Full Lane” signage and bicycle route signage.

Long-term Recommendation

With road widening, upgrade to 5-foot bicycle lanes on both sides of the street.



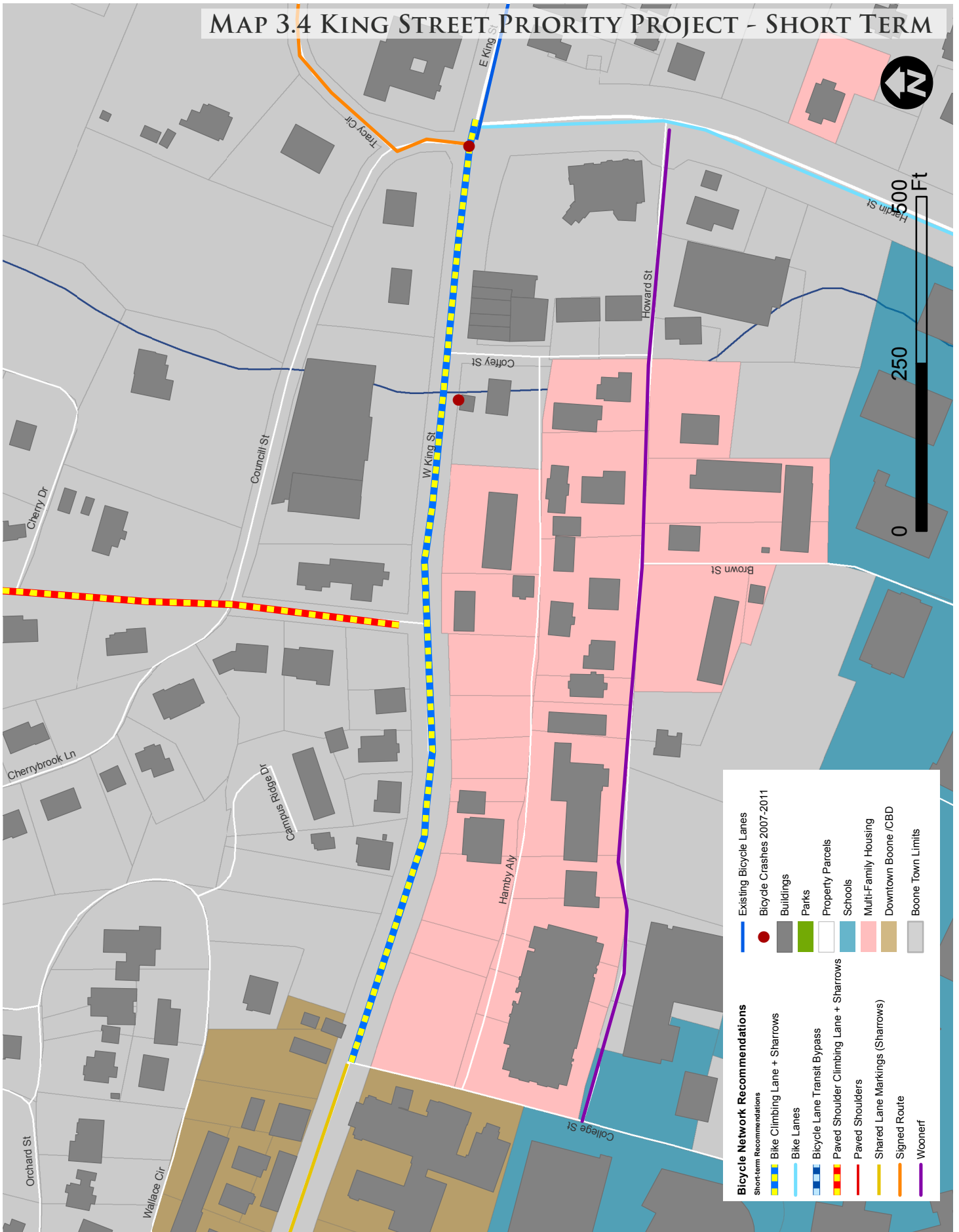
Left: Existing roadway conditions along King Street / US-421.



Below: Proposed roadway conditions with a climbing lane westbound uphill and sharrows eastbound downhill.



MAP 3.4 KING STREET PRIORITY PROJECT - SHORT TERM



	Existing Bicycle Lanes
	Bicycle Crashes 2007-2011
	Buildings
	Parks
	Property Parcels
	Schools
	Multi-Family Housing
	Downtown Boone / CBD
	Boone Town Limits
Bicycle Network Recommendations	
Short-term Recommendations	
	Bike Climbing Lane + Sharrows
	Bike Lanes
	Bicycle Lane Transit Bypass
	Paved Shoulder Climbing Lane + Sharrows
	Paved Shoulders
	Shared Lane Markings (Sharrows)
	Signed Route
	Woonerf



3

US-421 Bicycle Lanes

From: Jefferson Road/NC-194

To: Rocky Knob Mountain Bike Park

Distance: 7,307 feet (1.38 miles)

Speed Limit: 45 mph; 55 mph where divided highway begins east of Old US-421 S

Prioritization score: 12 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Extends the existing bicycle lanes on US-421 eastward to Rocky Knob Park and near Brookshire Park
- Segment scheduled for repaving in 2014
- Connects to proposed sharrows on Old East King Street and Watauga High School

- Links east neighborhoods to downtown
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Narrow the existing travel lanes and extend the existing bicycle lanes on US-421 eastward to Rocky Knob Mountain Bike Park. Intersection treatments should include pavement markings and signage that help to safely guide bicyclists along the corridor and make right-turning drivers aware of bicyclists' presence.

Long-term Recommendation

From Jefferson Road/NC 194 to Rocky Knob Park, construct a 10-foot shared-use trail along US-421 to connect to the recommended extension of the South Fork New River Greenway to Brookshire Park, and to the recommended shared-use trail along Jefferson Road to Hardin Park School.

