

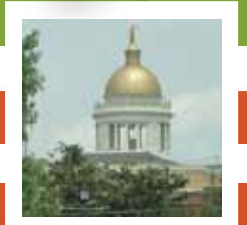


U.S. Department of Transportation
**Federal Highway
Administration**



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Custa Rail Trail Planning Study & Economic Impact Analysis



March 2012

**ECONSULT
CORPORATION®**

Member of the Econsult/Fairmount Group



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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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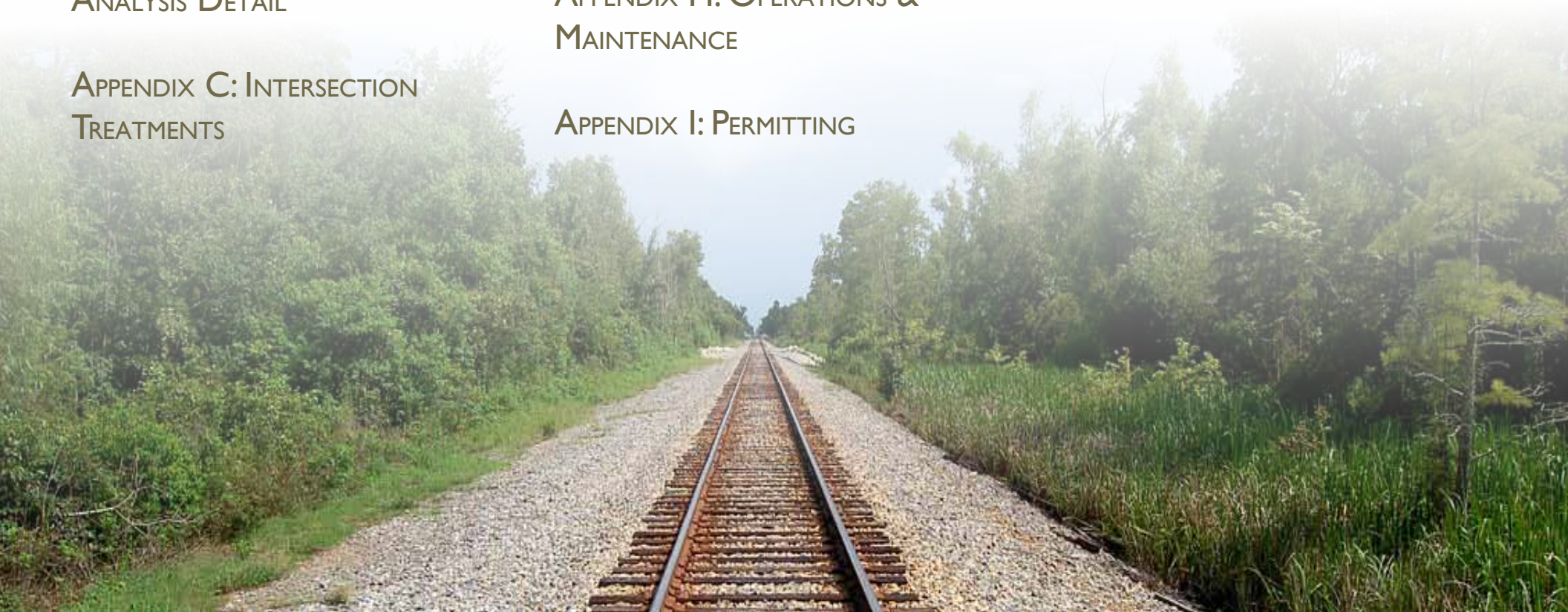
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Introduction

Overview

This report provides a comprehensive overview of the potential conversion of an inactive Norfolk Southern (NS) Railroad line to a multi-use trail between Hendersonville and Brevard, North Carolina called the Ecusta Rail Trail. The name Ecusta was chosen to honor the history of the region, and comes originally from the Cherokee Indian word for rippling water.¹ The purpose of the study is to identify the feasibility of converting the NS railroad line into a proposed 20-mile, multi-use trail through the process of federal railbanking. Railbanking is the process by which a railroad is preserved for future rail use through conversion to a trail in the interim. The railroad line, if converted to a trail, serves as a shared use path for pedestrians, bicyclists, and equestrians separated from motorized traffic.

Project Purpose

The City of Hendersonville received a grant from the Federal Highway Administration (FHWA) to fund the study, and it has been working with neighboring jurisdictions and other project stakeholders to recognize the value of a rail-to-trail conversion to the community as well as the region. Letters of resolution supporting the project can be found in Appendix J of this report. The trail, once constructed, will serve as a sustainable transportation corridor, provide recreation opportunities for residents and visitors, improve quality of life, increase property values

adjoining the corridor, and retain and attract new businesses and residents.

History of the Rail Line

The rail corridor is situated in the Blue Ridge Mountains of western North Carolina, between the cities of Brevard and Hendersonville, near the state's border with South Carolina. The 20-mile long railroad line was constructed in 1894 by the Hendersonville and Brevard Railway, Telegraph and Telephone Company. Beginning in 1939, the railroad supported the Ecusta Corporation, which operated a paper mill until 2002 at the western end of the line and played a significant role in the development of the region through the 20th century.² The rail line passes through Henderson County and Transylvania County, connects Hendersonville and Brevard, and passes through Laurel Park, Etowah, Horseshoe, and Pisgah Forest.

Although trains are not currently operating along the rail line, the railroad right-of-way (ROW) is owned by Norfolk Southern Corporation. The line has not been utilized for freight service since the Ecusta plant closed in 2002. With the recent approval of the plans for Davidson River Village on the Ecusta site as a residential, commercial, and green space village, it is less likely that there will be an industrial user that requires rail service.³ Given current economic conditions, however, the redevelopment of the Ecusta site is not fully known at this time, and it is not clear whether rail service to that site will be necessary as part of the redevelopment.



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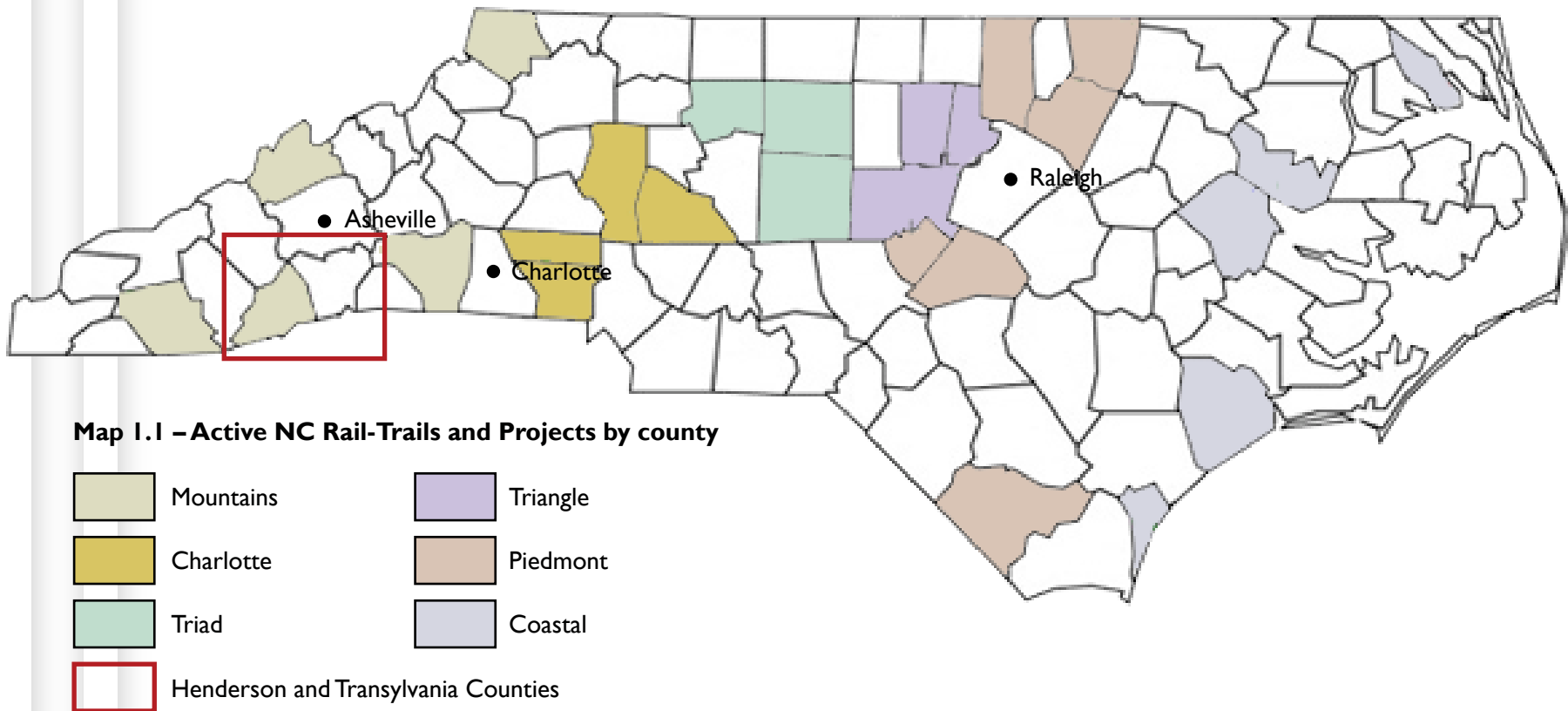
The rail line passes through several scenic parts of Henderson and Transylvania Counties.

Planning Context

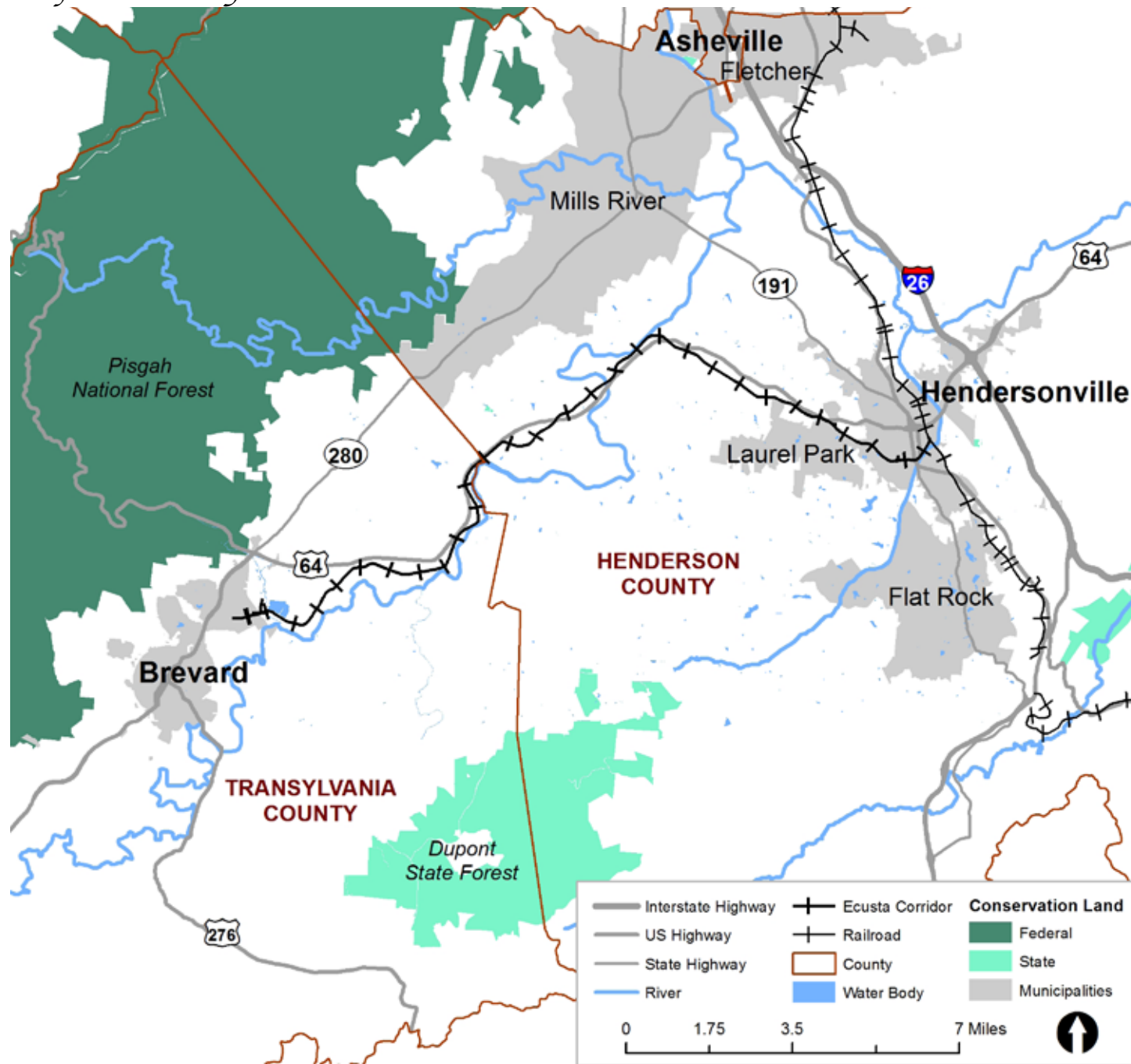
Henderson County and Transylvania County are situated within the Asheville-Brevard Combined Statistical Area. Henderson County is located within the Asheville Metropolitan Statistical Area, and Transylvania County is located within the Brevard Micropolitan Statistical Area. U.S. Census Bureau data indicate that the 2010 population of Henderson County was 106,740 (a 19.7 percent increase since 2000). The 2010 population of Transylvania County was 33,090 (a 12.8 percent increase since 2000).⁴ Henderson County's population is projected to increase to 123,135 by 2019, and Transylvania County's population is projected to increase to 36,753 by 2019.⁵

Recreational and Cultural Resources

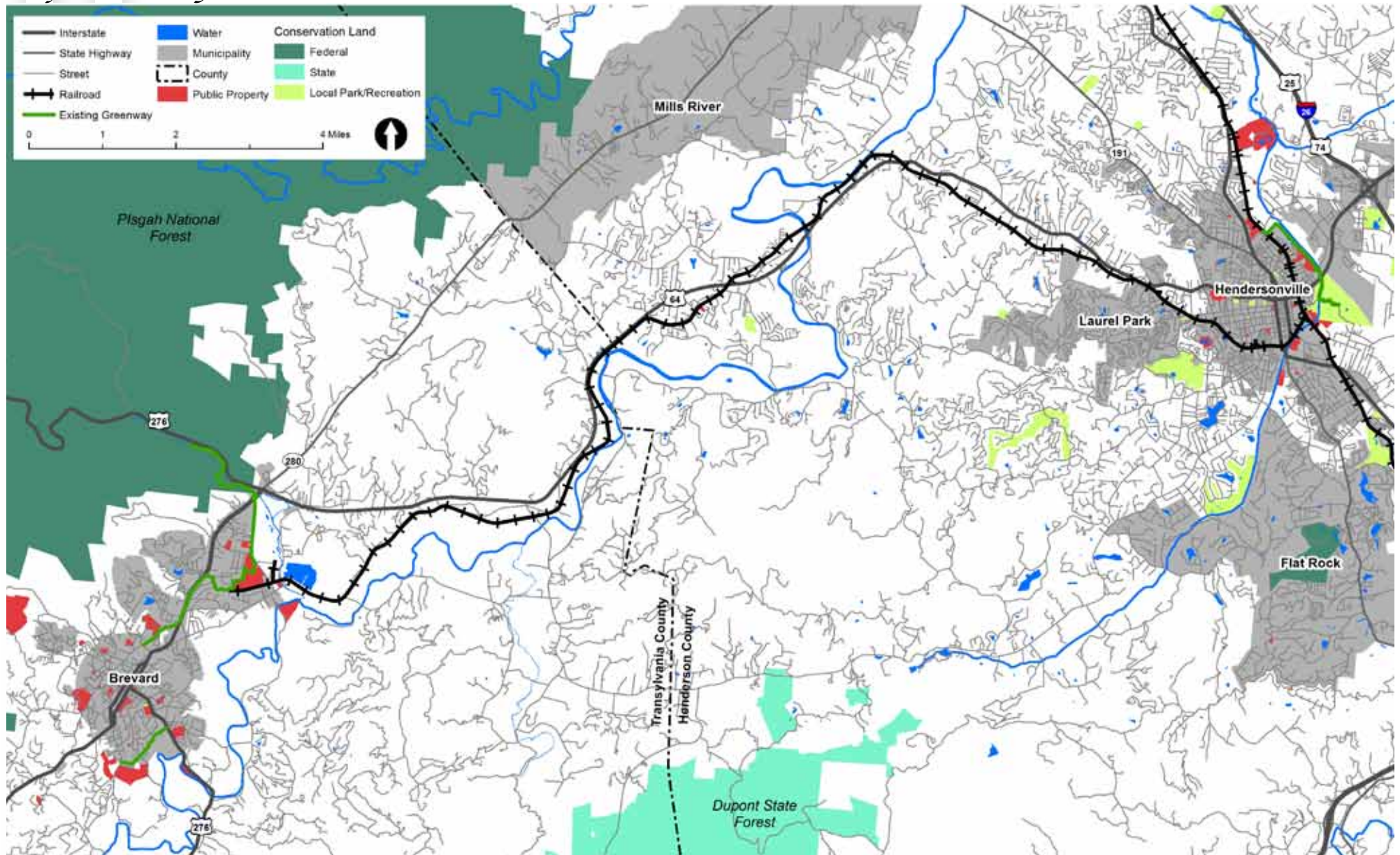
Situated within the mountains, Henderson and Transylvania Counties' geographical features attract those who are interested in a variety of activities. Historic downtown Hendersonville was entered into the National Register of Historic Places in March of 1988. The historic community of Flat Rock has been called "the Little Charleston of the Mountains," and the entire community is included in the National Register of Historic Places. Flat Rock Playhouse, founded in 1952, is a popular destination. Most of the storefronts in Brevard's downtown area are historic, and many have been restored to recapture the town's charming atmosphere.⁶



Map 1.2 – Study Area Overview



Map 1.3 – Study Corridor Overview



Henderson and Transylvania Counties' location provides residents with significant recreational amenities as well. Transylvania County was recently named "America's Best Kept Secret" for mountain biking by Bike Magazine. Numerous recreational opportunities are available within a short distance from the downtown Hendersonville and Brevard areas. The Green River offers whitewater kayaking, and Rumbling Bald Mountain offers a wide variety of bouldering and traditional rock climbing. The French Broad River and its tributaries are a popular location for local fly fishermen.⁷ DuPont State Forest is popular with walkers, hikers, equestrians, and mountain bike enthusiasts. Pisgah National Forest draws campers and hikers to enjoy its well-known waterfalls.

These many destinations - along with Chimney Rock State Park, Lake Lure, and the Blue Ridge Parkway - provide numerous boating, kayaking, hiking, mountain biking, rock climbing, fishing and camping opportunities to residents and visitors.

Notes

1. Wilma Dykeman, *The French Broad* (New York: Rinehart, 1955).
2. "Ecusta Trail History," <http://www.ecustatrail.org>.
3. "Ecusta Trail History."
4. "State & County QuickFacts: North Carolina," last modified January 17, 2012, <http://quickfacts.census.gov/qfd/states/37000.html>.
5. "Annual County Population Totals, 2010-2019," last modified September 1, 2011, http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates/demog/countytotals_2010_2019.html.
6. "Heart of Brevard Historic District," <http://www.visitnc.com/listings/view/48765/heart-of-brevard-historic-district>.
7. "Henderson County Things To Do", http://www.caulderrealty.com/henderson_county_things_to_do.htm.



