



Chapter 2: Existing Conditions

Chapter Outline:

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7. Corridor Impacts
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1. Overview

Greenways Incorporated (GWI), EcoScience (a division of PBS&J), and PBS&J-Charlotte conducted an existing conditions evaluation in January 2009 of the proposed greenway corridor. Consultant staff walked the majority of the corridor, photo-documenting site features, taking notes, observing use and connections, walking existing trails and mapping specific areas using Global Positioning Systems (GPS). Sites of opportunities and constraints were mapped using Geographic Informational Systems (GIS). The examination and analysis of the corridor included both GIS mapping and fieldwork. A graphic presentation of these results is included in Chapter 3: Opportunities and Constraints.

2. Green Infrastructure Assessment

Part of the analysis along the corridor includes observing existing vegetation, signs of wildlife, surrounding topography, significant natural features, and adjacent or intersecting streams. The Bolin Creek corridor includes natural features such as Bolin Creek and associated tributaries, Jones Creek and associated tributaries, wetlands, riparian forest, stands of mature hardwood, and rolling topography. The corridor supports abundant flora and fauna. Wildlife sightings and evidence at first glance indicate the presence of deer, raccoon, beaver, owl, and a variety of bird species including the red-shouldered hawk, flocks of blue birds, woodpeckers, and migratory cedar waxwings to name just a few. Stands of mature hardwood can be found along the corridor with tulip poplar, sweet gum, beech, sycamores, and oaks very common.

A Division of PBS&J (EcoScience) personnel conducted a preliminary constraints evaluation of potential environmental red flag issues which may affect the proposed greenway alignment and the findings are illustrated below.

Methodology

Natural resources data were gathered from a variety of sources including U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping, Natural Resource Conservation Service (NRCS) soils mapping, NC Flood Mapping Program Light Detection and Ranging (LIDAR) topographic data, U.S. Geological Survey (USGS) topographic mapping, USFWS distribution records of federally listed species, NC Natural Heritage Program (NCNHP) listed species occurrence data, Inventory of Natural Areas and Wildlife Habitat of Orange County, NC, NC Division of Water Quality (NCDWQ) watershed and water quality data, NC Gap Analysis Program (NCGAP) Land Use/Land Cover (LULC) data, and aerial photography of Orange County.

Field mapping was prepared and field investigations were conducted in January 2009. Field observations were used to modify the GIS database for the project and natural resources constraint data was utilized by GWI while developing the greenway alignment.

Physical Features

The Bolin and Jones Creek Project Study Area (PSA) is located within the Carolina Slate Belt ecoregion (*Griffith et al. 2002*), which extends from southern Virginia, across the Carolinas, and into Georgia. The mineral-rich metavolcanic and metasedimentary rocks with slaty cleavage are finer-grained and less metamorphosed than most Piedmont regions. Some parts are rugged, such as the Uwharrie Mountains, and many areas are distinguished by trellised drainage patterns. Silty and silty clay soils, such as the Georgeville and Herndon series, are typical. This region contains some of the lowest water-yielding rock units in the Carolinas. The landscape elevation ranges from approximately 370 feet North American Vertical Datum (NAVD 1988) at the southern extent of the PSA to 590 feet NAVD along a ridge in the northwestern portion of the Jones Creek extent of the PSA (Chapel Hill, NC USGS quadrangle).

A significant county-wide natural area is located in the southern portion of the PSA near Adams Tract and north along the large privately-owned tract according to the Natural Areas and Wildlife Habitat Inventory of Orange County. Noteworthy features include mature hardwood forest and swamp forest, as well as a rare dragonfly species.

According to the Orange County soil survey, approximately 12 percent of the PSA is comprised of partially hydric soil map units. Map units with hydric inclusions include Enon and Chewacla series. Approximately 86 percent of the PSA is mapped as non-hydric soils. Partially hydric soil map units generally follow the stream channel and banks in the Jones Creek section, and are mostly confined to interstream flat areas in the Bolin Creek section. Soil units range from somewhat poorly drained interstream flat soils to very poorly drained floodplain soils.

The PSA is located within the Cape Fear River Basin in USGS Hydrologic Unit (HU) 03030002, NCDWQ subbasin 03-06-06. The Jones Creek extent of the PSA contains two named streams, Jones Creek and Buckhorn Branch. Jones Creek flows northwest to southeast through the entire Jones Creek section of the PSA. Buckhorn Branch enters the PSA from its source to the west and flows into Jones Creek. There are three named streams within the Bolin Creek section of the PSA. These streams are Bolin Creek, Jolly Branch, and Dry Gulch Creek. Jolly Branch enters the PSA from the east and connects to Bolin Creek, which flows northwest to southeast through the entire Bolin Creek section of the PSA. Bolin Creek is included in the 303(d) list from Pathway Dr. downstream. Dry Gulch flows along the edge of the Pacifica and Bolin Forest subdivisions into Bolin Creek. Small streams within this subbasin typically stop flowing during low flow periods due to lack of groundwater recharge. All stream systems within the PSA carry the same best usage classification (C, NSW). There are no 303(d) listed (impaired) streams or National Pollutant Discharge Elimination System (NPDES) permitted dischargers within the PSA.

Biological Features

The PSA supports both maintained/managed areas and natural communities. Wildlife directly observed or determined to be present through evidence (tracks, scat) during field investigations are indicated with an asterisk (*).