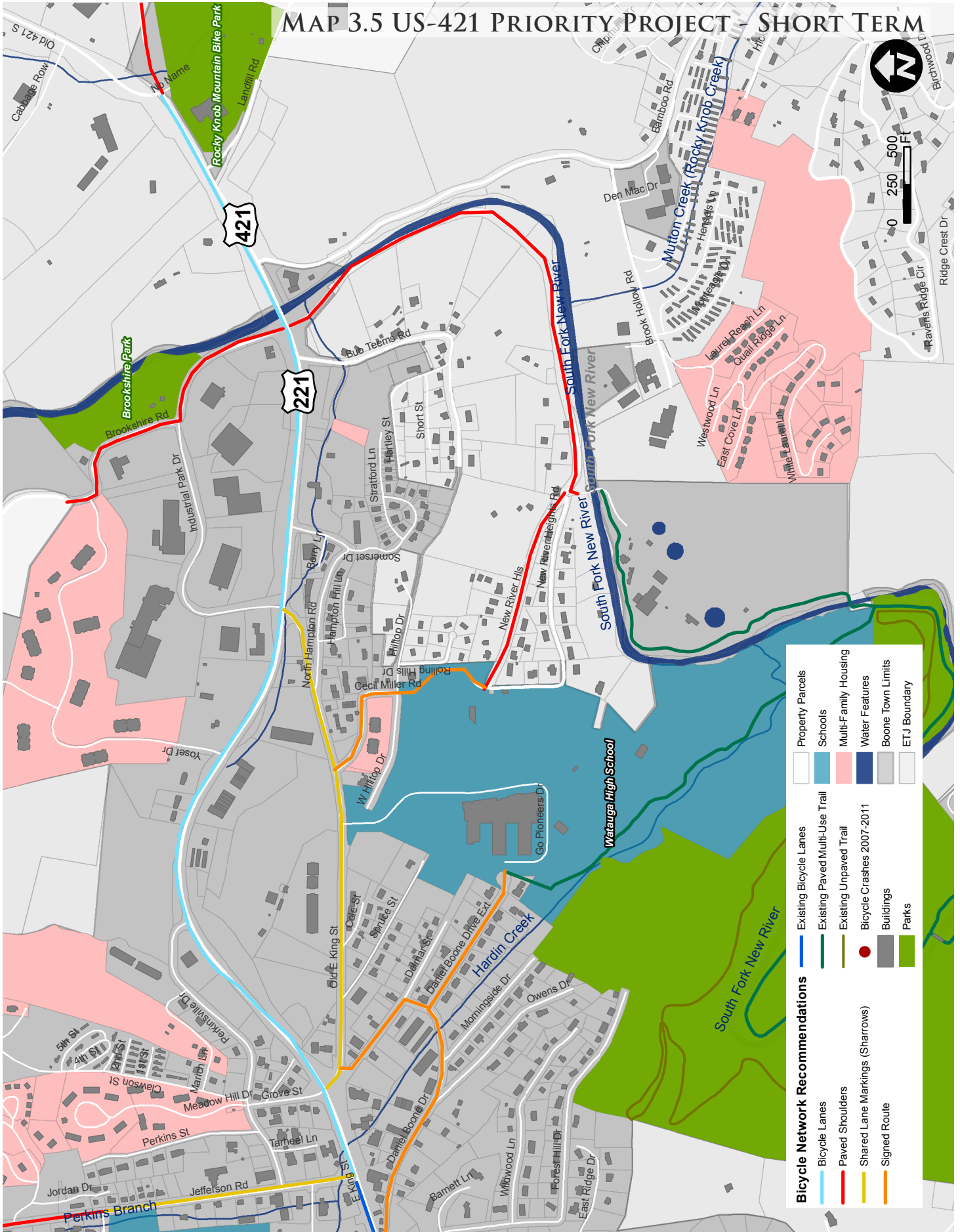


Above: The Rocky Knob Mountain Bike Park provides an attractive bicycling destination along US-421.

Left: Narrowing travel lanes, or adding additional corridor width during the next resurfacing project on US-421 would provide room for bicycle lanes.



MAP 3.5 US-421 PRIORITY PROJECT - SHORT TERM





4

King Street Shared Lanes/ Sharrows

From: Green Street

To: College Street

Distance: 3,075 feet (0.58 miles)

Speed Limit: 20 mph

Prioritization score: 12 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Provides bicycle access to shops and restaurants within Downtown Boone
- Connects to climbing lanes north of King Street to access nearby neighborhoods, parks, and the library
- Connects to recommended bicycle facilities south to ASU campus and west to paved shoulders on US-421 leading out of Boone
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings (sharrows) and signage along the downtown portion of King Street from Green Street to College Street. At signalized intersections, provide intersection markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Post “Bicycles May Use Full Lane” signage along the corridor. (See Appendix A: Design Guidelines.)

Parking on both sides of King Street limits space for a separated bicycle facility, and shared lane markings make both bicyclists and drivers aware that bicycles may use the full travel lane. Sharrows will also direct bicyclists to safely ride outside of the “door zone” of parked cars.

Long-term Recommendation

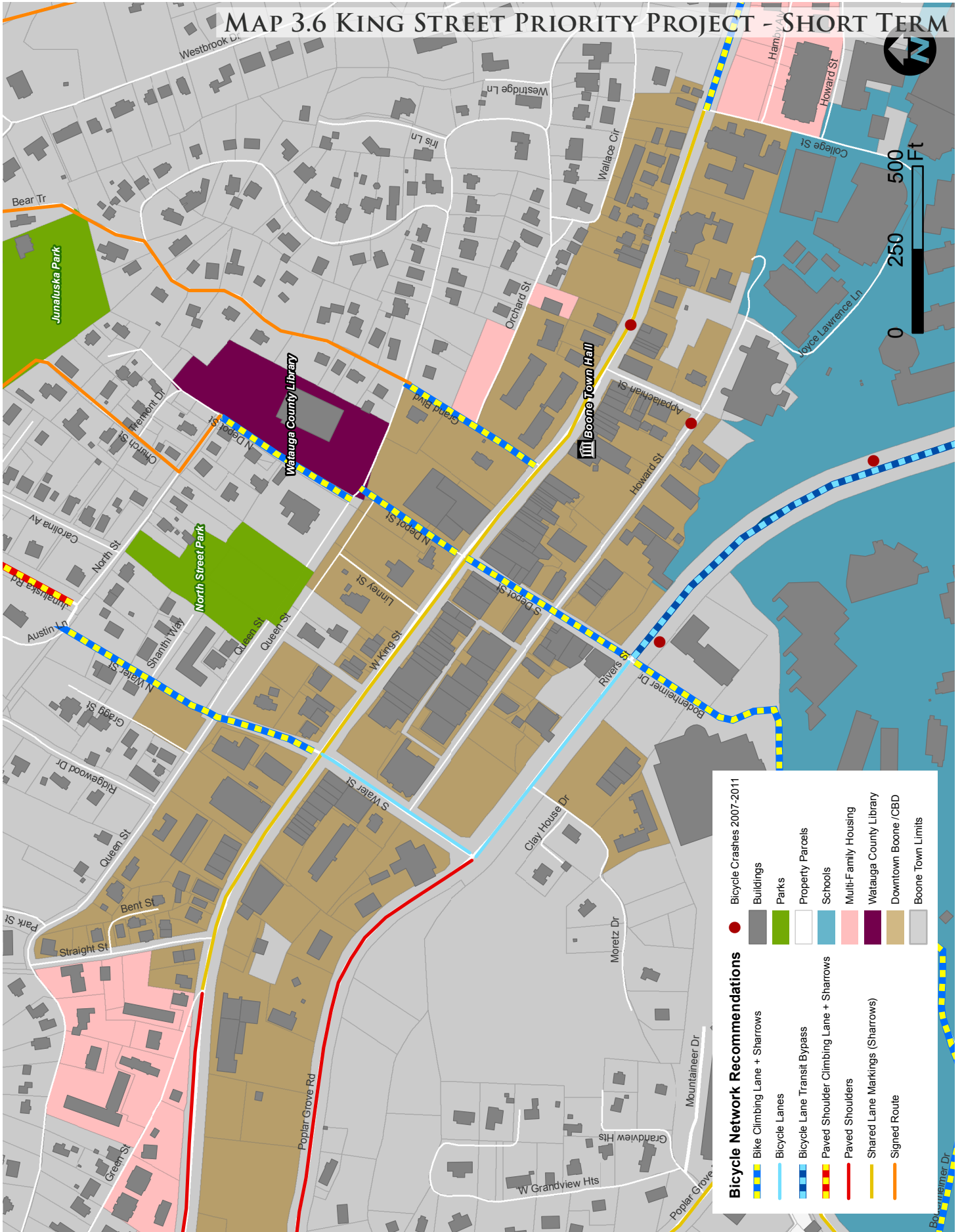
None.



Above & Left: King Street, downtown Boone.



MAP 3.6 KING STREET PRIORITY PROJECT - SHORT TERM





5

US-421 Paved Shoulders

From: Western ETJ limits

To: Green Street

Distance: 6,176 feet (1.17 miles)

Speed Limit: 20 mph

Prioritization score: 11 out of 15 points

Reasons for priority ranking:

- Connects to recommended King Street sharrows and Downtown Boone shops and restaurants
- Connects several major apartment complexes and businesses to town
- Serves multiple AppalCART stops
- Provides a regional bicycle connection westward out of Boone

- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Stripe paved shoulders on US-421 from Green Street westward to the ETJ boundary. 4-foot paved shoulders are recommended on both sides where possible. In areas where corridor constraints do not allow for 4 feet, provide as wide of a shoulder as possible until the shoulder can be extended. Provide bicycle route signage along the corridor.