The rail line in Hendersonville currently gets a significant amount of pedestrian traffic due to the fact that the railroad ROW offers connection to several local destinations.

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Existing Conditions



Overview

This section outlines the physical inventory for the rail line corridor. The inventory includes the features that were studied that will inform a comprehensive recommendation for a preferred trail alignment along the rail line. These features include elements that were gathered from GIS information provided by the Cities of Hendersonville and Brevard. In addition, on-the-ground fieldwork in Henderson and Transylvania Counties was performed by Alta/Greenways and Seamon Whiteside + Associates to gather information about elements more difficult to obtain through GIS. This included potentially enhanced connections to adjacent neighborhoods, schools, and parks; an inventory of possible greenway access points; and a structural analysis of existing bridges and crossings along the rail line corridor.

Physical Features

Land Use – Map 2.1 presents aerial imagery of the corridor and surrounding area. Aerial data was provided by the City of Hendersonville’s GIS department. Map 2.2 provides a summary of current zoning ordinances in several jurisdictions surrounding the rail corridor. Zoning categories were aggregated into general uses to provide an approximation of land use along the rail line.

Transylvania County is currently unzoned along this corridor, so information is not shown for areas outside of Brevard in that county. The majority of the corridor runs through land designated for residential use, with a few sections running through light commercial areas and one small industrial center. Significant conservation lands owned by the National and State Forest Services surround the region. A heavy commercial corridor running north to south through Hendersonville meets the rail line in downtown Hendersonville, while a mix of lighter commercial and institutional uses anchor the other end in Brevard.

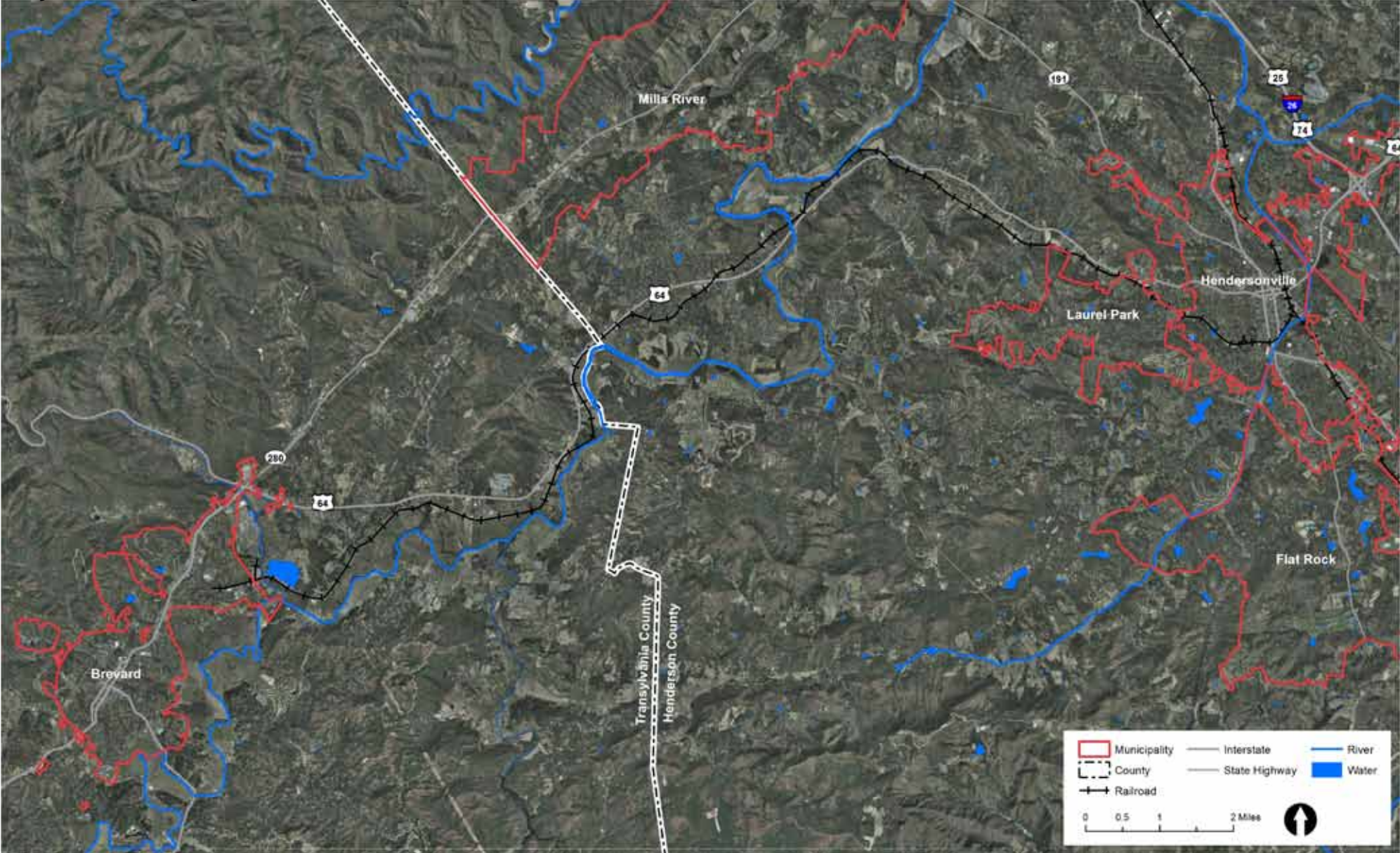
Natural Features

Existing Vegetation – Map 2.3 illustrates the land cover along the rail line and its surrounding area. The data for this map was obtained from the 2006 National Land Cover Dataset, distributed by the Multi-Resolution Land Characteristics Consortium (MRLC). This map displays 14 different land cover types based on analysis from satellite imagery. The greater region around Hendersonville and Brevard is dominated by deciduous forest, but the corridor itself is mostly bordered by low-density development and pastureland. The Towns of Brevard and Hendersonville provide anchors of medium intensity development at each end of the corridor. Some woody wetlands exist along

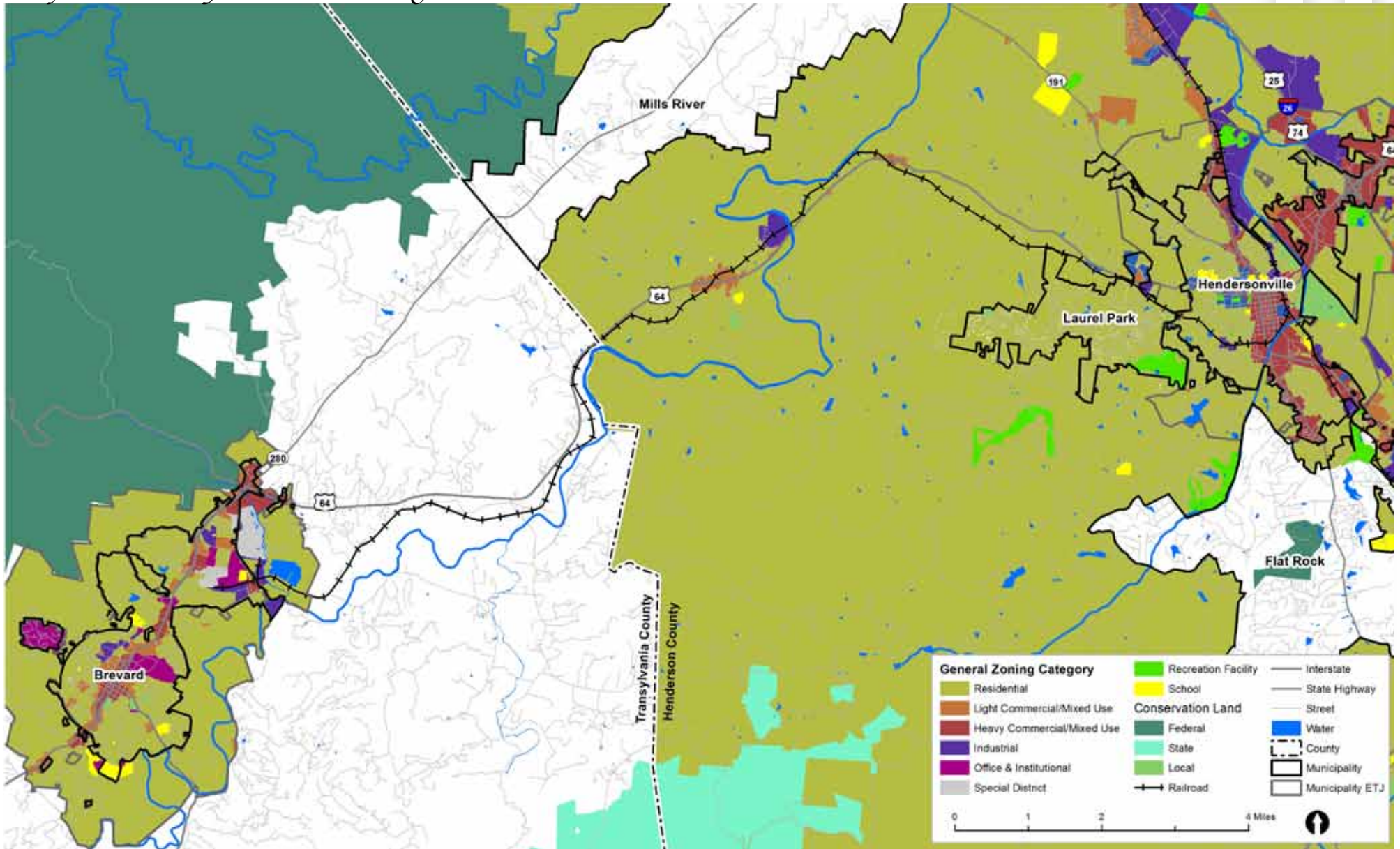
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- Overview
- Physical Features
- Natural Features
- Cultural and Historic Resources
- Destinations and Connections
- Infrastructure
- Rail Line Structural Assessment
- Environmental Issues
- Conclusion

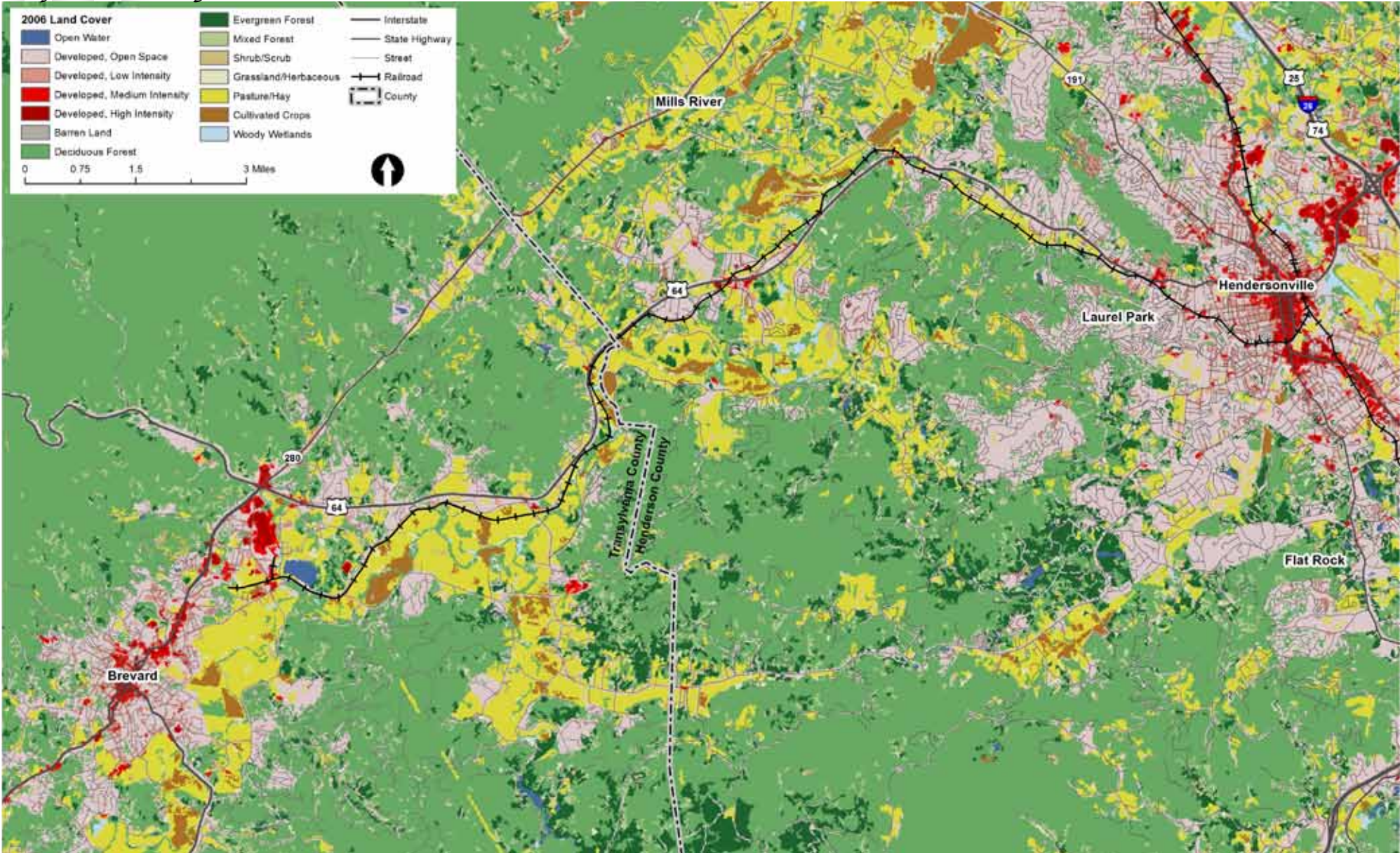
Map 2.1 – Study Corridor Aerial Overview



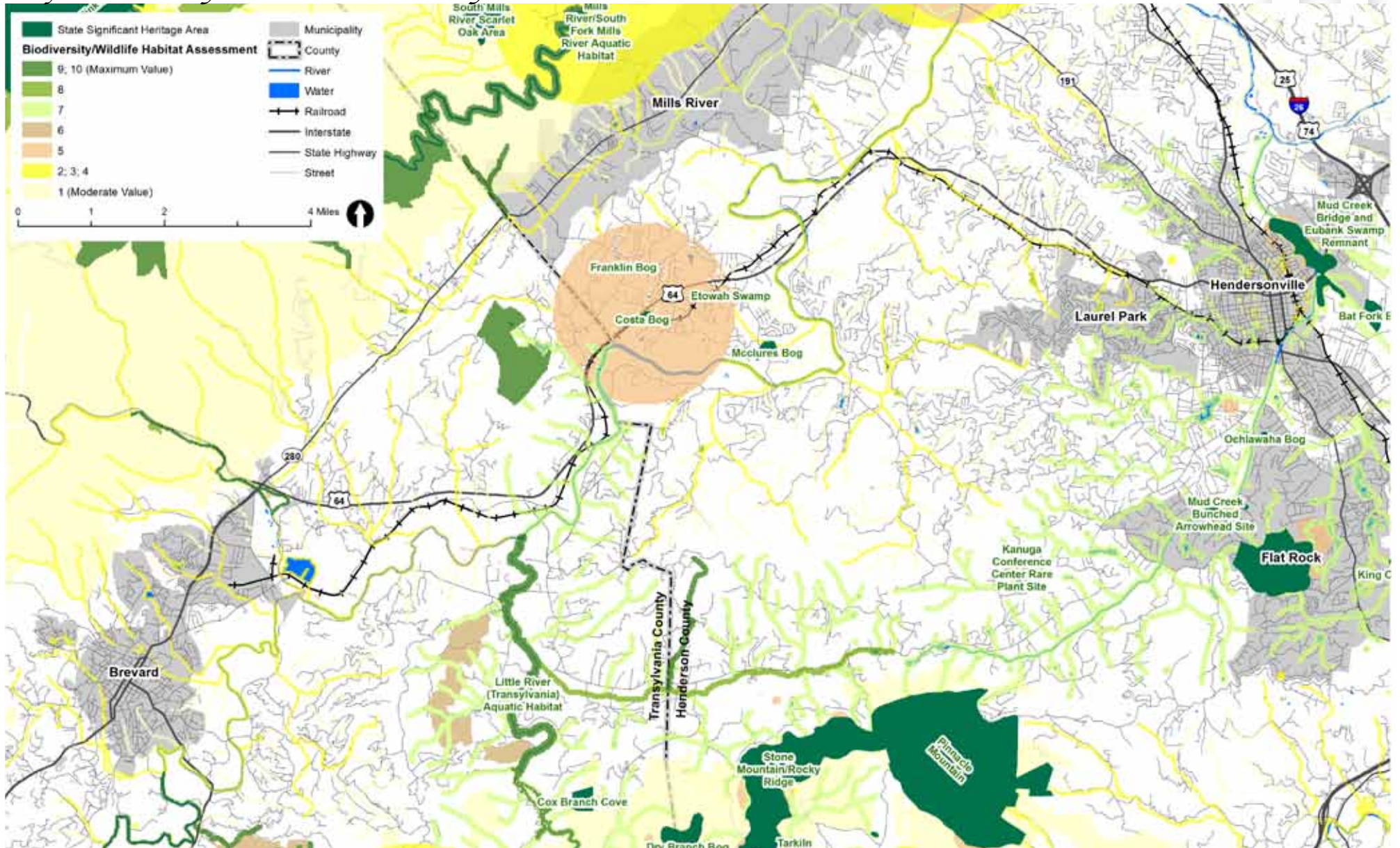
Map 2.2 - Study Corridor Zoning Overview



Map 2.3 – Study Corridor Land Cover



Map 2.4 - Study Corridor Biodiversity





A rail-to-trail installation along the Line could offer easy pedestrian access to Gateway Park.

the French Broad River, which flows north from Rosman and across the corridor toward Asheville.