Long-term Recommendation

With road widening and curb and gutter construction, upgrade paved shoulders to 5-foot bicycle lanes.

US-421 looking east towards Downtown Boone.

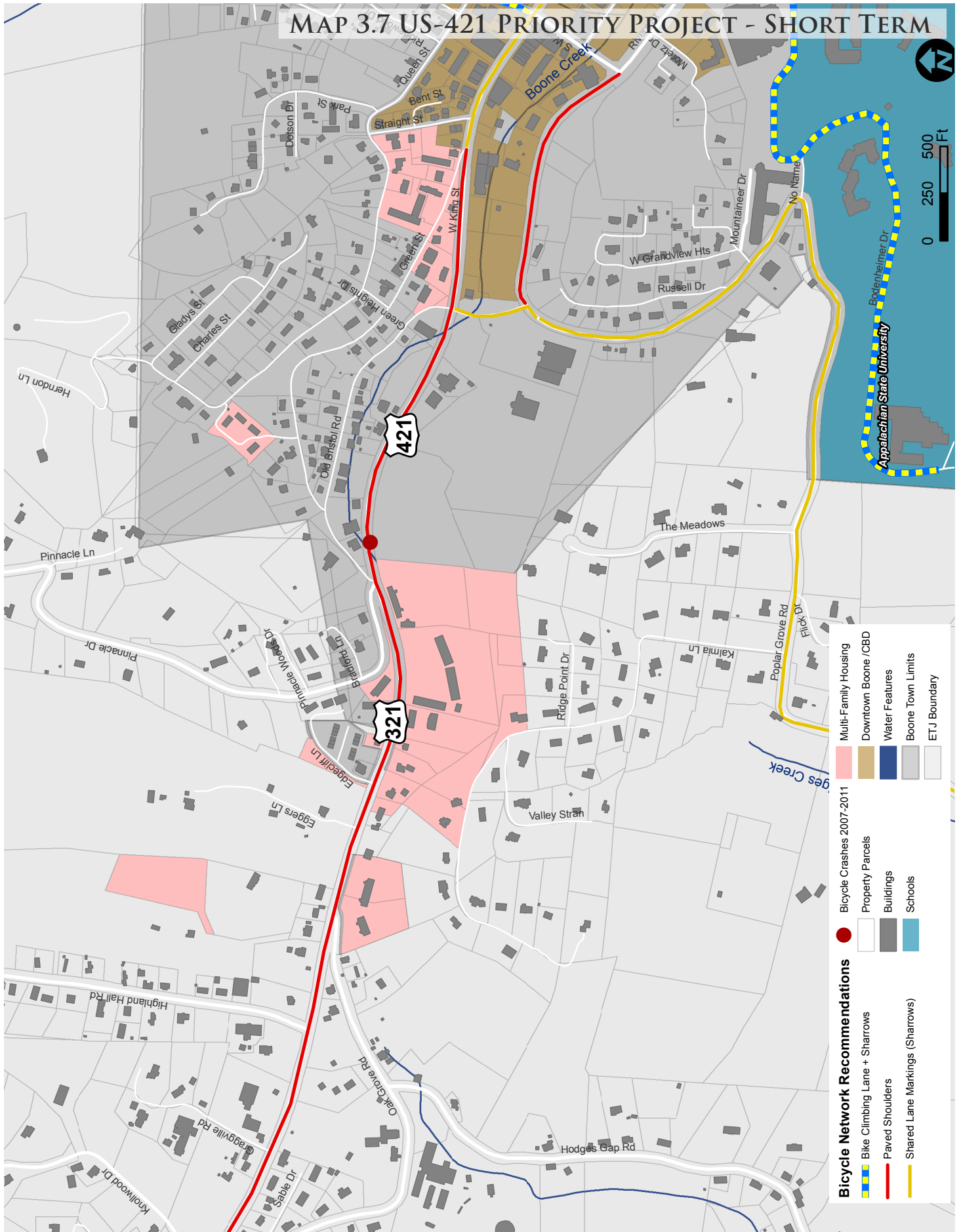


US-421 looking west out of town, with limited shoulder shown on the westbound side of the corridor.





MAP 3.7 US-421 PRIORITY PROJECT - SHORT TERM



6

US-321 Shared Lanes/Sharrows

From: NC 105

To: Boone Heights Drive

Distance: 3,705 feet (0.70 miles)

Speed Limit: 35 mph

Prioritization score: 11 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Provides access to apartment complexes along US-321 as well as Boone Mall, Shops at Shadowline, Watauga Village Shopping Center, and several other businesses and restaurants
- Connects to the Greenway Trail
- Multiple bicycle crashes reported
- High motor vehicle volume necessitates a designated facility for bicyclists

- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings and signage along US-321 from NC 105 to Boone Heights Drive. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic. Investigate access management opportunities to minimize driveways.

Long-term Recommendation

The recommended UDO policy revisions, covered in Appendix C, call for driveway access management and the improvement of existing 5-foot sidewalks to 10-foot sidepath with redevelopment. As access management strategies are implemented to reduce the number of driveways and conflict points between bicycles and motor vehicles, upgrade the shared lane facilities to bicycle lanes along the corridor.