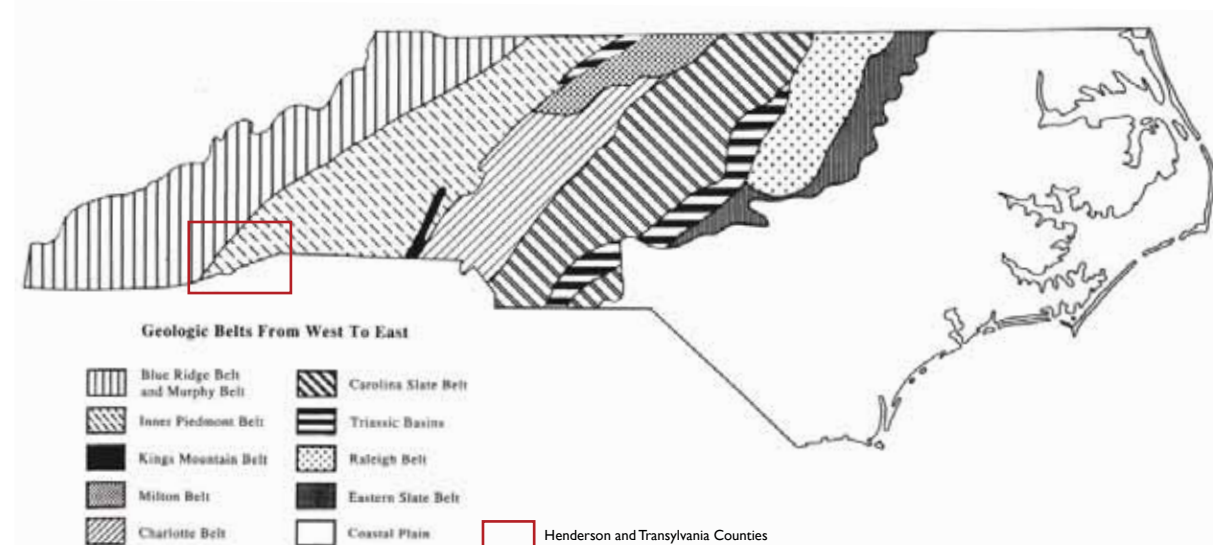
Wildlife Habitat – Biodiversity and wildlife habitat data was obtained from the Conservation Planning Tool for North Carolina. The tool was initially developed by a team of N.C. Natural Heritage Program staff, and then reviewed by field ecologists, biologists, and botanists from several state environmental agencies. This data compiles a multitude of complex variables that contribute to biodiversity and habitat assessment. Generally, for assessment of biodiversity, the available data represents three major components of ecological resources: biodiversity, both of aquatic and terrestrial species and communities; large scale terrestrial landscapes, including core wildlife habitats and habitat connectors; and other lands of particular importance to ecosystem processes, such as riparian buffers and wetlands.

Map 2.4 shows several small areas with a moderate

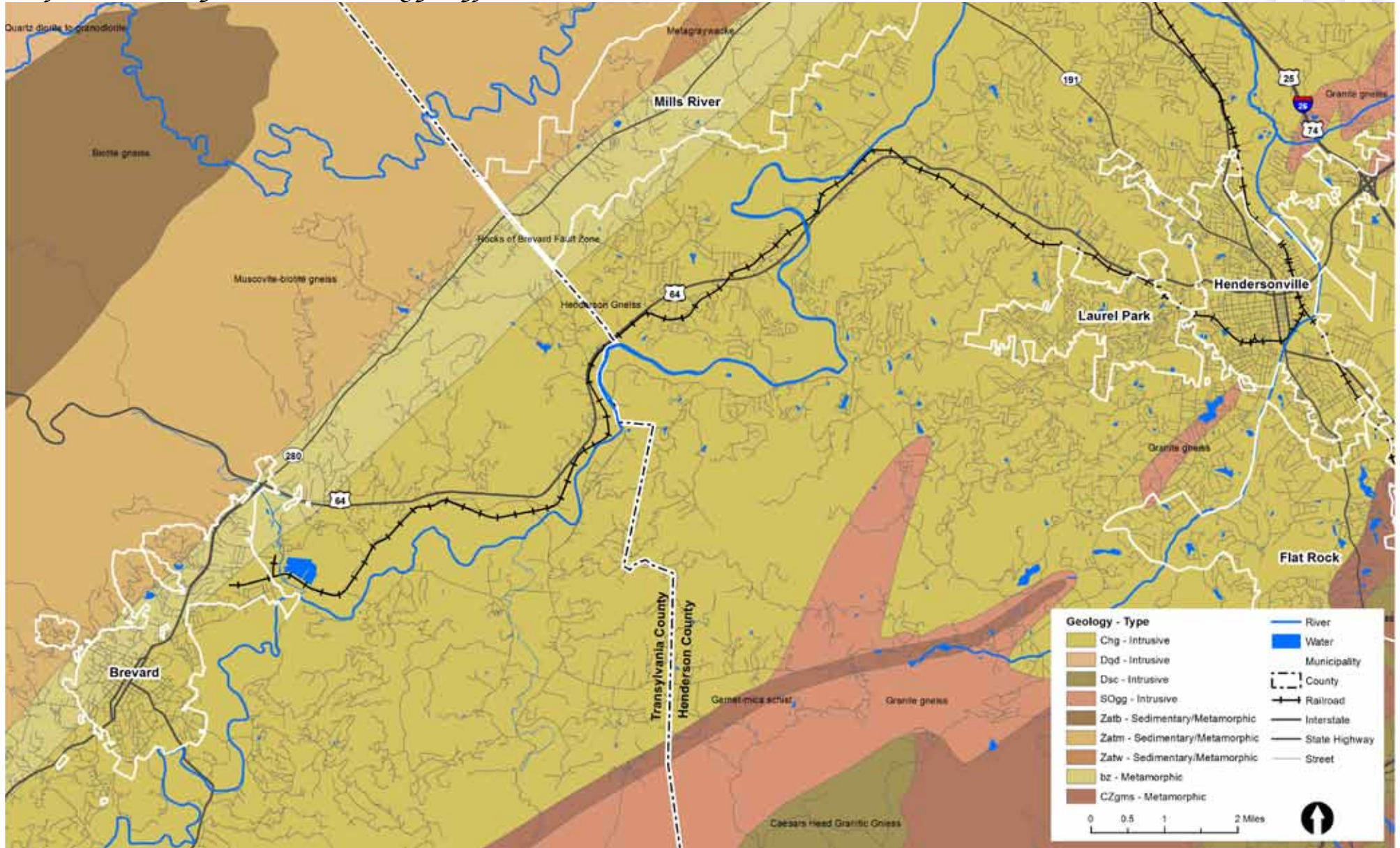
to high value assessment located near the corridor. The largest of these is a relatively low-lying area containing several marshes designated as State Significant Heritage Areas. These areas are also designated by the N.C. Natural Heritage Program because of their particular importance to the preservation of state biodiversity, and are therefore shown emphasized independently from the assessment data and labeled on Map 2.4. Several streams with a moderate assessment value also cross the corridor just west of the county line and within the city of Hendersonville.

Ecological Features – The rail corridor is located at the edge of the Inner Piedmont Belt, which is the most intensely distorted and metamorphosed segment of the Piedmont. The metamorphic rocks range from 500 to 750 million years in age. They include gneiss and schist that have been intruded by younger granite rocks (see Map 2.5 from the N.C. Geological Survey).

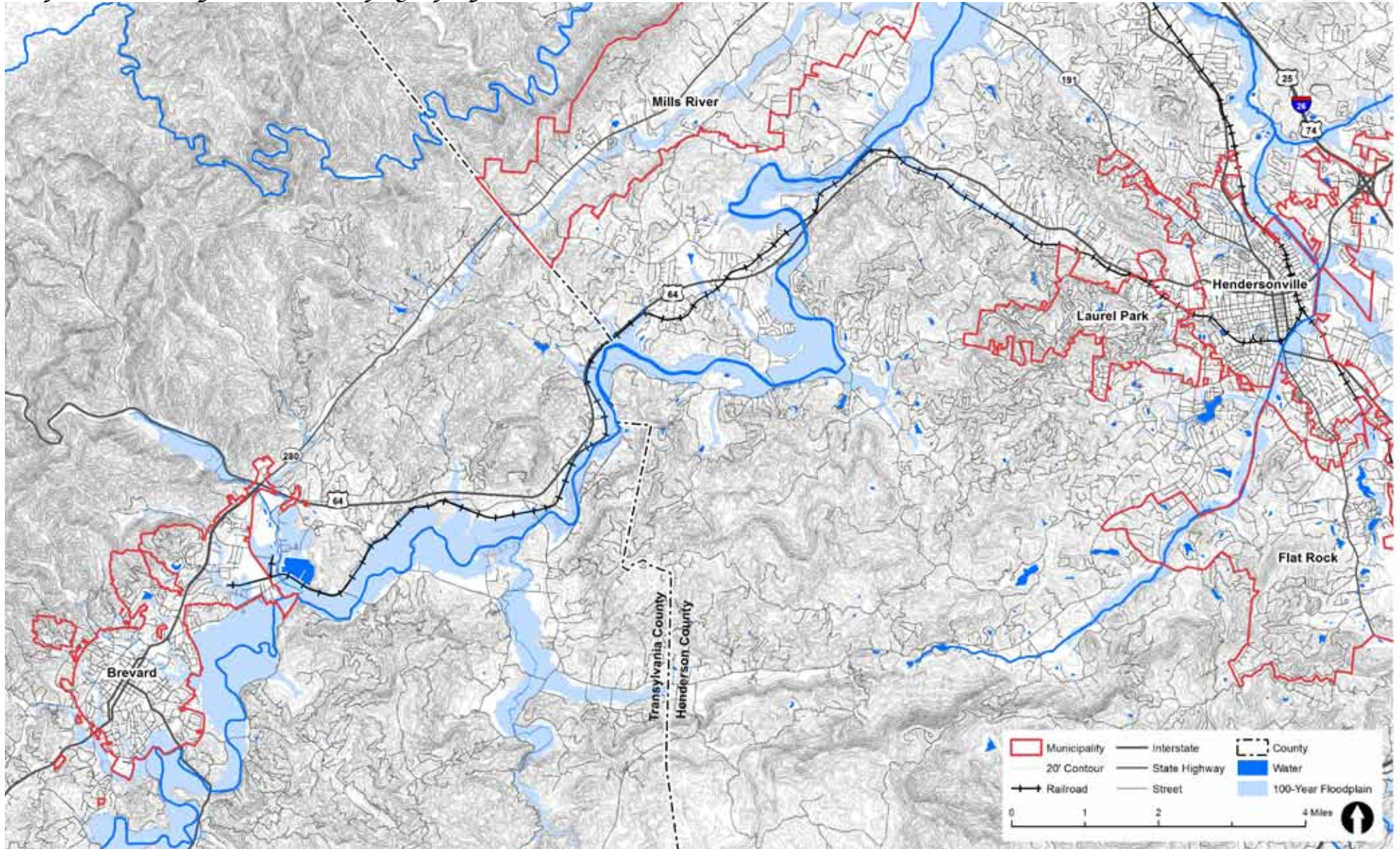
Map 2.5 – State Geology Types



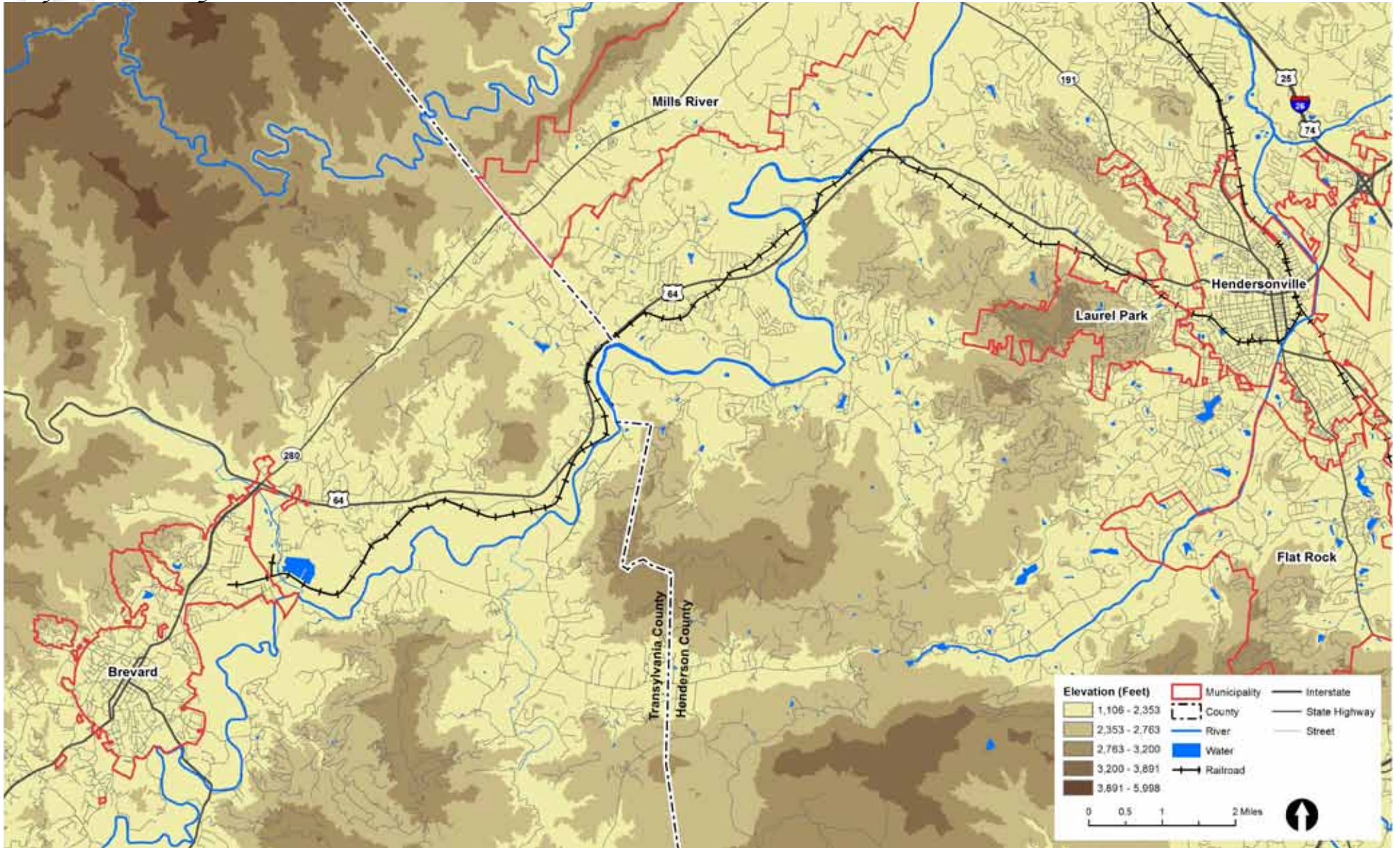
Map 2.6 – Study Corridor Geology Types



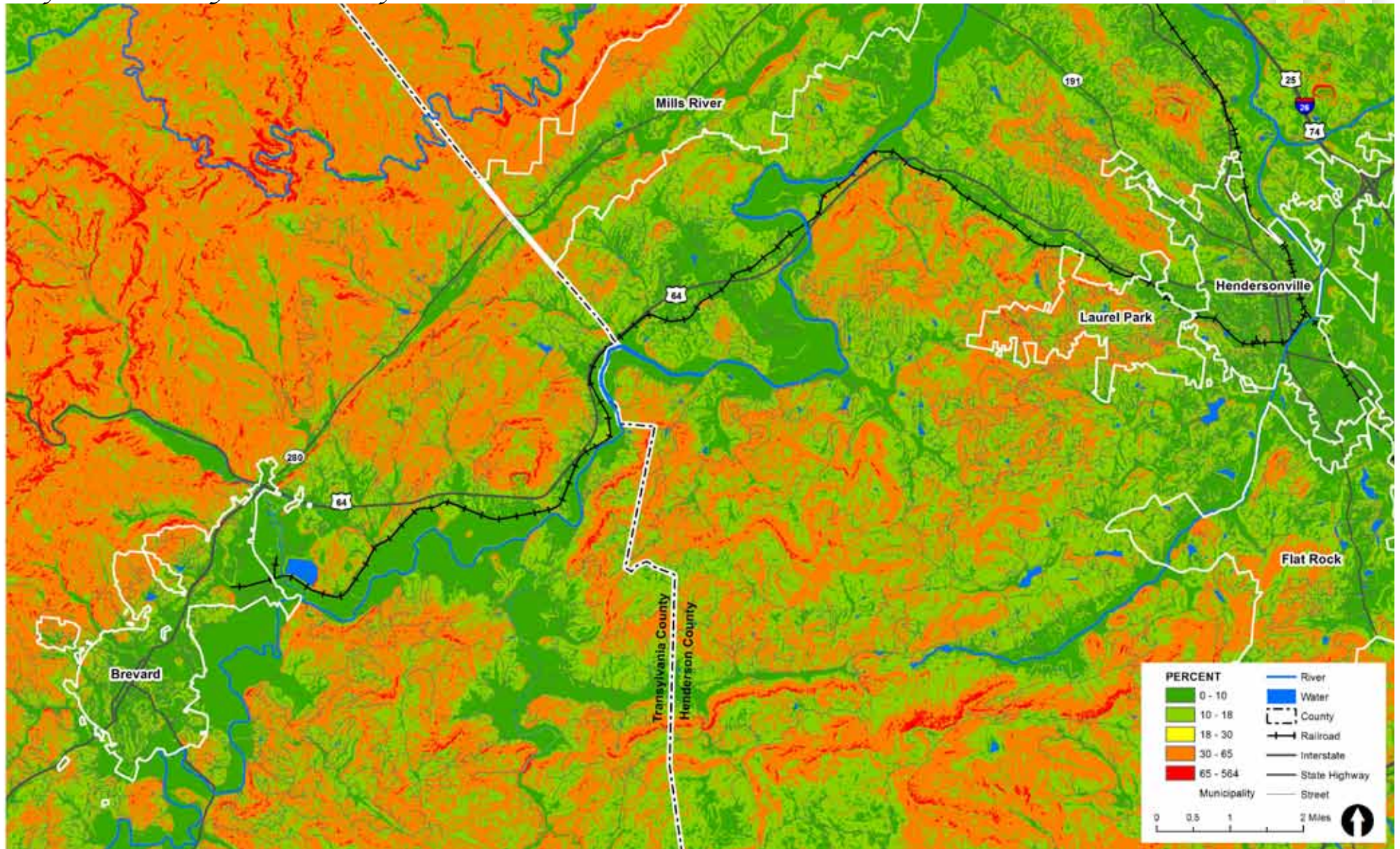
Map 2.8 - Study Corridor Topography



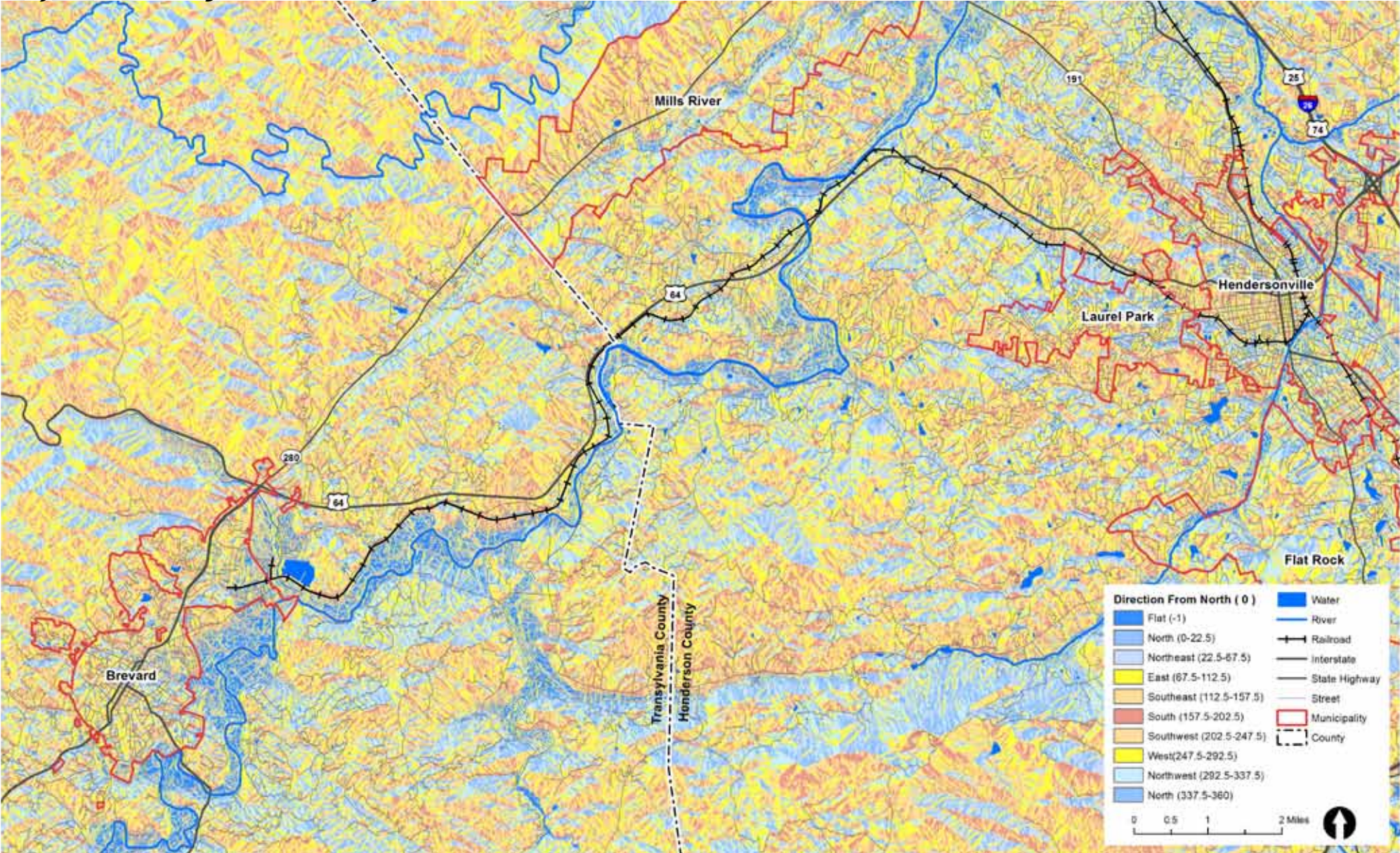
Map 2.9 – Study Corridor Elevation



Map 2.10 - Study Corridor Slope



Map 2.11 – Study Corridor Aspect



Map 2.6 illustrates the geology of the corridor and surrounding area as characterized by the N.C. Geological Survey (1998). The rail line is located almost entirely on Henderson Gneiss, but ends in the Rocks of Brevard Fault Zone at the city of Brevard. The Brevard Fault Zone contains a major fault line separating the Blue Ridge Geologic Province from the Inner Piedmont Geologic Province.