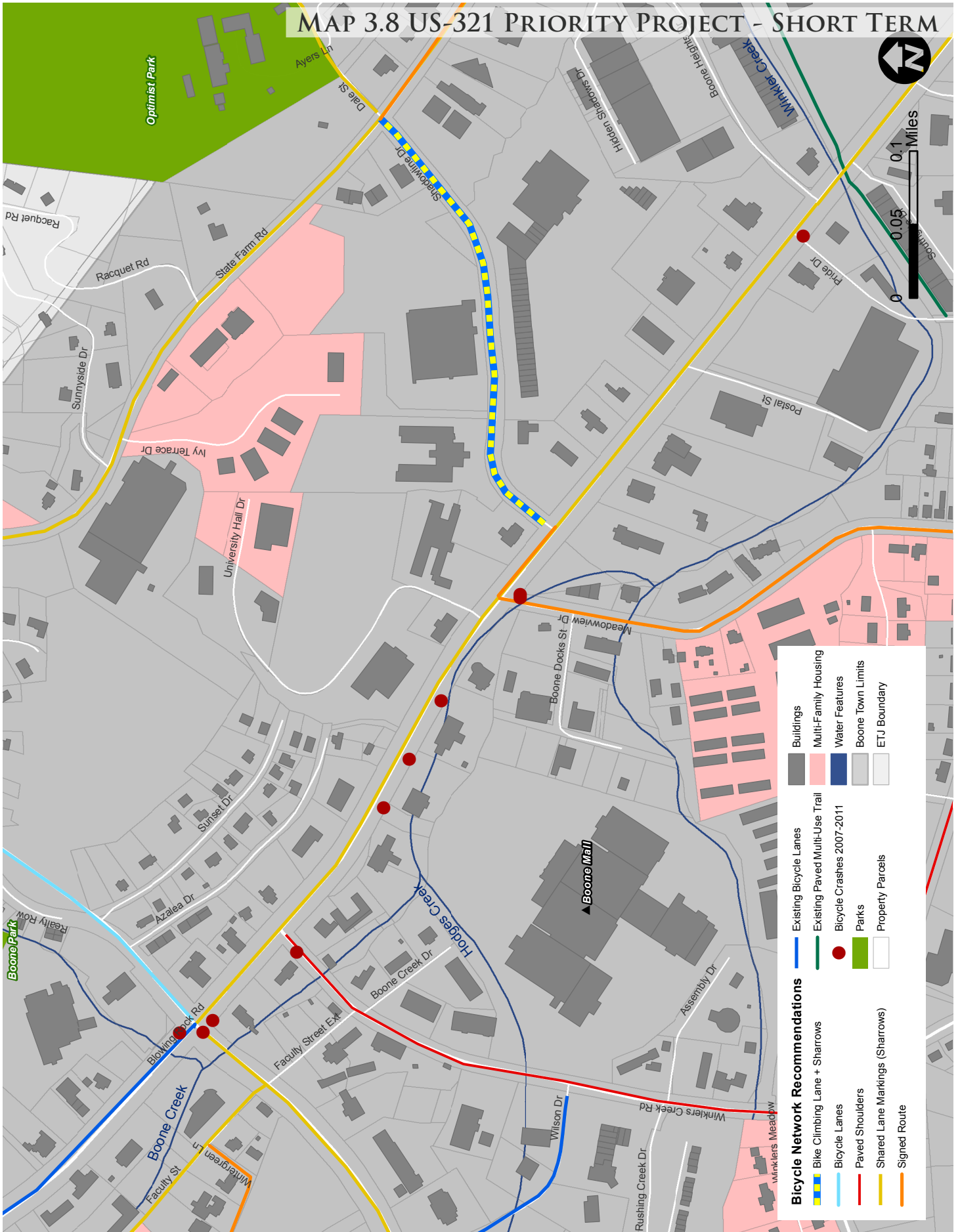


US-321, Boone, NC.





MAP 3.8 US-321 PRIORITY PROJECT - SHORT TERM





7

NC 105 Bicycle Lanes

From: King Street / US-421

To: Blowing Rock Road / US-321

Distance: 4,253 feet (0.81 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #2 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to existing bicycle lanes on US-421 and US-321
- Connects to recommended paved shoulders on Horn Avenue and shared lanes on US-321, NC 105, State Farm Road, and Beverly Heights Avenue
- Improves access to Boone Park, surrounding neighborhoods, and businesses along the corridor

- Multiple crashes reported at the intersection of NC 105 and US-321
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Narrow the existing travel lanes and stripe 4-foot bicycle lanes along the NC 105 “Extension” from King Street/US-421 to Blowing Rock Road/US-321. Investigate access management opportunities to minimize driveways. Provide pavement markings, signage, and spot medians at major intersections to help bicyclists safely navigate the corridor and alert right-turning drivers of bicyclists’ presence.

Long-term Recommendation

Upgrade bicycle lanes along NC 105 to buffered bicycle lanes, with 4-foot bicycle lanes and 2-foot striped buffers.

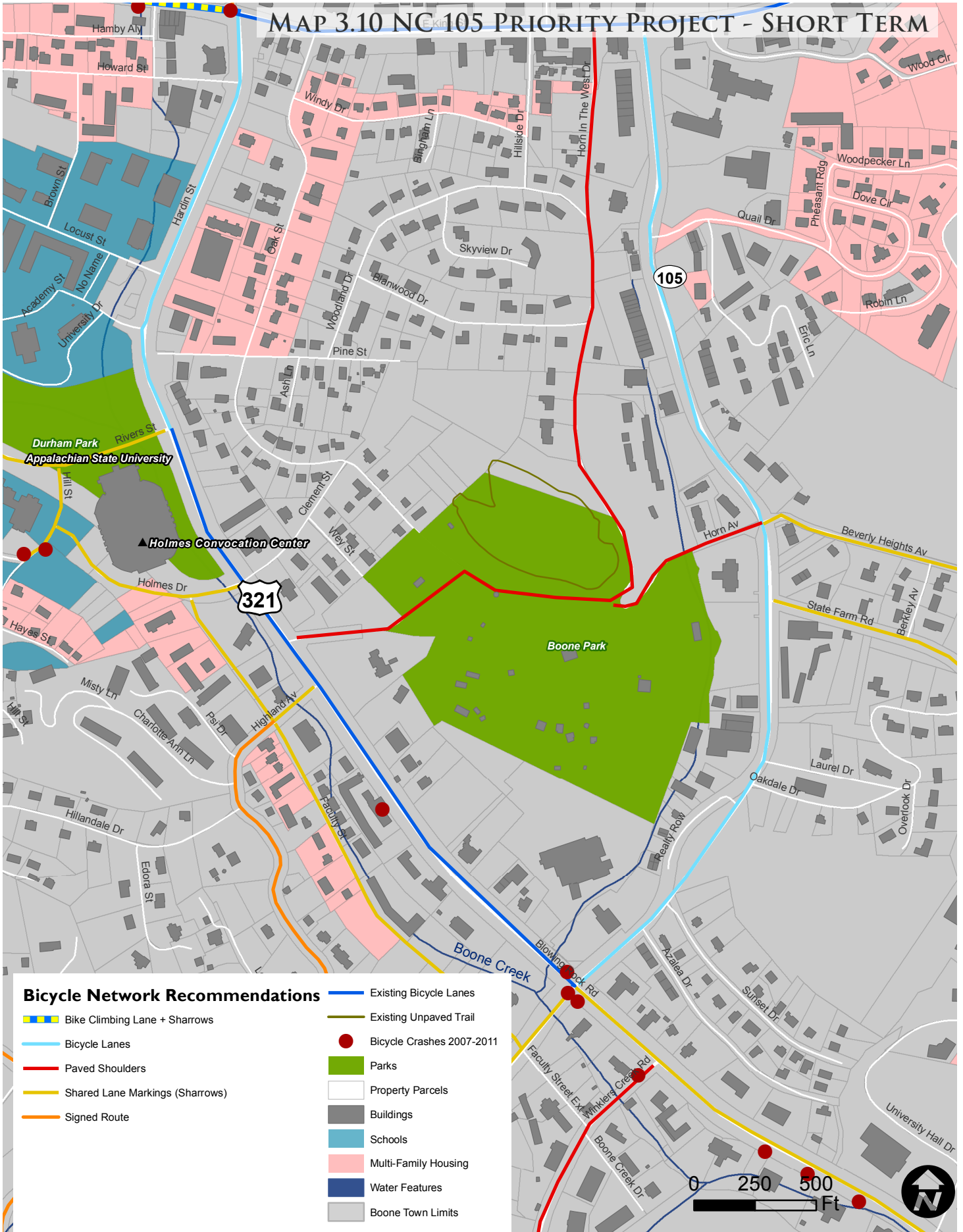


Above: Existing conditions on NC 105 near US-421, facing south.

Right: Narrowing the travel lanes on NC 105 would provide room for the addition of bicycle lanes to connect from bicycle lanes on US-421 to bicycle lanes on US-321.



MAP 3.10 NC 105 PRIORITY PROJECT - SHORT TERM





8

Rivers Street Shared Lanes/ Sharrows

From: Center Street

To: Blowing Rock Road / US-321

Distance: 932 feet (0.18 miles)

Speed Limit: 25 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- Links the recommended retrofit of existing bicycle lanes on Rivers Street to buffered bicycle lanes on US-321
- Serves multiple AppalCART stops
- Improves bicyclist access to ASU, Durham Park

Right: Existing conditions on Rivers Street east of Center Street.

Below: Proposed shared lane facility on Rivers Street. Continuing bicycle facilities on Rivers Street east of Center Street would provide bicycle access to the Holmes Convention Center (shown here) and to existing bicycle lanes on US-321.

- Multiple bicycle crashes reported
- Identified for improvements in the Watauga County CTP and High Country COG Bike Plan

Short-term Recommendation

Provide shared lanes with pavement markings and signage on Rivers Street from Center Street to US-321/Blowing Rock Road. The landscaped median along this segment constrains the roadway and leaves insufficient space for a separated bicycle facility in the short-term, and shared lanes will inform both bicyclists and drivers that bicyclists may use the full travel lane. Provide “Bicyclists May Use Full Lane” signage along the segment.

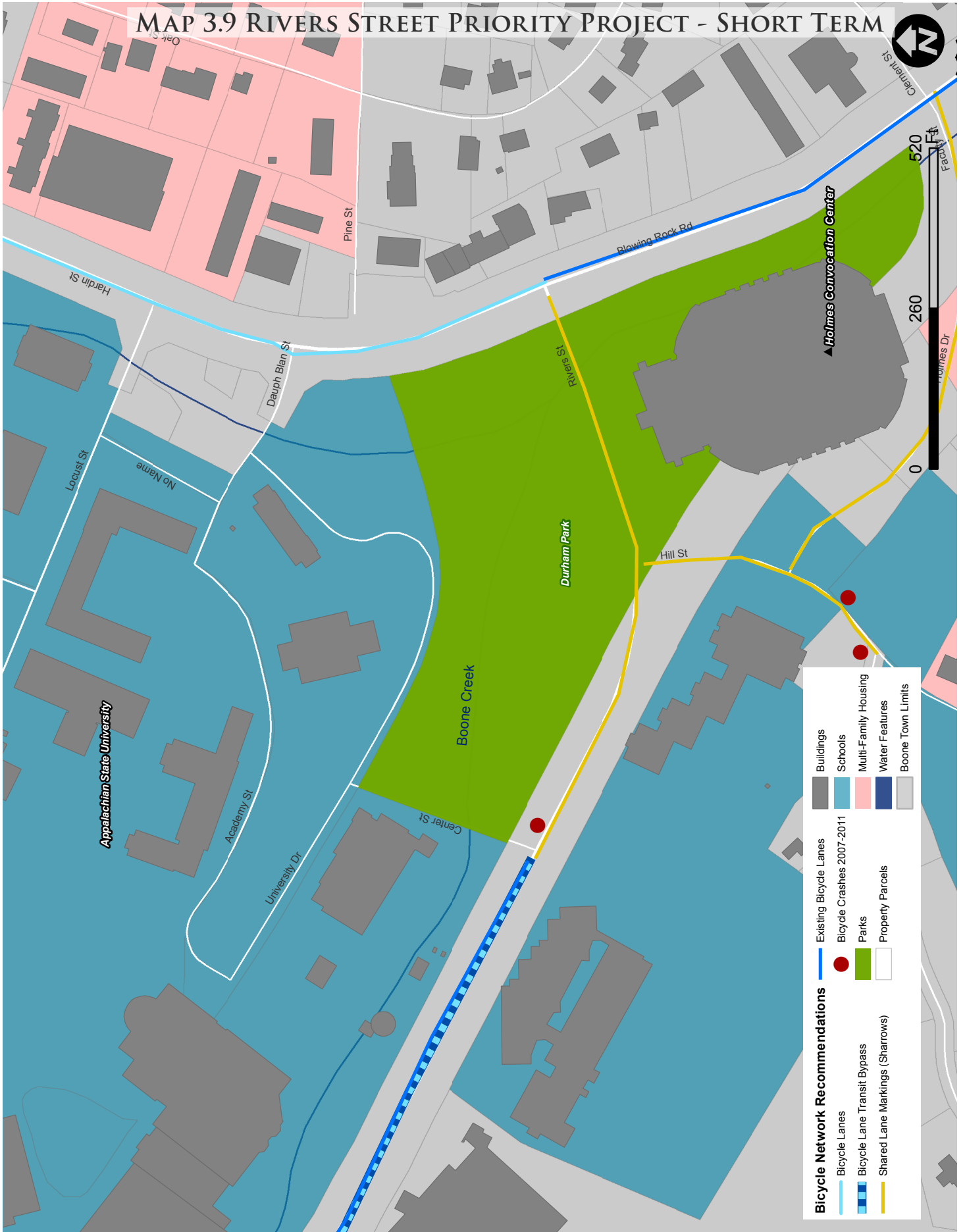
Long-term Recommendation

If a road diet is pursued along this segment, upgrade the shared lanes to 4-foot bicycle lanes.





MAP 3.9 RIVERS STREET PRIORITY PROJECT - SHORT TERM





9

US-321 Shared Lanes/Sharrows

From: Boone Heights Drive

To: Deerfield Road

Distance: 2,467 feet (0.47 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to the Greenway Trail, Optimist Park, and multiple major commercial centers, including Boone Heights, Southgate, and Watauga Village Shopping Centers
- Connects to recommended paved shoulders on Deerfield Road and Watauga Medical Center
- High motor vehicle volume necessitates a designated facility for bicyclists
- Serves multiple AppalCART stops

Below: US-321 shared outside lanes would provide improved bicycle access to homes and destinations along the corridor.

- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings and signage along US-321 from Boone Heights Drive to Deerfield Road. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic.

This facility will provide bicyclists with directional guidance to access commercial destinations and provide a key link to the hospital. Investigate access management opportunities to minimize driveways.