Map 2.7 displays the many soil units along the rail corridor and in the surrounding area. Over one hundred different soil units are represented within this area from the data provided by the U.S. Department of Agriculture's Natural Resources Conservation Service. Where the rail line follows the river, it passes over hydric soils. Hydric soils are defined as soils that form under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper levels. These soils can be found along small creeks and tributaries of the French Broad River, as well as along the river itself.

Landforms and Topography – Map 2.8 features 20-foot topographic contours for the corridor and surrounding area. The map is comprised of 2007 Light Detection and Ranging (LIDAR) data provided by the North Carolina Department of Transportation for Henderson and Transylvania counties. The one-hundred-year floodplain is shown to emphasize the flat corridor of the French Broad River outlined by the contours, which led to the eventual location of the rail line. The more dramatic landscapes of the Pisgah National Forest to the west and the Dupont State Forest to the south are indicated by the tight, almost overlapping contour lines in these areas.

Map 2.9 illustrates the elevation ranges in the region of the rail corridor. The elevations shown range from around 3,200 feet in the Pisgah National Forest to the northwest and 3,600 feet in the Dupont State Forest to the south, down to 2,000 feet along the French Broad River. The rail itself lies at approximately 2,100 feet along the entire length of the corridor, with a variation of approximately 50 feet either way. The data for this map comes from 2007 LIDAR data.

Map 2.10 displays slopes in percentages utilizing 2007 LIDAR data. This data is not survey quality; therefore, detailed topographic surveys should be conducted during the design development phase for any proposed construction project.

The two shades of green on the map identify slopes less than 18 percent where development may potentially occur. The majority of the rail corridor runs through these areas. Steep slopes do abut the corridor for several sections, however, and inhibit future trail alignment opportunities in certain directions from Brevard, Hendersonville, and Laurel Park. The maximum slopes for various development-related activities are as follows:

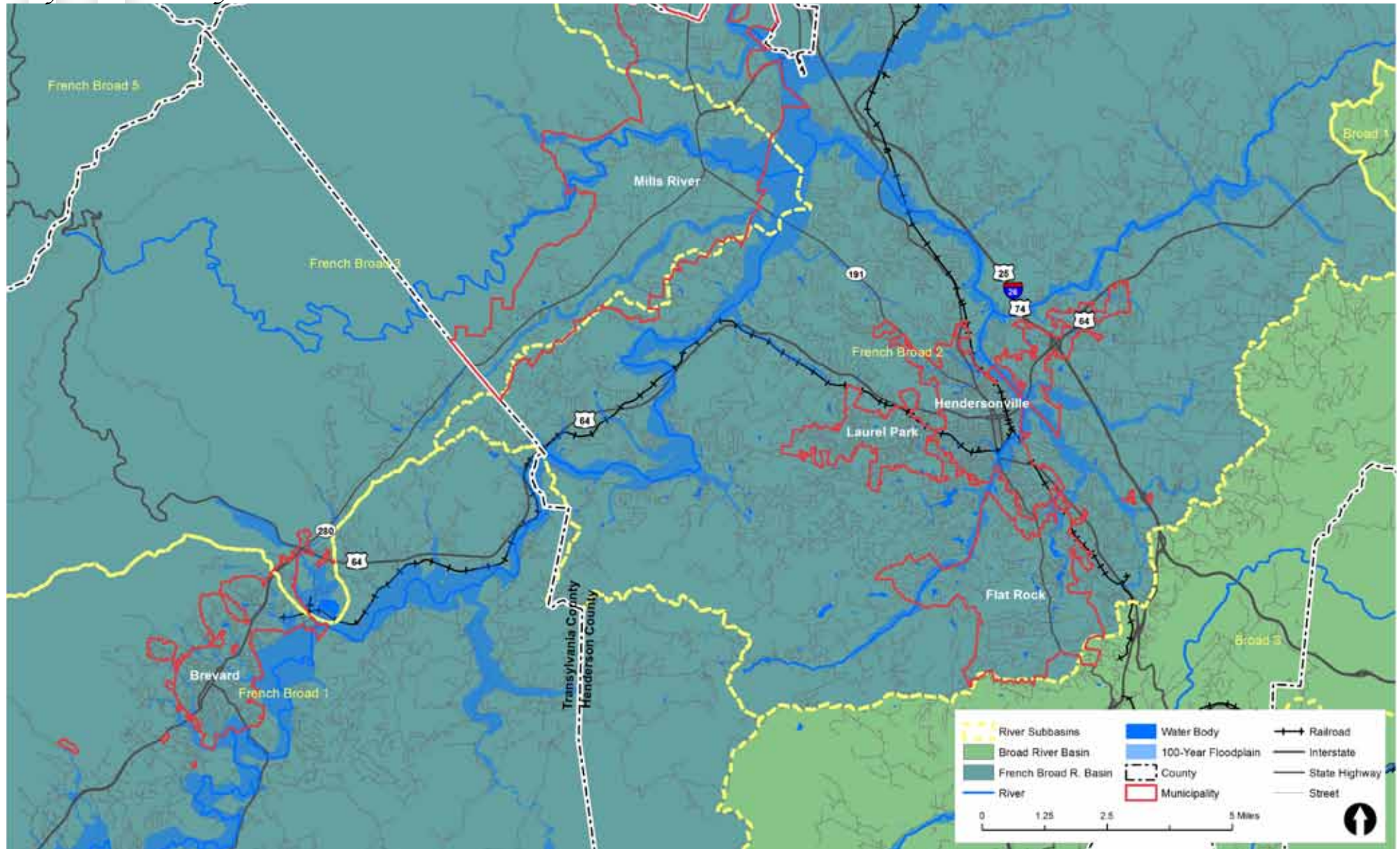
- 0-10% Easily buildable and pedestrian accessible; ideal for roads and trails.
- 11-18% Maximum buildable slopes for roads
- 19-30% Maximum buildable slopes; septic capable
- 31-65% Steepest provisionally for on-site sewer
- >65% Unbuildable

Map 2.11 illustrates the aspect of slopes in the region around the corridor. Aspect is the direction that land faces from north (0°) going

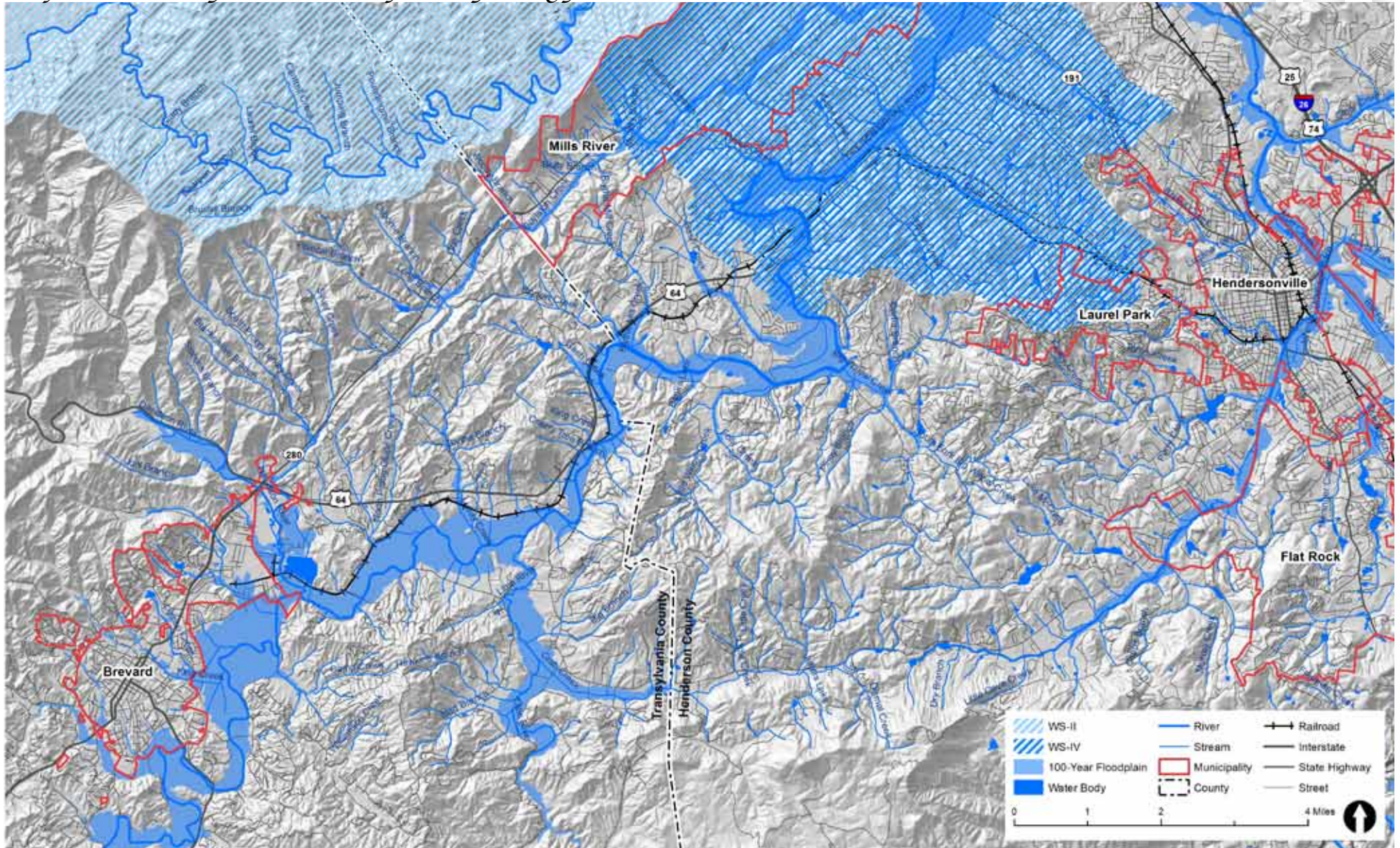


The rail line crosses and passes nearby the French Broad River in several locations between Brevard and Hendersonville.

Map 2.12 – Study Corridor River Subbasins and Water Bodies



Map 2.13 – Study Corridor Surface Hydrology





With the addition of interpretive features, wetland sites along the rail line like this one could offer educational opportunities for potential future trail users.

clockwise towards east (90°) and so forth back to north (360°). Aspect has an important effect on micro communities. Generally, south-facing slopes receive more sunlight, have drier soils and have higher temperature microclimates. North-facing slopes receive more shade and are typically more moist. South-facing slopes are ideal when planning buildings and public use areas utilizing energy-efficient techniques and solar energy harvesting. The map represents south-facing aspects in yellow and pink and north-facing aspects in blue. As indicated by the map, the corridor lies in north-facing slopes where it closely follows the river, but it generally passes through a mixture of conditions.

Hydrology (Flood Hazard Areas, Drainage Areas, Wetlands, Streams) – The State of North Carolina contains all or portions of 17 river basins, as seen on Map 2.14. The rail corridor falls entirely within the French Broad River basin, and

more specifically within the Upper French Broad River Subbasin (See Map 2.12). The majority of the corridor follows the French Broad River and intersects several smaller tributaries, as shown on Map 2.13.

The French Broad River, beginning in the mountains of Transylvania county, has a rich history as the third oldest river in the world, and it acts as a tributary of the Tennessee River.¹ The river flows north from Brevard through a mostly flat section to Asheville before heading toward Tennessee and ultimately the gulf of Mexico.² It is used extensively for rafting, supporting the tourism industry, and is an important water source in the region.

Map 2.13 shows all streams and rivers located near the rail corridor. The highest quality classifications for streams and rivers are High Quality Waters and Outstanding Resource Waters, as classified by the N.C. Division of Water Quality (NCDWQ).

Map 2.14 – North Carolina River Basins



 Henderson and Transylvania Counties

The French Broad River is currently a Class B waterway. The French Broad River Watershed, located in Henderson county and shown on Map 2.13, is a Class IV Water Supply Protected Area. Several tributary streams to the river located in the area, such as Lyday Creek and Big Willow Creek, are designated Trout Waters. While none of the creeks running across the rail corridor are impaired, a tributary running just east of Hendersonville, Mud Creek, is an impaired waterway.

The following definitions from the NCDWQ explain the classification of area waterways and watersheds.

Class C – Waters protected for uses such as secondary recreation; fishing; wildlife; fish consumption; aquatic life including propagation, survival, and maintenance of biological integrity; and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner.

Class B (French Broad River) – Waters protected for all Class C uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

Trout Waters (Lyday Creek, Glade Creek, Lambo Creek, Davidson River, Big Willow Creek) – Supplemental classification intended to protect freshwaters that have conditions that sustain and allow for trout propagation and survival of stocked trout on a year-round basis. Those

waters classified as Tr require maintenance of a 25-foot vegetative buffer on both sides based on State of North Carolina regulation.

Water Supply IV (French Broad River Watershed) – Waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I, II, or III classification is not feasible. These waters are also protected for Class C uses. WS-IV waters are generally in moderately to highly developed watersheds or Protected Areas.

Cultural and Historic Resources

Historic data – Before Hendersonville and Brevard became incorporated cities, the region was inhabited by the Cherokee nation. As European settlers began to find the area in the 18th century, the Cherokee nation suffered disease outbreaks and loss of territory. By the end of the 18th century, newcomers had made significant inroads into the area.³ Henderson County was formed in 1838, and Hendersonville became its county seat. Transylvania County became a county in 1861, with Brevard becoming its county seat.⁴

Hendersonville matured slowly during the middle decades of the nineteenth century. The town attracted a small collection of merchants, lawyers, and other professionals. By the 1910s, contiguous rows of mostly two-story, brick buildings characterized Main Street's commercial core, many of which are preserved in today's "Historic Downtown Hendersonville", which was entered into the National Register of Historic Places in March of 1988. The community's downtown has become important to its economic and cultural growth. Today's Main Street, decorated with planter boxes, is home to a variety of specialty



The rail line provides access to culturally significant and historical sites in Transylvania and Henderson counties like The Lenox Park Historic District.



A rail-to-trail project along the rail line could connect to the existing greenway in Brevard, providing access to downtown Brevard and Pisgah National Forest.

shops, antiques stores, and restaurants.⁵

The biggest impact on the development of Brevard began with the construction of the rail line by the Hendersonville and Brevard Railway, Telegraph and Telephone Company in 1894. The line served the Ecusta paper mill upon its construction in 1939; the paper mill was the primary economic driver of Brevard and surrounding towns during the 20th Century.⁶ Economic success allowed improvements in infrastructure and an increase in the population of the small town.⁷ The paper mill closed in the early 2000s, and the rail line, which is the subject of this study, is no longer in use. Today, historic downtown Brevard is home to a variety of shops and restaurants.

Cultural data – Cultural resources that would be accessible near the rail corridor are mainly located in the cities of Brevard and Hendersonville. In Brevard, trail users could access the Transylvania Heritage Museum. In Hendersonville, the Henderson County Heritage Museum, the Mineral and Lapidary Museum, the Hendersonville Little Theater, the Flat Rock Playhouse Downtown, and the Hands On! children’s gallery would be accessible to trail users. In addition, trail users could attend the numerous festivals and events that take place in both cities throughout the year. The Transylvania County Library in Brevard, the Henderson County Public Library in Hendersonville, and the Etowah Branch Library in Etowah, would be accessible from the rail corridor. The Henderson County Family YMCA, located in downtown Hendersonville, would be an important destination along the route.

Population Density – Map 2.15 shows the distribution of population around the rail corridor. The cities of Hendersonville and Brevard carry total populations of 13,137 and 7,609, respectively,

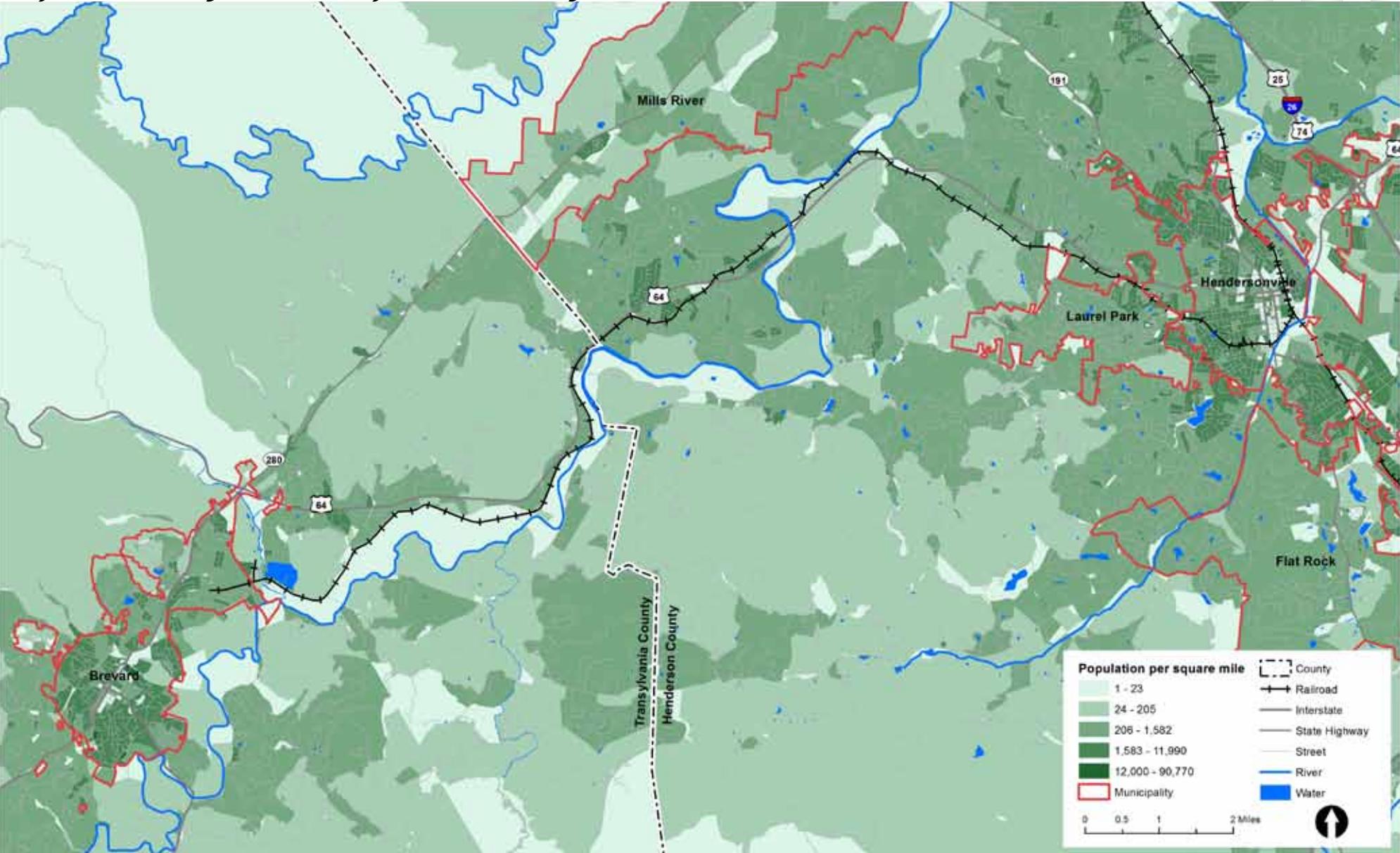
as of the 2010 U.S. Census. The nearby towns of Mills River (6,802) and Laurel Park (2,180) have smaller, more spread out populations.

Destinations and Connections

Access points – Existing greenways in Hendersonville and Brevard and walking trails in Laurel Park would provide access to the rail corridor. North Carolina State Bike Routes 1 and 8 cross the corridor in several locations. Numerous public roadways cross the corridor and could provide access. Etowah Elementary School, the Brevard Recreation Department, Davidson River School in Brevard, Laurel Park, and the proposed Gateway Park in Hendersonville could all provide access points to the rail corridor.

Destinations along the corridor – The key destinations along the corridor include the Cities of Brevard and Hendersonville, the Town of Laurel Park, and the Etowah area. Other destinations include Etowah Elementary School, Brevard Recreation Department, Davidson River School, the proposed Davidson River Village Development, and other Brevard area schools and parks. Henderson County’s Jackson Park can be connected to the corridor via Williams Street and 4th Avenue in Hendersonville. Retail destinations include numerous restaurants and convenience stores along the route, as well as within the towns of Brevard and Hendersonville. Additionally, a connection between Hendersonville and Brevard could provide access to Pisgah National Forest by means of bike or foot for residents and visitors of Hendersonville. The study corridor also intersects a high-tension power line corridor that runs south through Dupont State Forest. This could provide a future link to Dupont State Forest trails and recreation opportunities.

Map 2.15 - Study Corridor Population Density



Existing Bike, Pedestrian, and Recreational Facilities – The region around the rail corridor contains extensive recreation options, as shown on Map 2.16. Pisgah National Forest, located to the northwest of the corridor, covers an area greater than 500,000 acres in all and provides hiking, backpacking, fishing, and many other recreation opportunities.⁸ The Dupont State Forest south of the corridor is also known for its scenic beauty and recreational opportunities, with extensive waterfalls and around 100 miles of trails over 10,000 acres.⁹

The cities of Brevard and Hendersonville also provide a starting point for several existing trails and an extensive network of proposed trails. The existing Brevard Greenway trail connects Brevard to the Pisgah National Forest, while the proposed network links several centrally located parks. Similarly, the Apple Country Greenway recommended trail network running through Henderson County connects Hendersonville and Flat Rock to Dupont State forest - as well as local attractions like the Historic Johnson Farm and the French Broad River - via the rail corridor.

In addition to the two-mile Oklawaha Greenway connecting Jackson Park with Patton Park, the City of Hendersonville also boasts an extensive sidewalk network downtown, providing pedestrian access between potential trails and downtown amenities. Several state bike routes run through the region as well, linking other recreational areas.

The town of Laurel Park had just completed a parks and greenways plan at the time of this report, which proposes trails throughout the town.

Infrastructure

Roadways – Map 2.17 shows the road and rail transportation network between Brevard, Hendersonville, and nearby towns. Interstate Highway 26 runs south from Asheville and passes just east of Hendersonville, intersecting with US Highway 64 northeast of the city. US Highway 64 then parallels the rail line before heading south through Brevard, intersecting the rail in several locations. US Highway 276 provides a connection from Brevard north through the Pisgah National Forest and south to the South Carolina border. State Highways 280 and 191 provide alternative routes to Asheville from Brevard and Hendersonville, respectively.

Intersections – There are 70 official and unofficial roadway crossings of the rail corridor along its route from Brevard to Hendersonville. Many of these crossings are addressed in the following section describing opportunities and constraints along the corridor. Each crossing would require pedestrian facilities to notify vehicles of the trail and ensure safe passage for pedestrians. Local streets that cross the rail line are listed on the following page by county. US Highway crossings are listed separately. US 64 crosses the corridor at grade three times over the course of its length. These crossings would require the greatest investment in safety improvements of the crossings listed for a trail along the corridor.



The existing greenway in Brevard provides connections for several area schools. These connections could be significantly expanded if a trail along the rail line were linked with the existing greenway.



The Ecusta line crosses Highway 64 in three locations between Brevard and Hendersonville. Signage already in place - as shown in the example above - would make the conversion to a pedestrian crossing a relatively simple one.

Transylvania County Crossings

- Fisher
- Chestnut
- Osborne
- Ecusta
- Davidson River
- Old Hendersonville
- Everett
- Crab Creek
- Grove Bridge

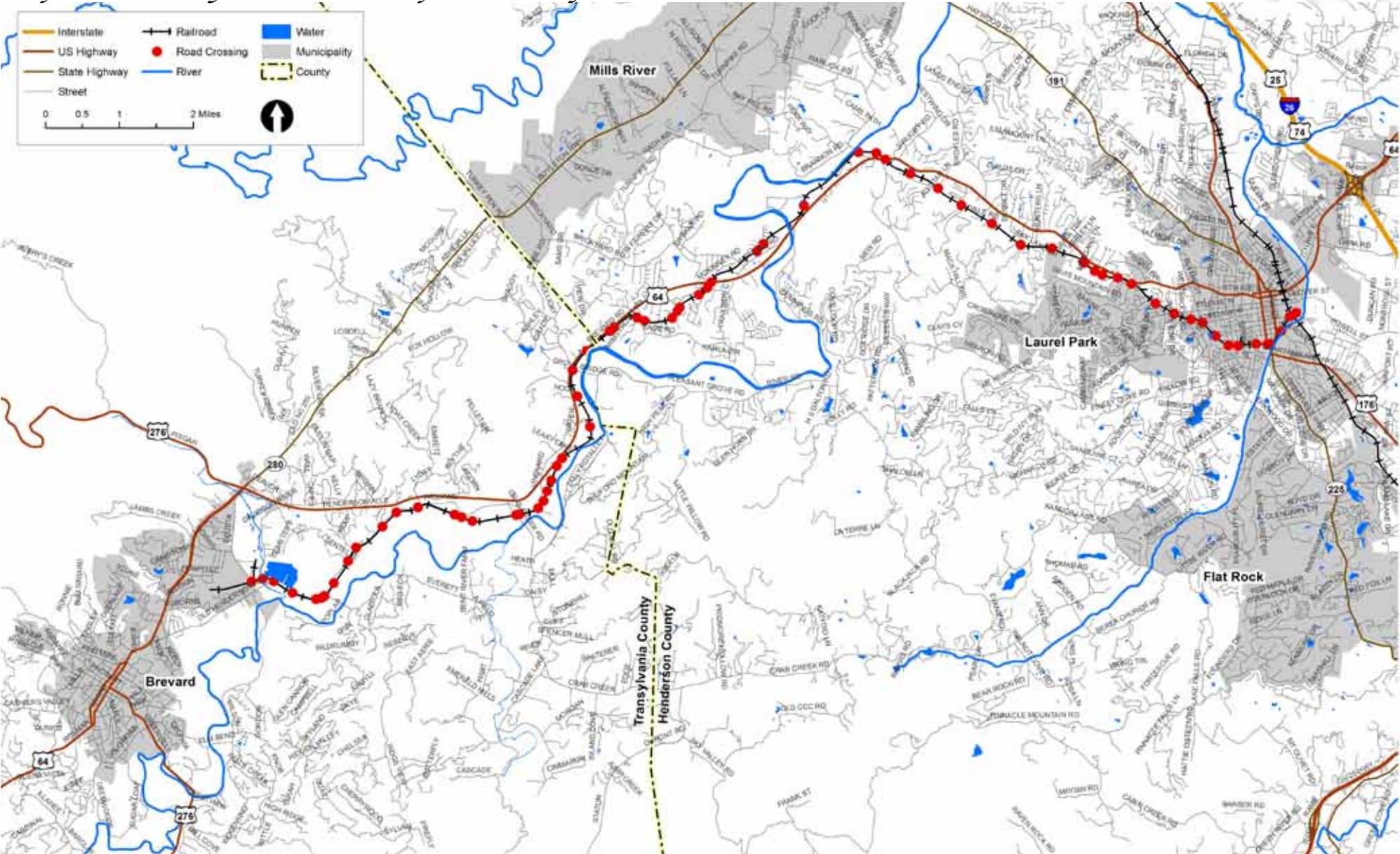
Henderson County Crossings

- Eade
- Timberlane
- Etowah School
- Banner Farm
- Battle Creek
- Hunters Glen
- Old Homestead
- Yale
- Turley Falls
- Daniel
- Glasgow
- 5th Avenue West
- Jordan Street
- 3rd Avenue West
- West Allen
- South Whitted
- Spring
- Kanuga
- South Grove
- 1st Avenue East

US Highway Crossings

- Asheville (US 64)
- Brevard (US 64) – 2 Crossing Locations
- Church (US 25)
- Main (US 25)

Map 2.17 - Study Corridor Transportation Infrastructure



Rail Line Structural Assessment

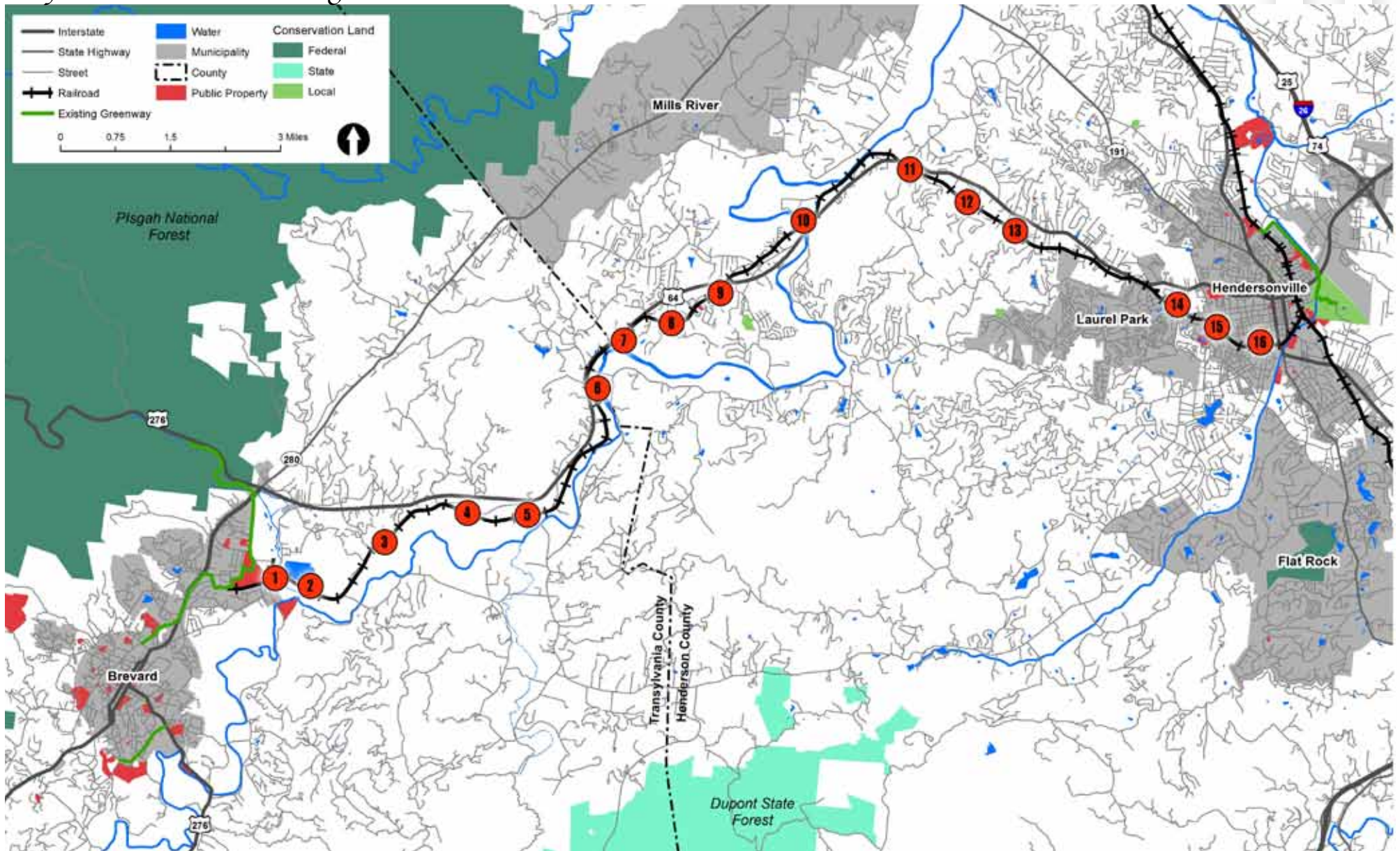
Field work included a structural assessment of the railroad bridges located along the proposed Ecusta Rail Trail in Henderson and Transylvania Counties. Map 2.18 shows the locations of the bridges assessed along the Ecusta corridor. The objective of the structural assessment is to verify structural integrity, both in material and methods. It is assumed that the proposed Ecusta Rail Trail will accommodate pedestrians, cyclists, equestrians, and maintenance vehicles where adjacent road accessibility is prohibitive. The following report provides a description of the existing bridge structures, the methods used for evaluating the bridges, and inspection documentation (field notes and photographs). The following chapters of this planning study will further evaluate recommendations for renovations, repairs, and reuse for these structures.



Bridges could provide interesting and attractive views and experiences for trail users.

Non-destructive bridge inspection techniques for detecting and assessing structural integrity were used during both site visits (July 13, 2011 and July 26, 2011). These methods included inventory analysis, visual assessment, and cursory inspection. Before the integrity can be fully determined, it is presumed that the proposed Ecusta Rail Trail structures will undergo further analysis and testing to include dye penetrant tests, magnetic particle tests, ultrasonic scanning, and acoustic emission monitoring. Furthermore, drilling and measuring bents, ballasts, and other materials based on predetermined locations likely to harbor decay (i.e. near drift pins, bolts, etc.) is recommended to ensure structural stability.

Map 2.18 - Railroad Bridge Locations



Concrete Caps



East View



Bridge Number: 1

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 144

Percent Deteriorated: 35%

Tie Span: Varies (18" O.C. Typical)

Ties Secured: Yes

The overall length of the eight-span bridge is approximately 181' with variable span lengths. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of a combination of concrete and timber caps, timber piles, and sway braces. (See typical cross-section)

Deck and Superstructure – Ties are deteriorating and causing debris to accumulate along the girders and metal sheathing. Ties are also deflecting, causing shift in the overall alignment of the superstructure. Girders are in satisfactory condition with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of the decking.

Substructure: – Both back walls are in poor condition with signs of decay, deterioration, and severe weathering. There is minor undermining and detaching of wing walls. Timber caps are in satisfactory condition with top 1/2" deteriorated. Timber piles show no signs of deterioration and only minor weathering, but do show signs

of deflecting. Metal sheathing shows signs of oxidation, resulting in severe corrosion. Wood shims show signs of severe deterioration. Substructure shows no signs of debris collection or vegetation growth. Sway braces show signs of minimal weathering and deterioration. Stone pile supports of river span show no signs of deflection or erosion. Metal bridge span shows surface rust, but no severe corrosion present.

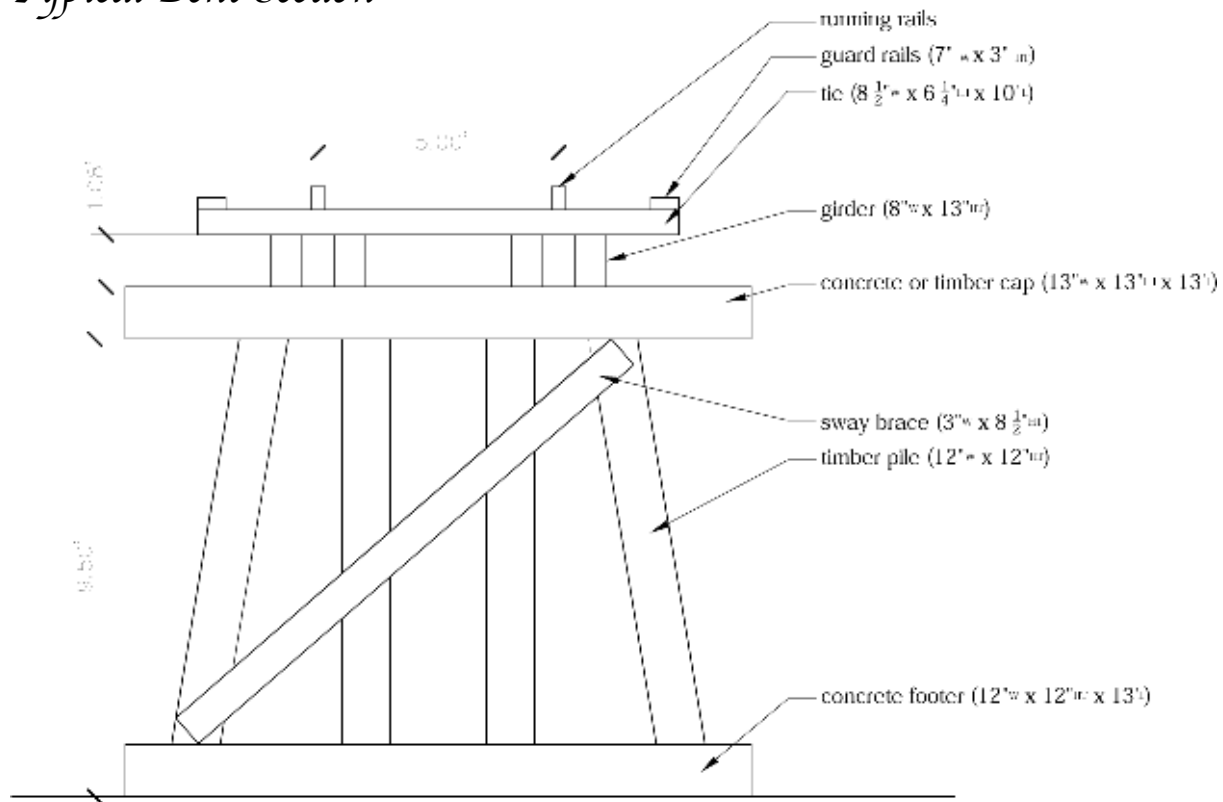
Timber Piles Deflecting



Panoramic



Typical Bent Section



Back Wall Erosion



Back Wall Deflection



View North



Bridge Number: 2

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 20

Percent Deteriorated: 100%

Tie Span: Varies (14"-18" O.C. Typical)

Ties Secured: Yes

The overall length of the three-span bridge is approximately 24' with 12' span lengths. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps and timber piles. (See typical cross-section)

Deck and Superstructure – All ties are severely deteriorating along the girders. Ties are also deflecting, causing shift in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard rails are severely deteriorated.