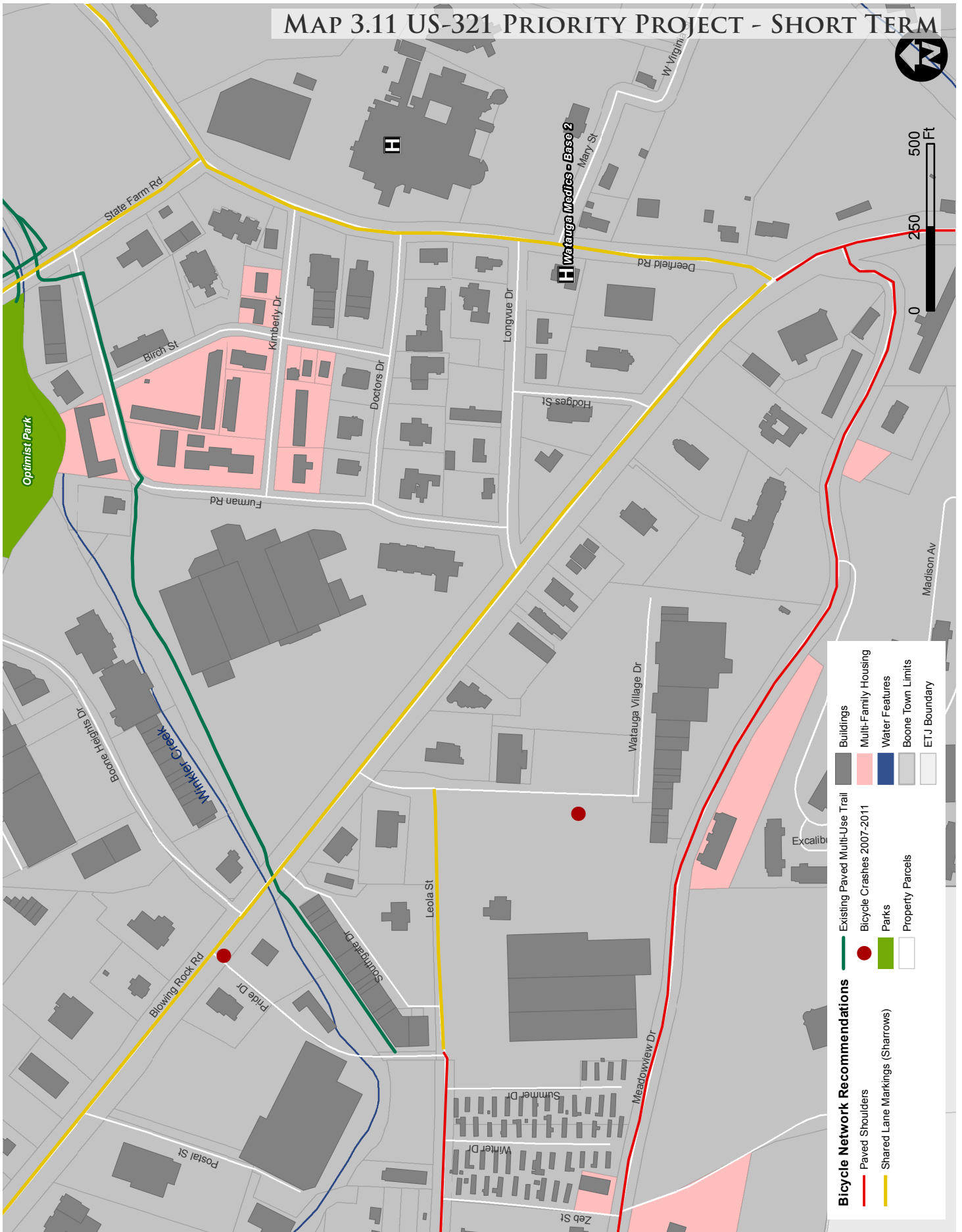
Long-term Recommendation

The recommended UDO policy revisions, covered in Appendix C, call for driveway access management and the improvement of existing 5-foot sidewalk to 10-foot sidepath with redevelopment. As access management strategies are implemented to reduce the number of driveways and conflict points between bicycles and motor vehicles, upgrade the shared lane facilities to bicycle lanes along the corridor.





MAP 3.11 US-321 PRIORITY PROJECT - SHORT TERM



10

NC 105 Shared Lanes/Sharrows

From: Poplar Hill Drive

To: Blowing Rock Road / US-321

Distance: 5,194 feet (0.98 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #2 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects west neighborhoods to central destinations, including Boone Park, Boone Mall, and businesses along US-321
- Multiple bicycle crashes reported at NC 105/US-321 intersection
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Include a shared lane facility with pavement markings and signage on the outside lanes of NC 105 to connect to recommended bicycle lanes on US-321 and recommended paved shoulder on NC 105 west of Poplar Hill Drive. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic. Reduce the speed limit along this segment from 35 mph to 30 mph.

Long-term Recommendation

Upgrade NC 105 shared lanes to a paved shared-use trail from US-321 to Poplar Grove Road. Existing sidewalk along NC 105 should be widened to provide a shared use path. Areas along corridor with no sidewalk should construct new shared-use trail. A 10-foot wide path is recommended, though can be narrower in sections of the corridor that are constrained by topography or right-of-way.



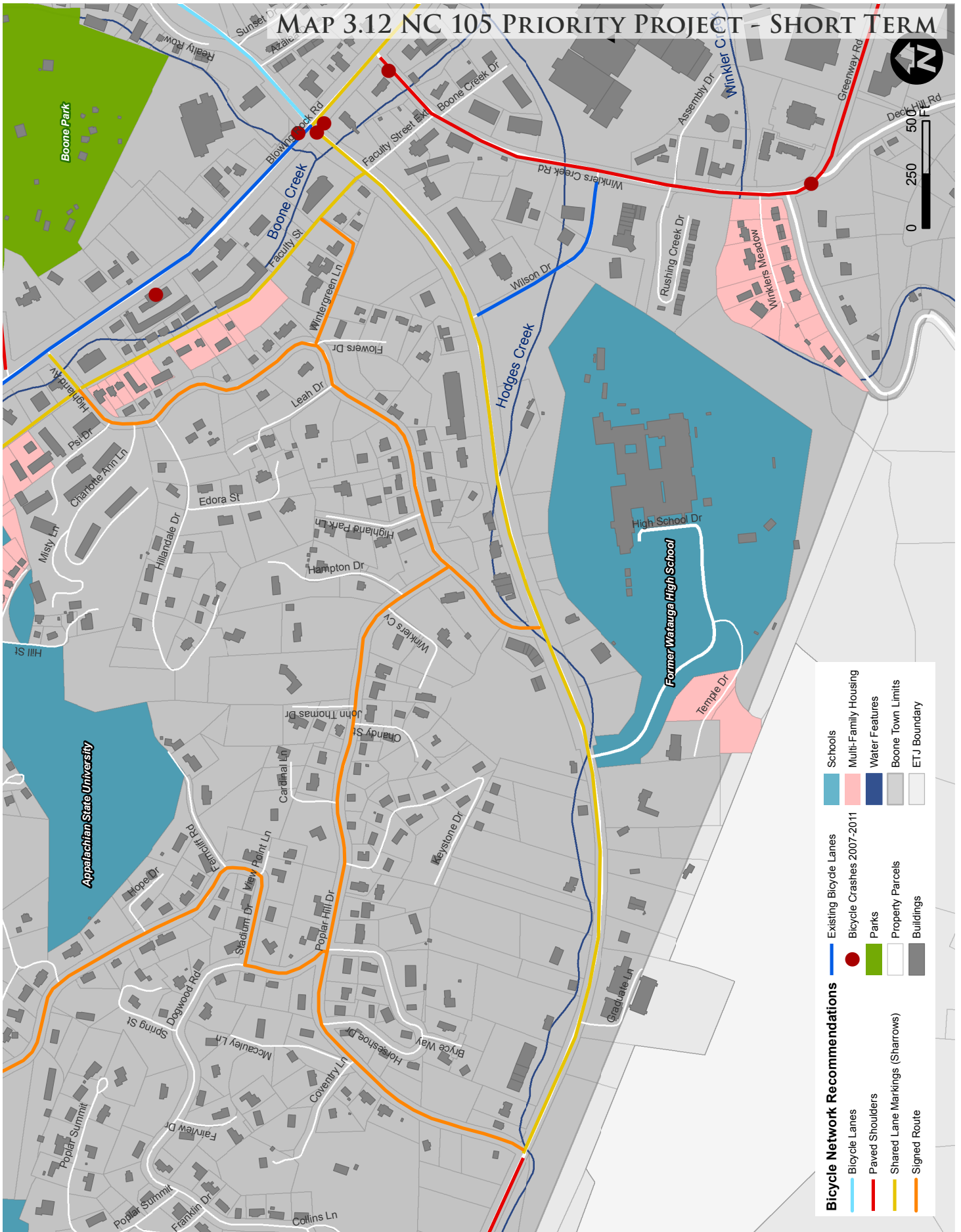
Left: Existing roadway conditions on NC 105, with two lanes in each direction and a center turn lane.

Below: Proposed roadway conditions with sharrows in the outside lane and a speed limit reduction to 30 mph.





MAP 3.12 NC 105 PRIORITY PROJECT - SHORT TERM



11

Greenway Road Paved Shoulders

From: Winklers Creek Road

To: Pride Drive

Distance: 2,823 feet (0.53 miles)

Speed Limit: 25 mph

Prioritization score: 8 out of 15 points

Reasons for priority ranking:

- Provides bicycle access to several apartment complexes, restaurants, and businesses
- Connects to multiple major commercial centers: Southgate Shopping Center, Watauga Village, and nearby Boone Mall
- Multiple bicycle crashes reported

- Provides an east-west alternative to US-321/Blowing Rock Road
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide 4-foot paved shoulders on Greenway Road, where possible. In places where the roadway corridor does not provide sufficient width, stripe as wide of a paved shoulder as possible until the pavement can be extended. Provide bicycle route signage along the corridor.

Long-term Recommendation

With road widening and curb and gutter construction, upgrade paved shoulders to bicycle lanes.