Substructure – Both back walls are in poor condition with signs of decay, deterioration and severe weathering. There is minor undermining and detaching walls. Timber piles show no signs of deterioration and only minor weathering; however, most of the piles are underwater (unknown depth). Wood shims show signs of severe deterioration. Substructure shows no signs of debris collection or vegetation growth.

Back Wall



Overall View



Undermining at Back Wall



Bridge Number: 3

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 35

Percent Deteriorated: 15%

Tie Span: Varies (18" O.C. Typical)

Ties Secured: Yes

The overall length of the five-span bridge is approximately 54' with variable span lengths. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps and timber piles. (See typical cross-section)

Deck and Superstructure – Ties are deteriorating and show minor weathering. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are in satisfactory condition and show minor weathering resulting in detachment from decking.

Substructure – Both back walls are in poor condition with signs of decay, deterioration and severe weathering. There is severe undermining and detaching of wing walls. Concrete caps are in satisfactory condition showing no visual signs of cracking. Timber piles show no signs of deterioration, only minor surface weathering. Wood shims show signs of severe deterioration. Substructure is collecting large amounts of debris

from upstream, resulting in severe sediment collection at all bents. Signs of frequent flooding are resulting in back wall and bent undermining.

Typical Bent



Typical Bent



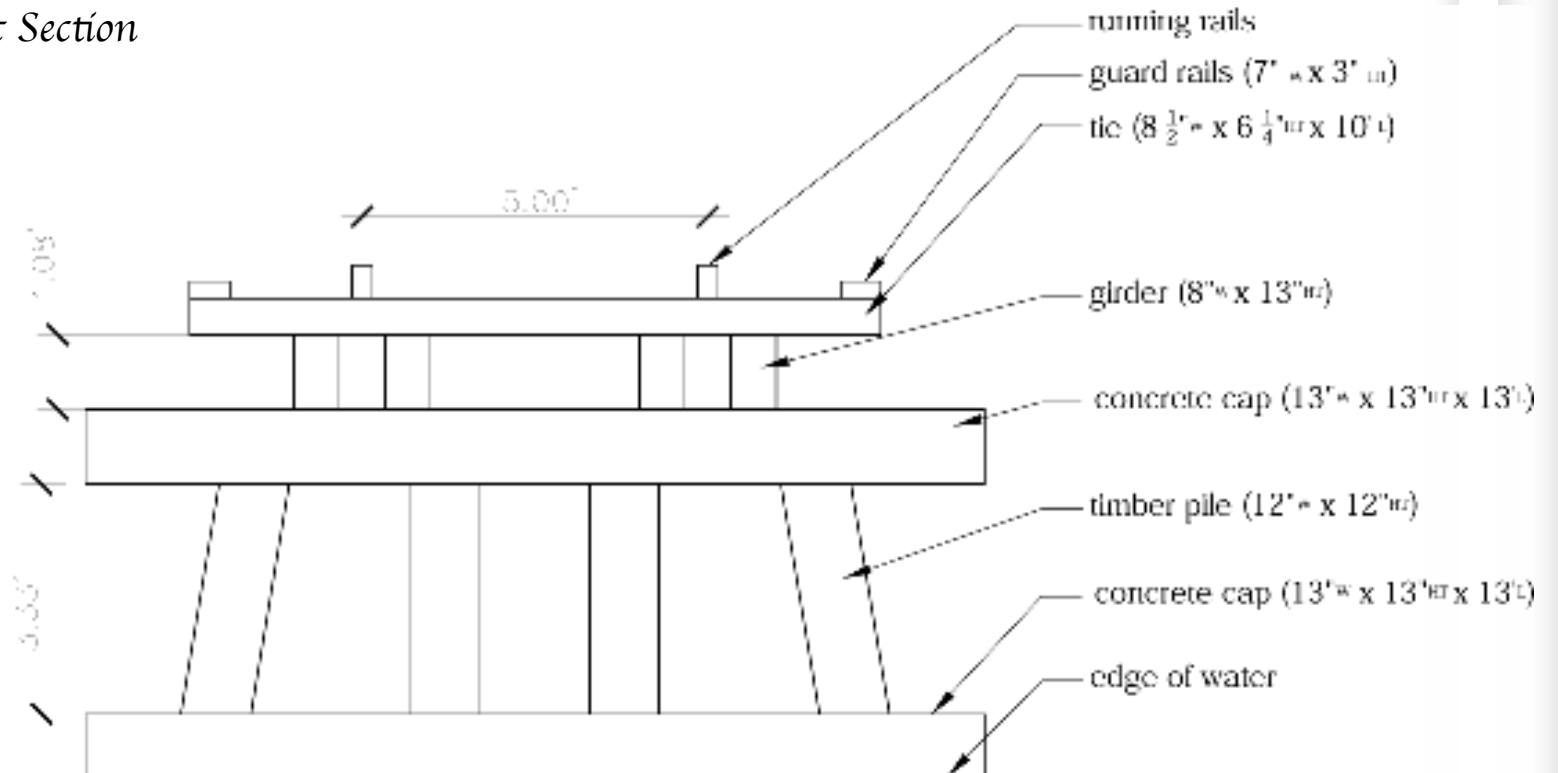
North Substructure View



South Substructure View



Typical Bent Section



Overall View



Bridge Number: 4

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 46

Percent Deteriorated: 5%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the four-span bridge is approximately 70' with approximately 15' span lengths. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps, timber piles, and timber cross braces. (See typical cross-section)

Deck and Superstructure – Ties show minor weathering. Girders are in satisfactory condition with few areas of deterioration and minor weathering. Guard and running rails are in satisfactory condition and show minor weathering resulting in detachment from decking.

Substructure – Both back walls are in satisfactory condition, with minimal signs of deterioration and weathering. There is minor undermining and detachment of walls. North back wall constructed of concrete bags and timber ties.

South back wall constructed of timber ties. Timber piles show no signs of deterioration, only minor weathering; however, the piles terminate to unknown foundations due to sediment build-

up (unknown depth). Wood shims show signs of minor deterioration. Substructure shows signs of debris collection and vegetation growth.

North Back Wall



Typical Bent



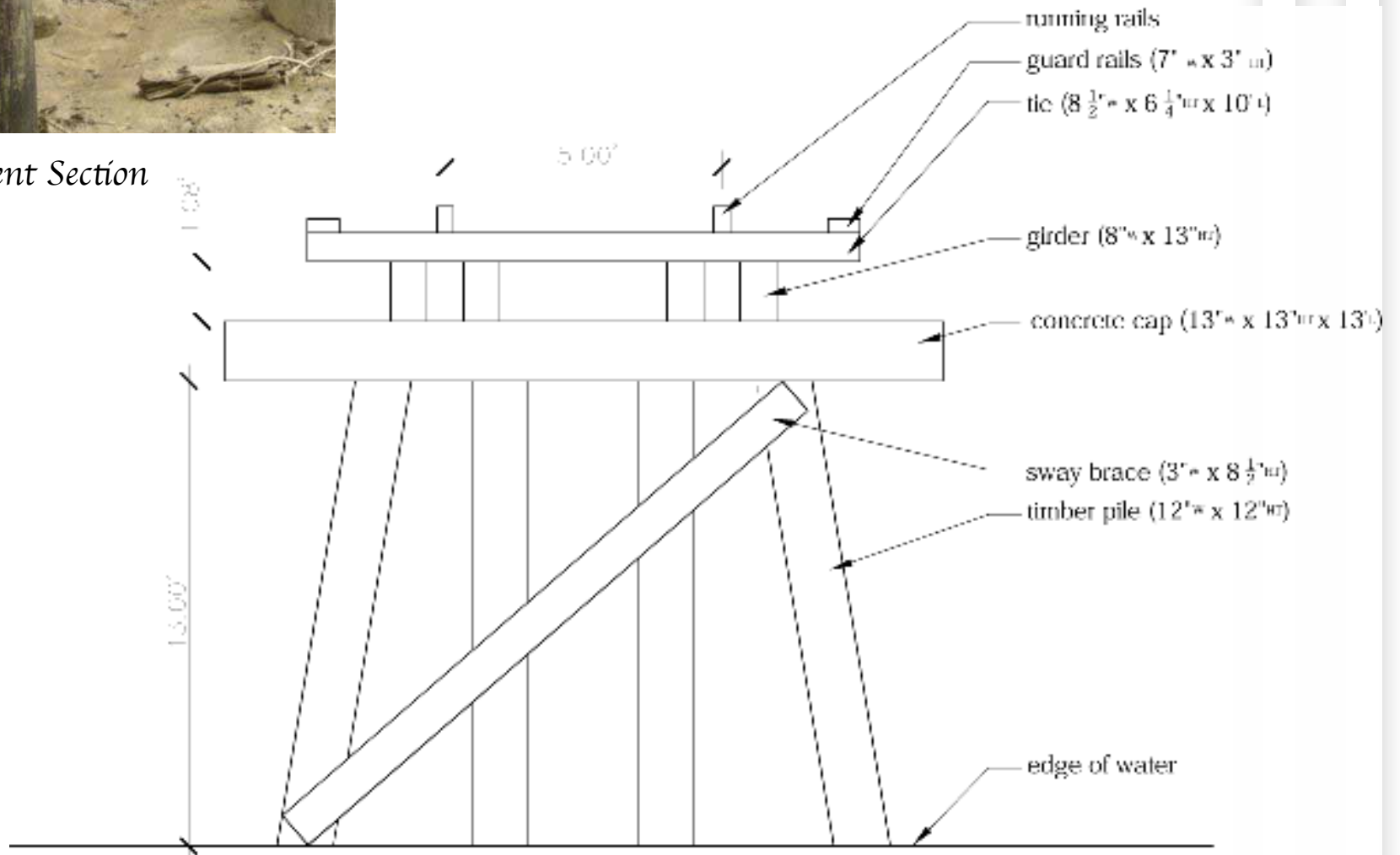
Back Wall Deterioration



Back Wall Undermining



Typical Bent Section



Overall View



Bridge Number: 5

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 8

Percent Deteriorated: 20%

Tie Span: Varies (18"-20" O.C. Typical)

Ties Secured: Yes

The overall length of the free span bridge is approximately 13'. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber tie retaining walls. (See imagery support)

Deck and Superstructure – Ties show minor weathering. Girders are in poor condition, with significant areas of deterioration and weathering. Guard and running rails are in satisfactory condition and show minor weathering, resulting in detachment from decking.

Substructure – Both back walls are in satisfactory condition with minimal signs of deterioration and weathering. South wing deflecting into stream and is constructed of stacked concrete ties. Minor undermining and detachment of walls. Back walls constructed of timber ties. Timber piles show signs of deterioration and minor weathering. Wood shims show signs of minor deterioration. Substructure shows signs of debris collection.

Concrete Tie Wing Wall



South Back Wall



North Back Wall



Overall View



Bridge Number: 6

County: Transylvania County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 80

Percent Deteriorated: 20%

Tie Span: Varies 18" O.C. Typical

Ties Secured: Yes

The overall length of the six-span bridge is approximately 93'. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber tie retaining walls. (See imagery support)

Deck and Superstructure – Ties show minor weathering and deterioration. Girders are in fair condition with some areas of deterioration and weathering. Guard and running rails are in satisfactory condition and show minor weathering resulting in detachment from decking.

Substructure – Both back walls are in poor condition with signs of deterioration and weathering. Both back walls are further supported by stacked concrete ties. Minor undermining and detachment of walls are occurring as a result of frequent flooding. Back walls constructed of timber ties. Timber piles show signs of deterioration and weathering due to frequent flooding. Wood shims show signs of minor deterioration. Substructure shows signs of debris collection and significant vegetative growth.

Undermining of Timber Piles



Typical Bent



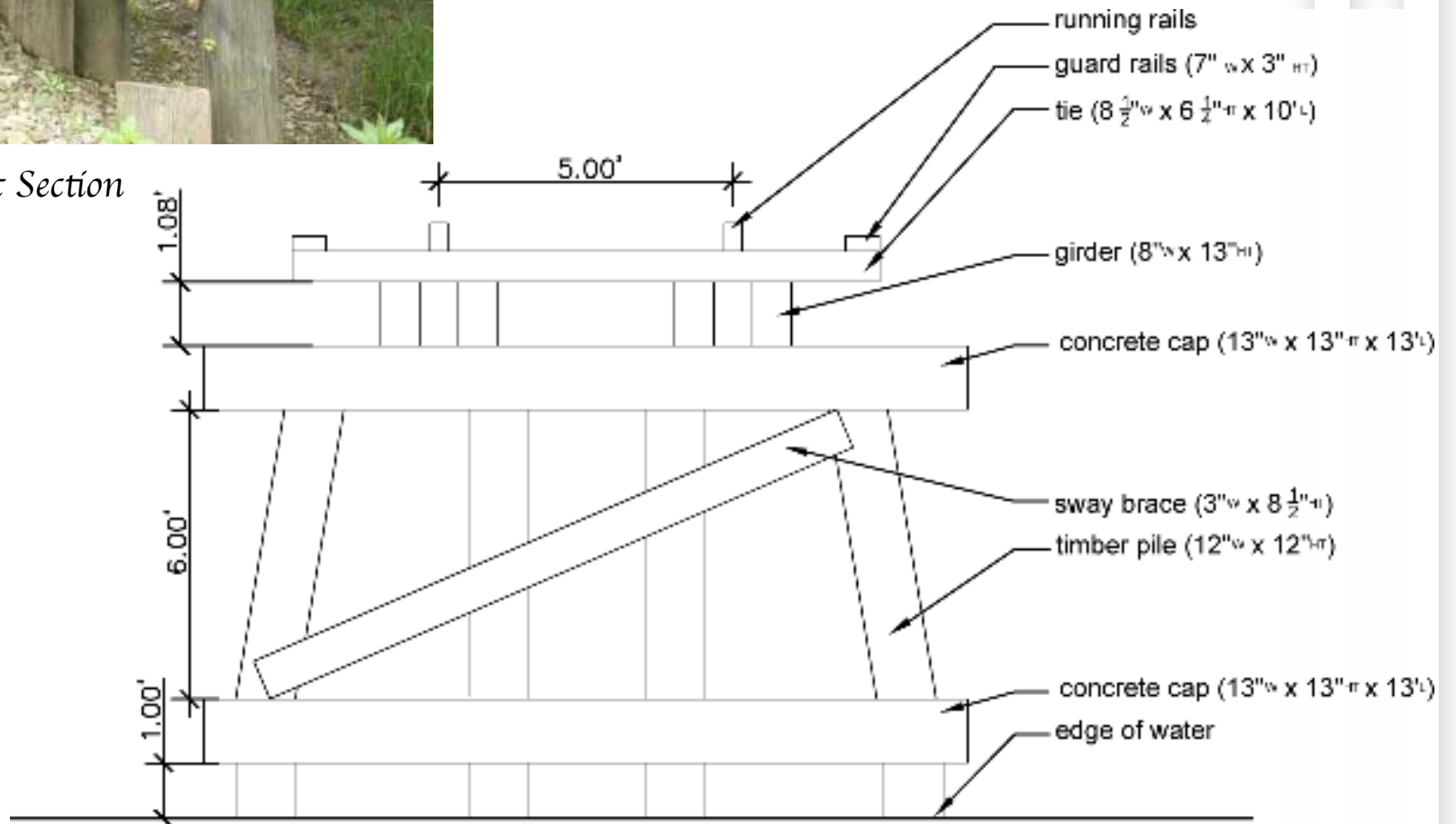
South Back Wall



Timber Pile Shims Along Bent



Typical Bent Section



Typical Bent



Bridge Number: 7

County: Henderson County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 55

Percent Deteriorated: 30%

Tie Span: Varies 18"-22" O.C. Typical

Ties Secured: Yes

The overall length of the five-span bridge is approximately 80'. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber tie retaining walls. (See imagery support)

Deck and Superstructure – Ties show minor weathering and deterioration. Girders are in fair condition, with some areas of deterioration and weathering. Guard and running rails are in satisfactory condition and show minor weathering resulting in detachment from decking.

Substructure – Both back walls are in poor, with signs of deterioration and weathering. Both back walls are further supported by drilled timber piles. There is severe undermining and detachment of timber tie back walls.

Timber piles show signs of deterioration and weathering due to frequent flooding. Wood shims show signs of minor deterioration. Substructure shows signs of debris collection and significant vegetative growth.