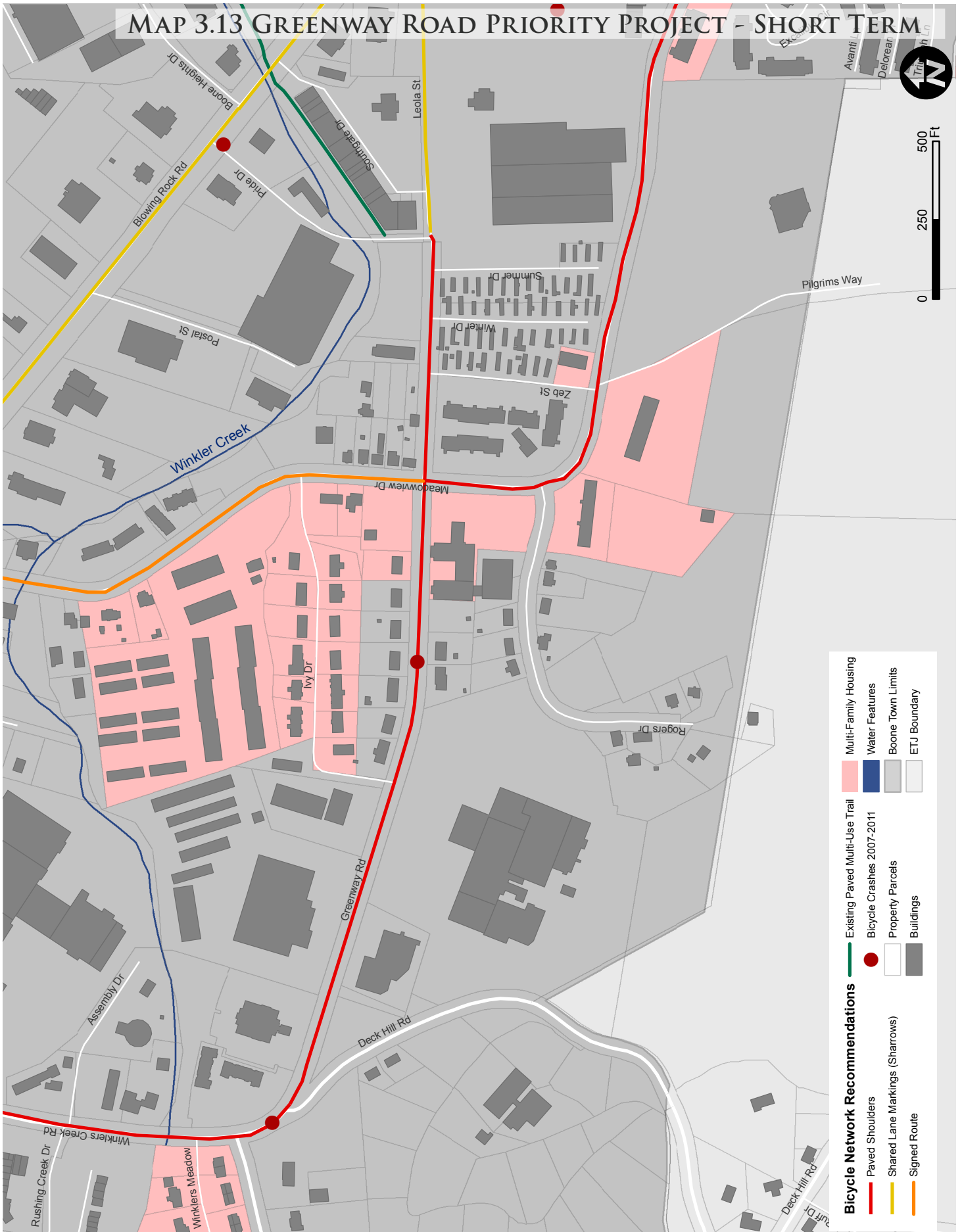
Above: Existing conditions on Greenway Road with no shoulder.

Right: Greenway Road connecting to Winkler’s Creek Road is a popular route for local bicyclists.





MAP 3.13 GREENWAY ROAD PRIORITY PROJECT - SHORT TERM



- Bicycle Network Recommendations**
- Paved Shoulders
 - Shared Lane Markings (Sharrows)
 - Signed Route
 - Existing Paved Multi-Use Trail
 - Bicycle Crashes 2007-2011
 - Property Parcels
 - Buildings
 - Multi-Family Housing
 - Water Features
 - Boone Town Limits
 - ETJ Boundary



12

Jefferson Road Sharrows and Paved Shoulders

From: US-421

To: Northern ETJ limits

Distance: 2,986 feet (0.57 miles)

Speed Limit: 35 mph

Prioritization score: 7 out of 15 points

Reasons for priority ranking:

- Provides bicycle access to destinations along Jefferson Road and New Market Boulevard, including Hardin Park Elementary School and several shops and restaurants
- Scheduled for resurfacing in 2014
- Multiple AppalCART bus stops nearby
- Identified for improvements in the Watauga County CTP and High Country COG Bike Plan
- Connects to existing bicycle lanes on US-421/King Street and the recommended shared lanes on New Market Boulevard

Right: Paved shoulders and an eventual shared-use trail would greatly improve bicycle and pedestrian access to Hardin Park Elementary School and other destinations along Jefferson Road and New Market Boulevard.

Short-term Recommendation

From US-421 to New Market Boulevard, include a shared lane facility with sharrows with the scheduled 2014 resurfacing of Jefferson Road. North of New Market Boulevard, stripe 4-foot paved shoulders where possible, though narrower shoulders are acceptable where space is constrained. Provide bicycle route signage along the corridor. Install “No Parking” signage and inform residents that they should not park within the roadway right-of-way.

Long-term Recommendation

Investigate the possibility of a bicycle lanes on Jefferson Road leading from the recommended shared-use trail extension on US-421 to Hardin Park Elementary School on New Market Boulevard. Bicycle lanes on Jefferson Road will provide a connection to bicycle facilities on New Market Boulevard and improve bicycle and pedestrian access to the school, Boone United Methodist Church, and neighborhoods and businesses on New Market Boulevard.





MAP 3.14 JEFFERSON ROAD PRIORITY PROJECT - SHORT TERM

Bicycle Network Recommendations

- Existing Bicycle Lanes
- Bicycle Climbing Lane + Sharrows
- Bicycle Lanes
- Paved Shoulder Climbing Lane + Sharrows
- Paved Shoulders
- Shared Lane Markings (Sharrows)
- Signed Route
- Bicycle Crashes 2007-2011
- Property Parcels
- Buildings
- Schools
- Multi-Family Housing
- Water Features
- Boone Town Limits

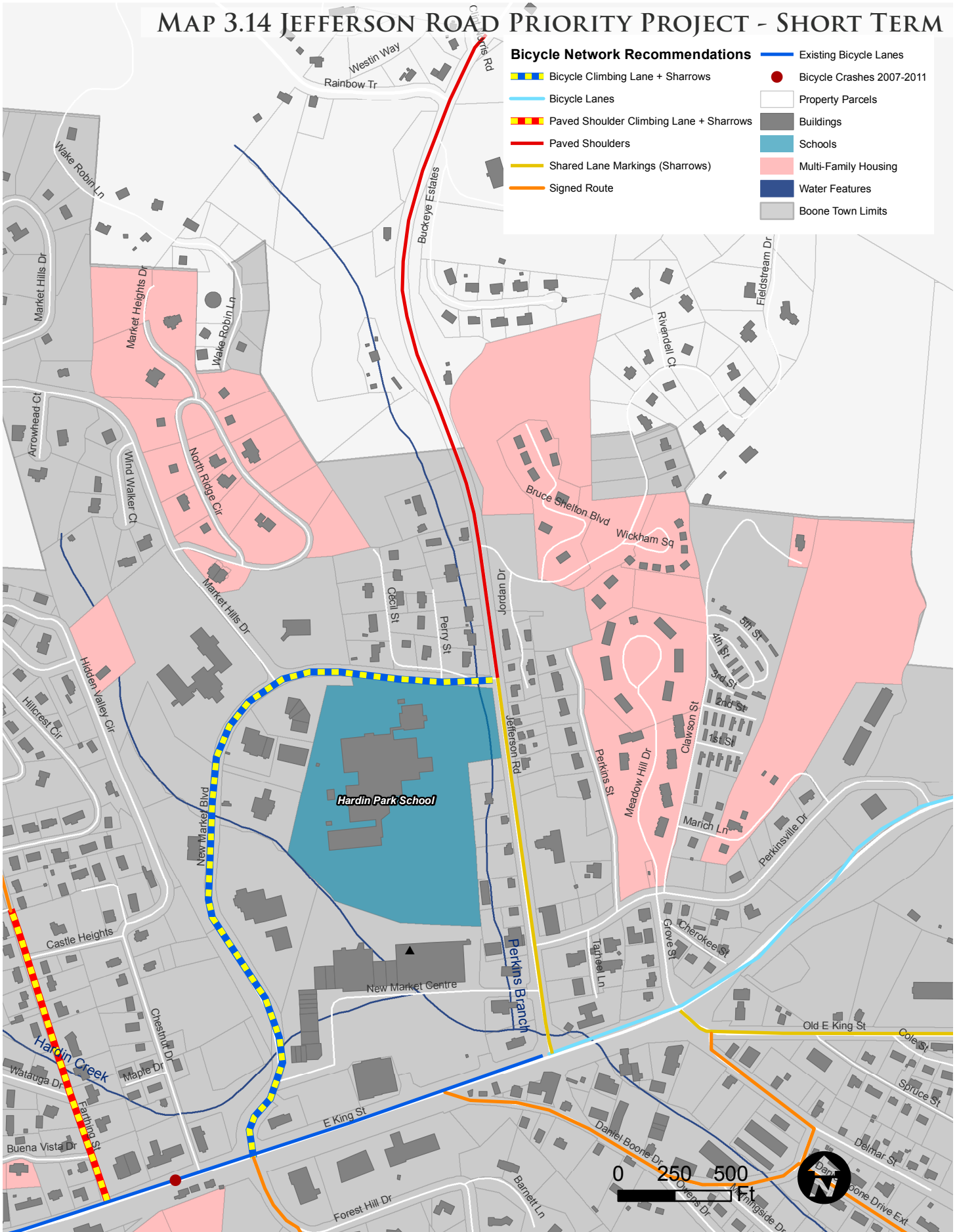




TABLE 3.3 PROJECT PRIORITIZATION WORKSHEET

Project Name	Total	Public Input	Greenway Priority List	CTP Recommendation	HCCOG Regional Bike Plan Recommendation	2030 Land Use Plan Recommendation	Bicycle Crash Location	Access to School or Library	Access to ASU	Access to Downtown	Access to Park	Connects to Existing Bicycle Facility	Connects to Proposed Bicycle Facility	Access to Commercial Centers	High Density Area	Serves AppalCART Stops
1. US-321 Bicycle Lanes	14	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
2. King Street/US-421 Climbing Lane + Sharrows	13	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
3. US-421 Bicycle Lanes	12	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
4. King Street Shared Lanes/Sharrows	12	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
5. US-421 Paved Shoulders	11	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
6. US-321 Shared Lanes/Sharrows	11	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1
7. NC 105 Bicycle Lanes	10	1	0	1	1	1	1	0	0	0	1	1	1	1	1	1
8. Rivers Street Shared Lanes/Sharrows	10	0	1	1	1	0	1	0	1	1	1	1	0	1	1	1
9. US-321 Shared Lanes/Sharrows	10	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1
10. NC 105 Shared Lanes/Sharrows	10	1	0	1	1	1	1	0	0	0	1	1	1	1	1	1
11. Greenway Road Paved Shoulders	8	0	0	1	0	1	1	0	0	0	1	1	1	1	1	1
12. Jefferson Road Paved Shoulders	7	0	0	1	1	0	1	0	0	0	1	1	1	1	1	1



TABLE 3.4 PRIORITY PROJECT COST ESTIMATES

Priority	Street Name	Start/End Point	Facility Type	Facility Length (Feet)	\$2.00/LF per single solid line removal*	\$0.25/LF per single dashed line removal*	\$1.85 per single solid line to stripe**	\$0.46 per single dashed line to stripe**	# of bicycle symbol markings (placed every 250 ft)**	\$220 per bicycle symbol marking*	# of bicycle signs (placed every 600 ft)**	\$170 per bicycle sign*	\$7 per reflective marker (66 per mile)*	# of intersection conflict areas	Total \$ Estimate***
1	US 321	US 421 to Rivers Street	Bicycle Lanes	700	\$0.00	\$0.00	\$2,590.00	\$0.00	6	\$1,320.00	0	\$0.00	\$0.00	2	\$5,508.50
2	King Street	College Street to US 321	Climbing Lane + Sharrows	1,432	\$0.00	\$0.00	\$2,649.20	\$0.00	12	\$2,640.00	3	\$510.00	\$0.00	2	\$7,175.08
3	US 421	Old East King Street to Eastern town limits	Bicycle Lanes	7,307	\$29,228.00	\$7,307.00	\$54,071.80	\$13,444.88	60	\$13,200.00	0	\$0.00	\$1,278.73	3	\$137,827.97
4	King Street	Green Street to College Street	Shared Lanes/Sharrows	3,075	\$0.00	\$0.00	\$0.00	\$0.00	26	\$5,720.00	12	\$2,040.00	\$0.00	4	\$8,924.00
5	US 421	Western ETJ limits to Green Street	Paved Shoulders	6,176	\$49,408.00	\$0.00	\$45,702.40	\$0.00	0	\$0.00	22	\$3,740.00	\$540.40	0	\$114,299.42
6	US 321	NC 105 to Boone Heights Drive	Shared Lanes/Sharrows	3,705	\$0.00	\$0.00	\$0.00	\$0.00	30	\$6,600.00	14	\$2,380.00	\$0.00	4	\$10,327.00
7	Rivers Street	Center Street to US 321	Shared Lanes/Sharrows	932	\$0.00	\$0.00	\$0.00	\$0.00	8	\$1,760.00	4	\$680.00	\$0.00	2	\$2,806.00
8	NC 105	King Street to US 321	Bicycle Lanes	4,253	\$0.00	\$2,126.50	\$15,736.10	\$3,912.76	36	\$7,920.00	0	\$0.00	\$744.28	3	\$36,523.58
9	US 321	Boone Heights Drive to Deerfield Road	Shared Lanes/Sharrows	2,467	\$0.00	\$0.00	\$0.00	\$0.00	20	\$4,400.00	10	\$1,700.00	\$0.00	3	\$7,015.00
10	NC 105	Poplar Hill Drive to US 321	Shared Lanes/Sharrows	5,194	\$0.00	\$0.00	\$0.00	\$0.00	42	\$9,240.00	18	\$3,060.00	\$0.00	3	\$14,145.00
11	Greenway Road	Winklers Creek Road to Pride Drive	Paved Shoulders	2,823	\$5,646.00	\$0.00	\$10,445.10	\$0.00	0	\$0.00	10	\$1,700.00	\$0.00	0	\$20,459.77
12	Jefferson Road	US 421 to Northern ETJ limits	Paved Shoulders	2,986	\$11,944.00	\$0.00	\$11,048.20	\$0.00	0	\$0.00	10	\$1,700.00	\$0.00	1	\$28,396.03
Totals				41,050	\$96,226.00	\$9,433.50	\$142,242.80	\$17,357.64	\$240.00	\$52,800.00	\$103.00	\$17,510.00	\$2,563.41	\$27.00	\$393,407.35

*per unit cost estimates are based on information provided by the Town of Boone and the NCDOT Division 11 Engineers in August 2013

**based on AASHTO guidance

***estimates include a 15% contingency



Bicycle lanes on Hardin Street/US-321 between Rivers Street and NC 105.