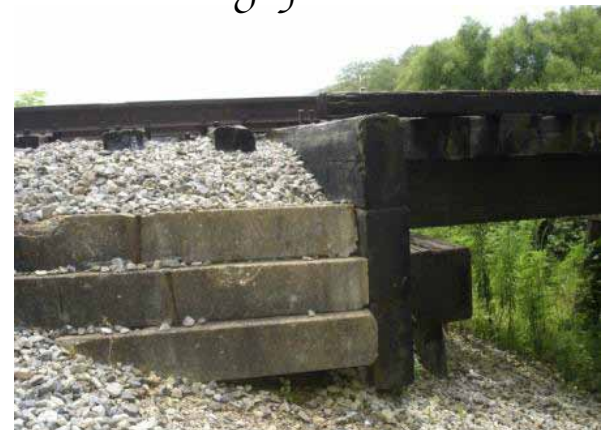
Typical Bent



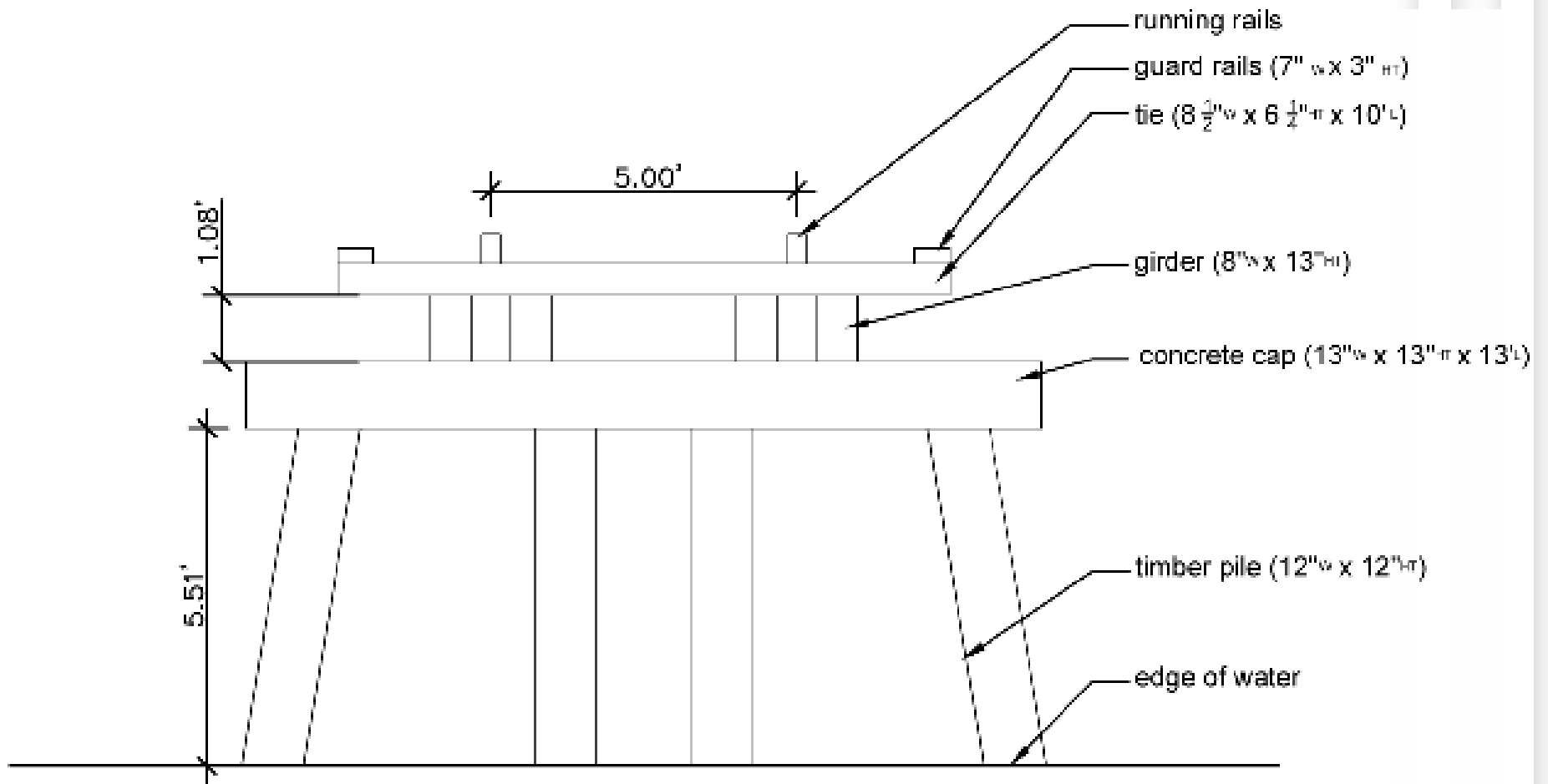
North Back Wall and Bent



Undermining of South Back Wall



Typical Bent Section



Overall View



Bridge Number: 8

County: Henderson County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 40

Percent Deteriorated: 5%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the two-span bridge is approximately 54'. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber tie retaining walls. (See imagery support)

Deck and Superstructure – Ties appear to be new construction (previous 3 years). Girders are in fair condition with some areas of deterioration and weathering. Guard and running rails are in good condition and show no weathering or deterioration.

Substructure – Both back walls are in poor condition, with signs of deterioration and weathering. There is severe undermining and detachment of timber tie back walls. Timber piles show signs of deterioration and weathering due to frequent flooding. Wood shims show signs of minor deterioration. Substructure shows signs of debris collection and significant vegetative growth.

Timber Cap Deterioration



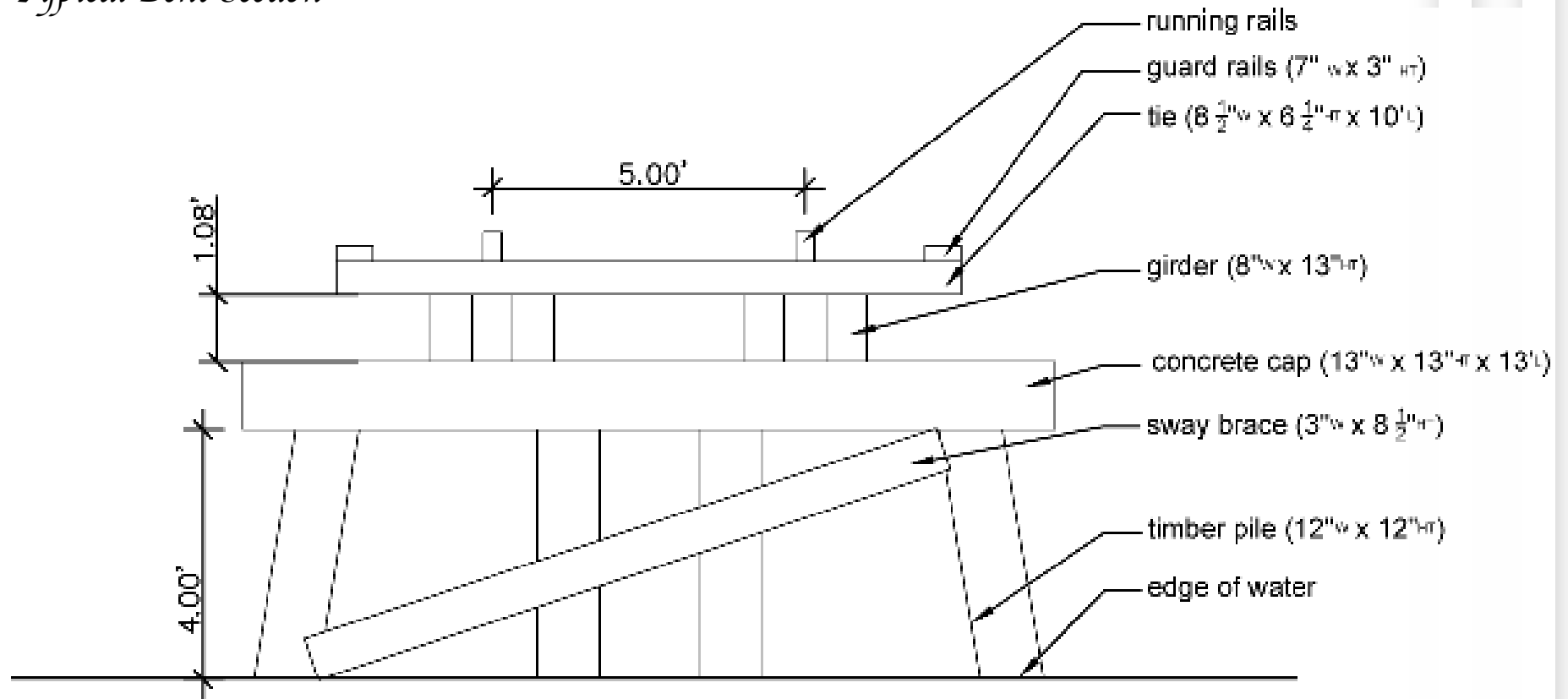
Typical Bent



South Back Wall



Typical Bent Section



Overall View North



Bridge Number: 9

County: Henderson County

Inspection Date: July 13, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 25

Percent Deteriorated: 100%

Tie Span: Varies (14"-18" O.C. Typical)

Ties Secured: Yes

The overall length of the two-span bridge is approximately 38' with variable span lengths. The superstructure consists of six timber girders: three each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps, timber cross braces, and timber piles. (See typical cross-section)

Deck and Superstructure – Some timber ties are severely deteriorating along the girders. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard rails are severely deteriorated.

Substructure – Both back walls are in poor condition, with signs of decay, deterioration and severe weathering. There is minor undermining and detaching of walls. Timber piles show signs of deterioration and minor weathering due to frequent flooding; Timber piles' foundations are underwater (unknown depth). Wood shims

show signs of severe deterioration. Substructure shows significant signs of debris collection and vegetative growth due to frequent flooding.

Typical Bent



Debris and Visual Foundation During Drought



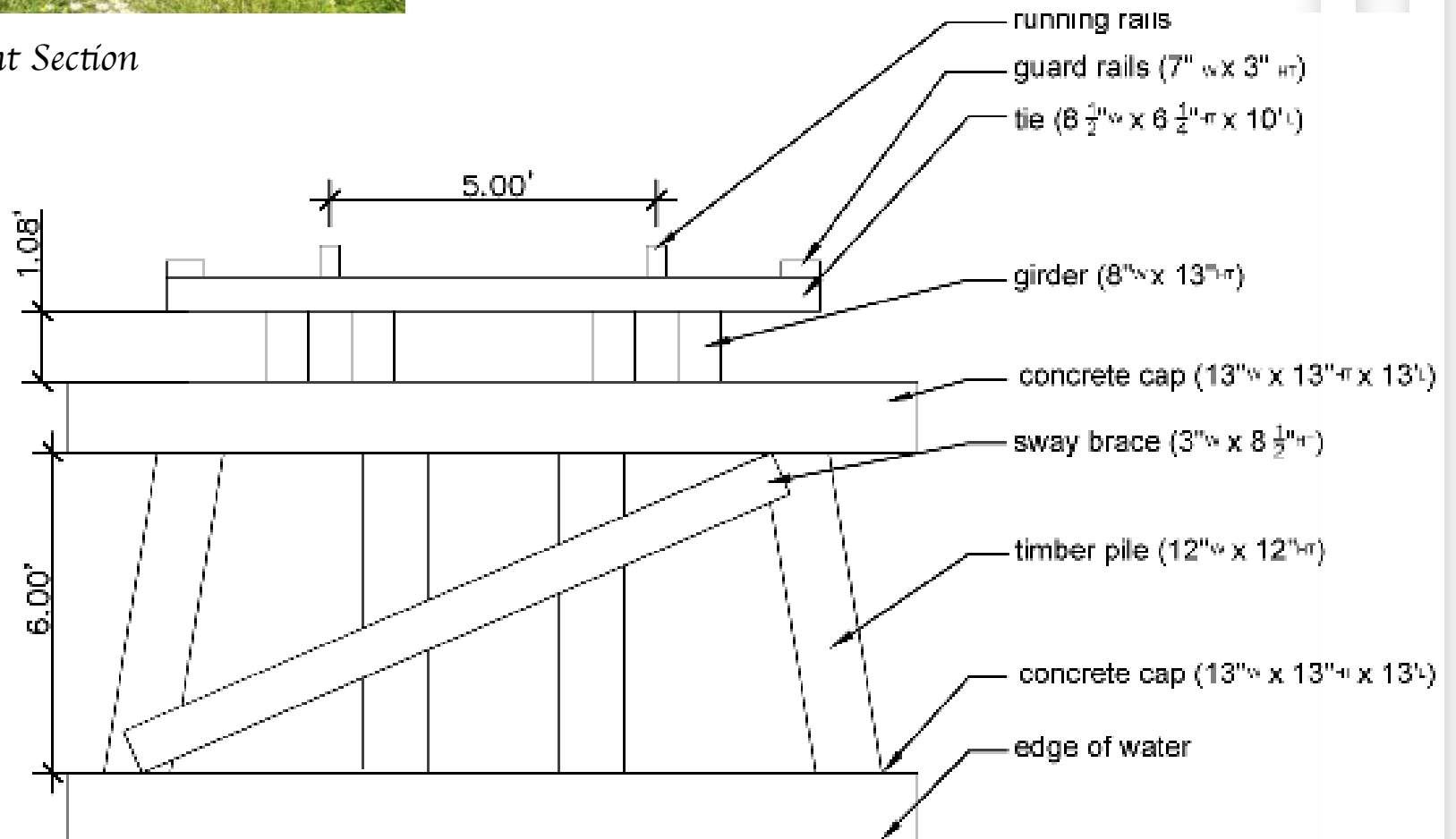
Debris Collection



Deflecting of Back Wall



Typical Bent Section



Overall View South



North Back Wall



Bridge Number: 10

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 565

Percent Deteriorated: 10%

Tie Span: Varies (18"-24" O.C. Typical)

Ties Secured: Yes

The overall length of the forty-four-span bridge is approximately 734' with variable span lengths. The superstructure consists of steel girders: two on each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of a combination of concrete and timber caps and timber piles and sway braces. (See typical cross-section)

Deck and Superstructure – Ties are deteriorating and causing debris along the girders and metal sheathing. Ties are also deflecting, causing shift in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of decking.

Substructure – Both back walls are in poor condition, with signs of decay, deterioration and severe weathering. There is minor undermining and detaching of wing walls. Timber caps are in satisfactory condition, with top 1/2" deteriorated. Timber piles show no signs of deterioration and only minor weathering, but do show signs

of deflecting. Metal sheathing showing signs of oxidation, resulting in severe corrosion. Wood shims show signs of severe deterioration. Substructure shows no signs of debris collection or vegetation growth. Sway braces show signs of minimal weathering and deterioration. Stone pile supports of river span show no signs of deflection and minimal erosion. Metal bridge span shows surface rust, but no severe corrosion present.

Timber Piles Deflecting



Typical Bent



Typical Bent Cross Brace



Bent Foundation Undermining



Bent View North



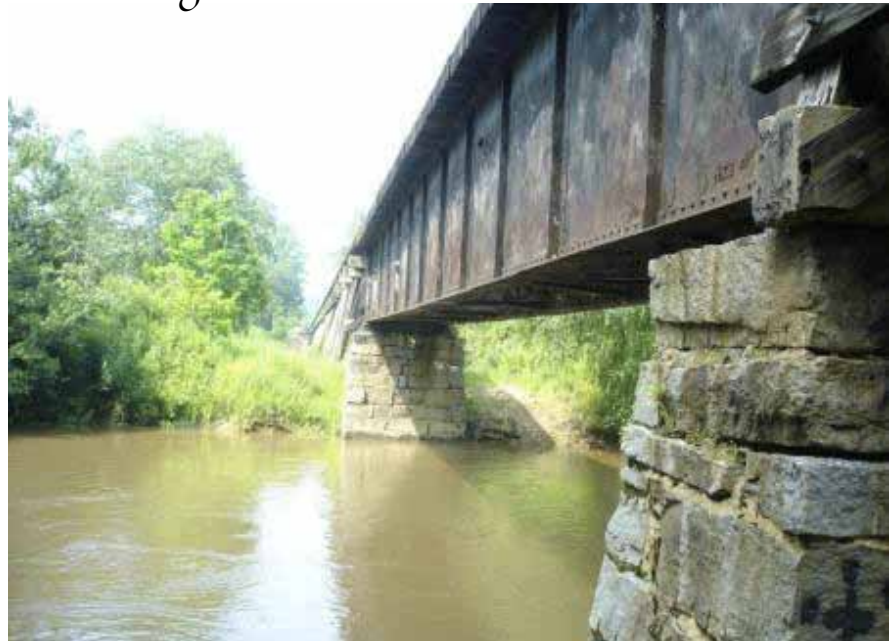
South Superstructure



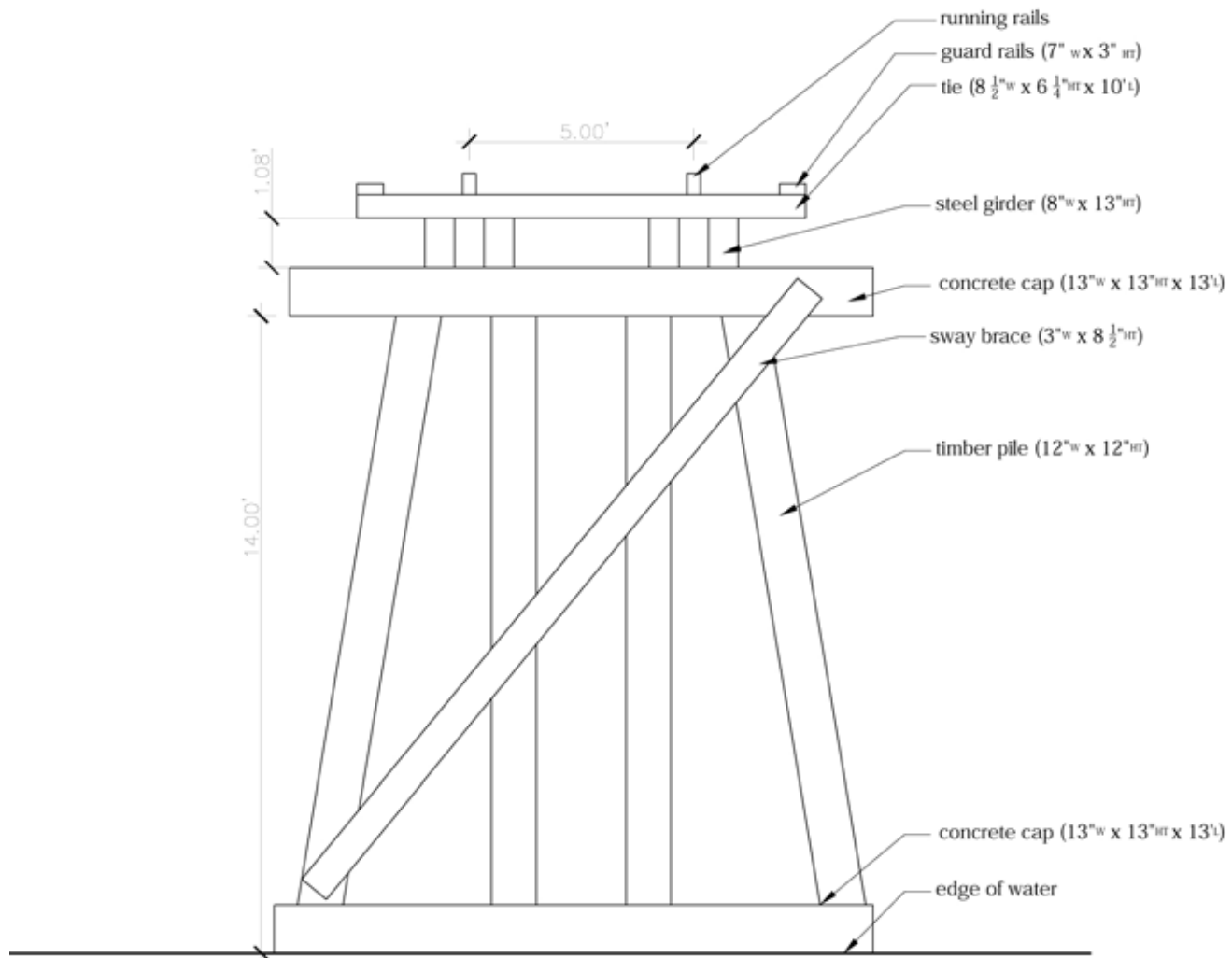
Steel Bridge Foundation



Steel Bridge



Typical Bent Section



Overall View North



Bridge Number: 11

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 34

Percent Deteriorated: 30%

Tie Span: Varies (18"-20" O.C. Typical)

Ties Secured: Yes

The overall length of the three-span bridge is approximately 52' with variable span lengths. The superstructure consists of six timber tie girders: three on each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of stacked concrete caps. (See typical cross-section)

Deck and Superstructure – Ties are deteriorating and deflecting, causing shifts in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of decking.

Substructure – Both back walls are in satisfactory condition, with minor signs of decay, deterioration and weathering. There is minor undermining of wing walls. Concrete caps are in satisfactory condition, with no signs of cracking. Wood shims show minor signs of deterioration. Substructure shows no signs of debris collection, but does show wetland vegetative growth. Sediment and undermining is caused by frequent flooding.

Tie Deterioration



North Back Wall



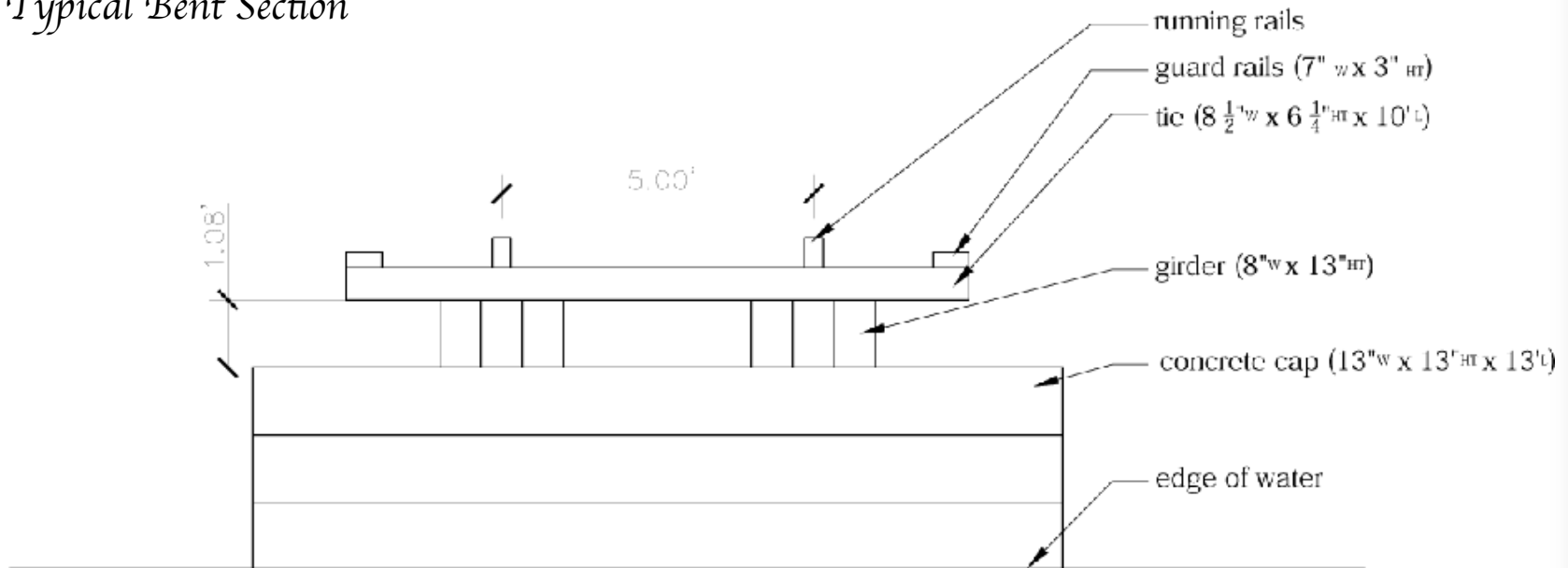
Typical Bent



South Back Wall



Typical Bent Section



Overall View North



Bridge Number: 12

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 36

Percent Deteriorated: 10%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the three-span bridge is approximately 54' with variable span lengths. The superstructure consists of six timber tie girders: three on each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps and timber piles. (See typical cross-section)

Deck and Superstructure – Ties are deteriorating and deflecting, causing shifts in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of decking.

Substructure – Both back walls are in poor condition, with significant signs of decay, deterioration and weathering. There is severe undermining of both north and south back walls and wing walls. Timber piles show significant signs of deterioration and hollowing. Concrete caps are in satisfactory condition, with no signs of cracking. Wood shims show minor signs of deterioration. Substructure shows no signs of debris collection but does show wetland vegetative growth.

Sediment and undermining of timber piles and back walls is caused by frequent flooding.

Typical Bent



North Back Wall Undermining



Sediment Build-up



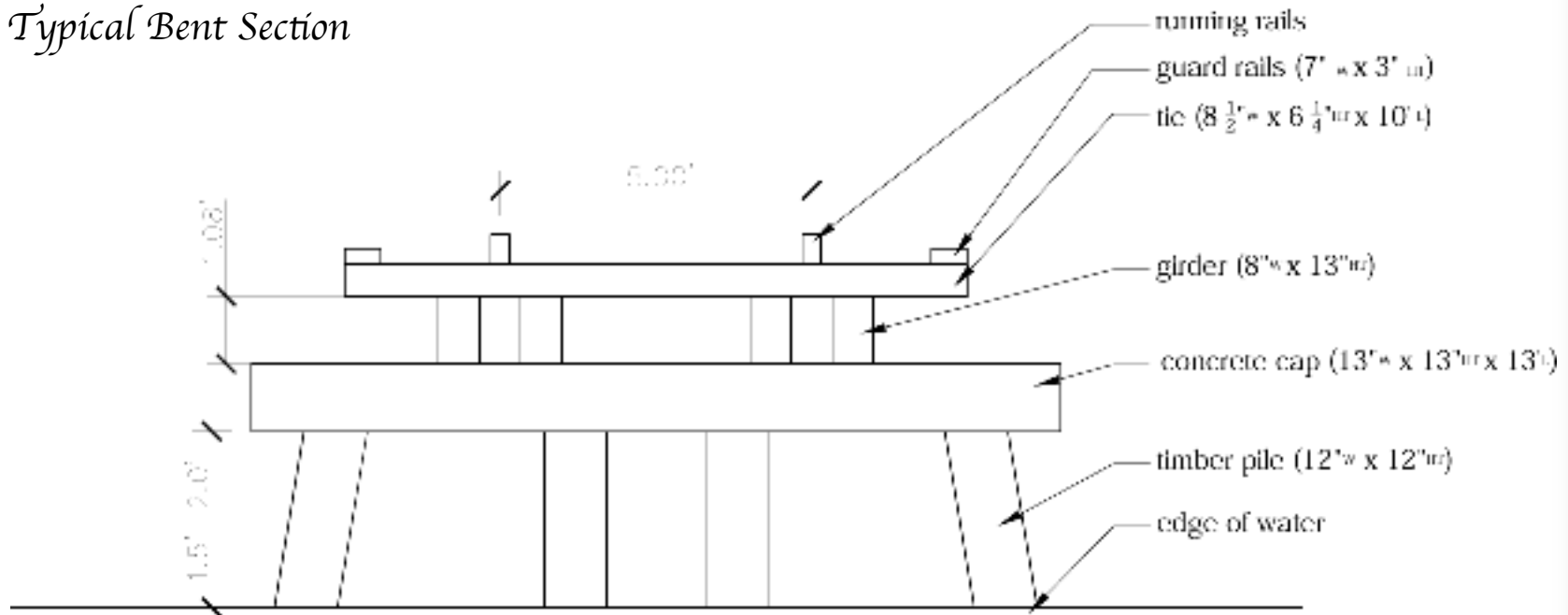
Timber Pile Deterioration



South Back Wall Deflection



Typical Bent Section



Overall View North



Bridge Number: 13

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 15

Percent Deteriorated: 10%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the free span bridge is approximately 17'. The superstructure consists of six timber tie girders: three on each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber caps and stacked stone foundation walls against edge of water.

Deck and Superstructure – Ties are deteriorating and deflecting, causing shifts in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of decking and are in poor condition.

Substructure – Both back walls are in poor condition, with significant signs of decay, deterioration and weathering. There is severe undermining and deflection of both north and south back walls and wing walls. Sediment and undermining of stone foundation and back walls is caused by frequent flooding.

North Back Wall and Stone Foundation



Back Wall Deflection



South Back Wall Deflection



North Back Wall Undermining



Severe Erosion



Overall View North



Bridge Number: 14

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 11

Percent Deteriorated: 30%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the free span bridge is approximately 14.5'. The superstructure consists of six timber tie girders: three on each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of timber caps and stacked stone foundation walls against edge of water.

Deck and Superstructure – Ties are deteriorating and deflecting, causing shifts in overall alignment of superstructure. Girders are in satisfactory condition, with few areas of deterioration and minor weathering. Guard and running rails are deflecting, causing shift and detachment of decking and are in poor condition.

Substructure – Both back walls are in poor condition, with significant signs of decay, deterioration and weathering. There is severe undermining and deflection of both north and south back walls and wing walls. Sediment and undermining of stone foundation and back walls is caused by frequent flooding.

North Back Wall



South Back Wall



South Back Wall



North Back Wall Deflecting



Tie and Timber Deterioration



Overall View North



Bridge Number: 15

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 30

Percent Deteriorated: 0%

Tie Span: Varies (18"-20" O.C. Typical)

Ties Secured: Yes

The overall length of the two-span bridge is approximately 40' with variable span lengths. The superstructure consists of four steel girders: two each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps, timber piles, and timber cross braces. (See typical cross-section)

Deck and Superstructure – Timber ties appear to be new construction (previous 3 years). Girders are in satisfactory condition with few areas of minor weathering and oxidation. Guard rails appear to be new construction (previous 3 years).

Substructure – Both back walls are in fair condition, with minor signs of deterioration and weathering. There is minor undermining and detaching of walls. Timber piles show signs of deterioration and minor weathering. Substructure shows significant signs of debris collection and vegetative growth due to frequent flooding. Stacked stone wall at edge of water shows signs of mortar cracking, undermining, and deflecting.

North Back Wall and Stone Foundation



South Back Wall



Typical Bent



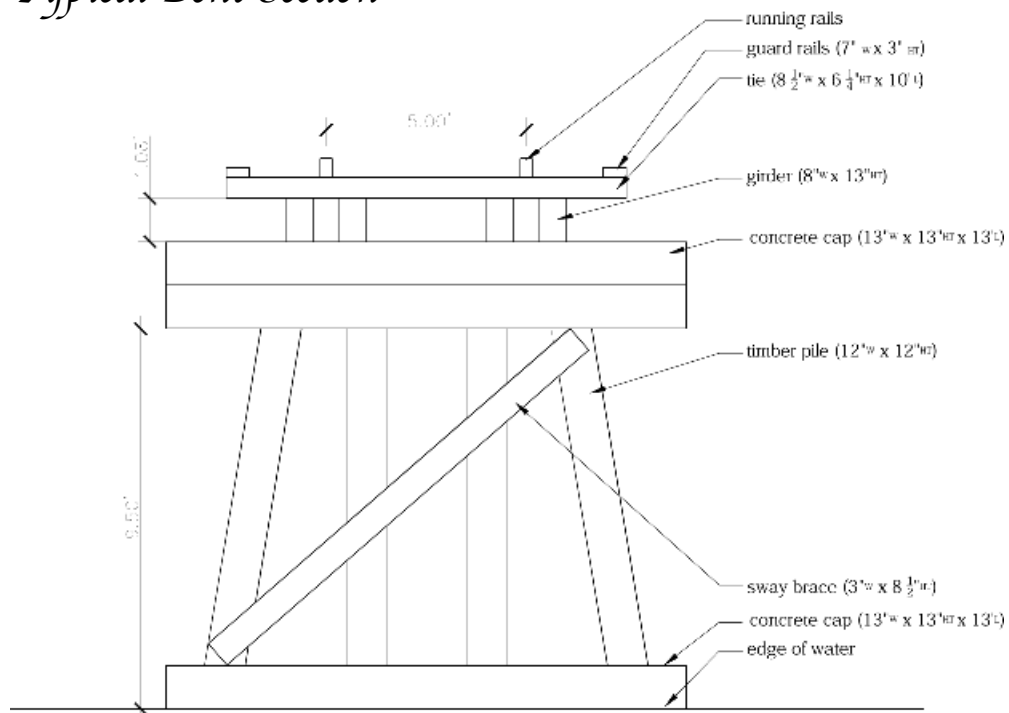
South Back Wall Undermining



Debris Collection



Typical Bent Section



Overall View North



Bridge Number: 16

County: Henderson County

Inspection Date: July 26, 2011

Inspection Type: Visual

Year Built: Unknown

Number of Ties: 30

Percent Deteriorated: 10%

Tie Span: 18" O.C. Typical

Ties Secured: Yes

The overall length of the two-span bridge is approximately 38' with variable span lengths. The superstructure consists of four steel girders: two each side approximately 8" wide by 13" high. The timber railroad ties are supported by the girders or stringers. The substructure consists of concrete caps and timber piles. (See typical cross-section)

Typical Bent



Deck and Superstructure – Timber ties appear to be new construction (previous 3 years.) Girders are in satisfactory condition with few areas of minor weathering and oxidation. Guard rails appear to be new construction (previous 3 years).

Substructure – Both back walls are in fair condition, with minor signs of deterioration and weathering. There is minor undermining and detaching of walls. Timber piles show signs of deterioration and minor weathering due to frequent flooding; Some timber piles and foundations of bents are underwater (unknown depth).

Wood shims show signs of severe deterioration. Substructure shows significant signs of debris collection and vegetative growth due to frequent flooding.

Varying Bent Sections Occur



Block Wall Undermining



Deterioration of Timber Cross Brace



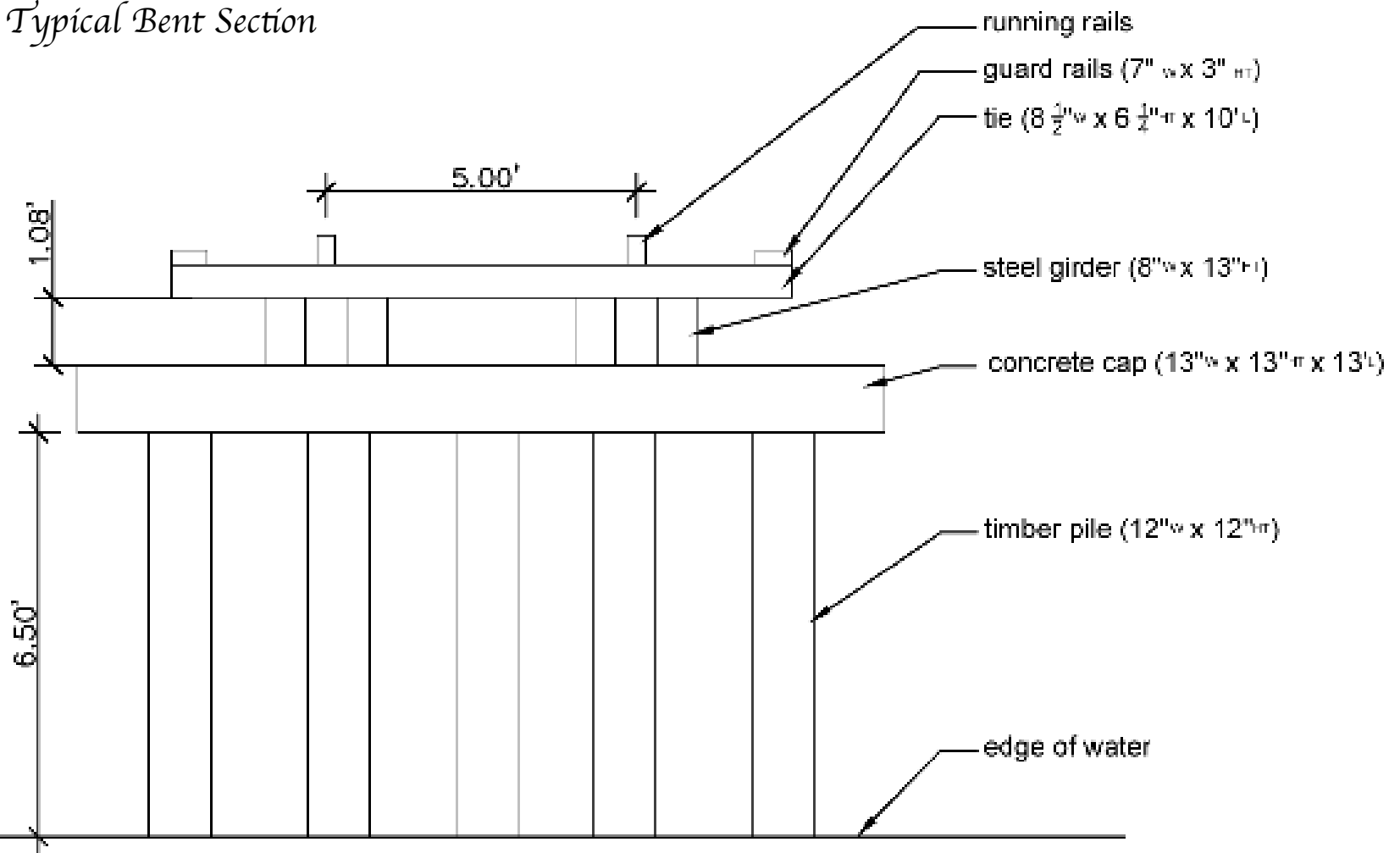
Deterioration of Timber Piles



Debris Collection



Bridge 16: Typical Bent Section



Environmental Issues

Wetlands – The team identified several areas in the field where the rail line passes by or through wetland sites. Most of the areas observed appeared to be undisturbed by the presence of the rail line. However, the construction of the rail line has rerouted a stream and led to serious erosion in one area by Armstong Road, near the Etowah area. In addition, there may be issues where the rail line passes through a wetland area behind the Ecusta Mill reservoir outside of Brevard. The reservoir is reported to have potential pollution problems as a result of the former paper mill. Further study is warranted to ensure the safety of potential trail users in this area.

Conclusion

The Cities of Hendersonville and Brevard recognize that bicycling and walking are important aspects of transportation, recreation, health, and livability for residents, commuters, and visitors to the area. A rail-to-trail project along the inactive railroad line from Hendersonville to Brevard would provide these benefits. The project would benefit all residents and visitors who desire to improve their level of daily physical activity by bicycling or walking to school, work, and other local destinations, or by going for a walk, bicycle ride, or horseback ride to enjoy the many features and attractions of Henderson and Transylvania Counties.

A future trail along the railroad line offers options to the community for non-motorized travel, close-to-home outdoor activities, potential economic development, and the health benefits of regular exercise. These opportunities can help the community become more sustainable, help people

be active and healthy, combat obesity in children, and encourage environmental stewardship in trail users of all ages.

Notes

1. "RiverLink: River Facts", <http://www.riverlink.org/FrenchBroadFacts.asp>.
2. "Basin 5 French Broad," http://www.ncwater.org/Reports_and_Publications/swsp/swsp_jan2001/final_pdfs/B05_FrBroad.pdf.
3. "A Look Back in Time," <http://brevardncproperty.com/brevard-nc-property-c5652.html>.
4. "North Carolina: The Counties from 1664 to Present," <http://www.carolana.com/NC/Counties/>.
5. "Hendersonville," <http://www.blueridgeheritage.com/attractions-destinations/historic-small-towns-and-cities/hendersonville>.
6. "Ecusta Trail History," <http://www.ecustatrail.org/history.html>.
7. "A Look Back in Time"
8. USDA Forest Service, "Pisgah National Forest," <http://www.fs.usda.gov/main/nfsnc/about-forest>.
9. North Carolina Forest Service, "DuPont State Forest," <http://ncforestservice.gov/Contacts/dsf.htm>.



There are some areas with erosion or other environmental degradation along the rail line that may require remediation.

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