Maintained/managed areas are dominated by open fields, maintained rights-of-way and landscaped areas. Vegetation within maintained/managed areas varies from common herbaceous species and horticultural varieties of shrubs and trees to invasive exotics. These areas likely provide habitat for wildlife adapted to disturbance and habitat fragmentation such as white-tailed deer (*Odocoileus virginianus*), raccoon* (*Procyon lotor*), Norway rat (*Rattus norvegicus*), little brown myotis (*Myotis lucifugus*), American robin* (*Turdus migratorius*), blue jay* (*Cyanocitta cristata*), northern cardinal* (*Cardinalis cardinalis*), worm snake (*Carphophis amoenus*), and brown snake (*Storeria dekayi*).

Natural communities (as described in *Classification of the Natural Communities of North Carolina* [Schafale and Weakley 1990]) observed within the PSA include **Piedmont/Mountain Bottomland Forest**, **Basic Mesic Forest** (Piedmont Subtype) and **Mesic Mixed Hardwood Forest** (Piedmont Subtype).

Piedmont/Mountain Bottomland Forests occur on parts of floodplains, floodplain ridges, and terraces. Since they do not occur on active levees, greater vegetation diversity as well as a more developed herbaceous layer is typical. Canopy species include tulip poplar (*Liriodendron tulipifera*), cherrybark oak (*Quercus pagoda*), swamp chestnut oak (*Quercus michauxii*), American elm (*Ulmus americana*), ironwood (*Carpinus caroliniana*), green ash (*Fraxinus pennsylvanica*), loblolly pine (*Pinus taeda*), black walnut (*Juglans nigra*), sweetgum (*Liquidambar styraciflua*), American sycamore (*Platanus occidentalis*), and shagbark hickory (*Carya ovata*). The herb and shrub layers are diverse, but can sometimes be heavily invaded by Japanese honeysuckle (*Lonicera japonica*), Russian olive (*Elaeagnus angustifolia*), and Chinese privet (*Ligustrum sinense*), especially near road and utility margins. Other bottomland shrubs include flowering dogwood (*Cornus florida*), tag alder (*Alnus serrulata*), spicebush (*Lindera benzoin*) and pinxter-flower (*Rhododendron periclymenoides*). Herbs include wild ginger (*Hexastylis arifolia*), soft rush (*Juncus effusus*), bottlebrush grass (*Elymus hystrix*), and sedges (*Carex* spp.). A few large areas of joint-head arthraxon (*Arthraxon hispidus*) and microstegium (*Microstegium vimineum*), both invasive exotic grasses, were observed. Vines consist of cat greenbrier (*Smilax glauca*), poison ivy (*Toxicodendron radicans*), and others. Wildlife species that prefer bottomland habitat such as beaver* (*Castor canadensis*), mallard* (*Anas platyrhynchos*), belted kingfisher* (*Ceryle alcyon*) and northern water snake (*Nerodia sipedon*) are prevalent. Significant beaver activity was observed within the Bolin Creek section of the PSA.

Basic Mesic Forests (Piedmont Subtype) occur along lower slopes, ravines and well-drained stream bottoms with basic or circumneutral soils. They are distinguished from other adjacent communities by richer soils and greater vegetative species richness. The canopy is dominated by mesophytic trees such as tulip poplar, American beech (*Fagus grandifolia*), Eastern red cedar (*Juniperus virginiana*), American holly (*Ilex opaca*), hackberry (*Celtis laevigata*), southern sugar maple (*Acer floridanum*), buckeye (*Aesculus sylvatica*), hop hornbeam (*Ostrya virginiana*), willow oak (*Quercus phellos*), and northern red oak (*Q. rubra*). The herb layer is generally dense and very diverse. Herb layer species observed include Christmas fern (*Polystichum acrostichoides*), wild ginger, crane fly orchid (*Tipularia discolor*), and rattlesnake fern (*Botrychium* sp.). Wildlife species include white-tailed deer*, raccoon*, hermit thrush* (*Catharus guttatus*), winter wren* (*Troglodytes troglodytes*), Cooper's hawk* (*Accipiter cooperii*), barred owl* (*Strix varia*), ringneck snake (*Diadophis punctatus*), and five-lined skink (*Eumeces fasciatus*).

Mesic Mixed Hardwood Forests (Piedmont Subtype) occur on lower slopes, steep north-facing slopes, ravines, and acidic well-drained stream bottoms. The canopy is dominated by mesophytic trees such as American beech, white oak (*Quercus alba*), tulip poplar, sourwood (*Oxydendrum arboreum*), shortleaf pine (*Pinus echinata*), mockernut hickory (*Carya alba*), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*). The herb layer is often moderately dense and diverse, though it may be sparse under heavy shade. Mesic Mixed Hardwood Forests can be distinguished from Basic Mesic Forests by more acidic soils, absence of base-loving plants, sparser herb layer, and lower floristic diversity. Some herbs observed were crane fly orchid, with broomsedge (*Andropogon virginicus*), wingstem (*Verbesina occidentalis*), dog fennel (*Eupatorium capillifolium*), and invasive sericea lespedeza (*Lespedeza cuneata*) along sunny edges. The vine component includes muscadine grape (*Vitis rotundifolia*), greenbrier (*Smilax rotundifolia*), and trumpet creeper (*Campsis radicans*). Wildlife species likely include those found in Basic Mesic Forests.

Protected Species

The following species are listed by the USFWS as protected (i.e., those with a federal listing of Threatened or Endangered) for Orange County: red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta heterodon*), Michaux's sumac (*Rhus michauxii*), and smooth coneflower (*Echinacea laevigata*). The bald eagle (*Haliaeetus leucocephalus*) has been federally delisted but still maintains protection under the Bald and Golden Eagle Protection Act (BGPA). All of the protected species are federally listed as Endangered. According to NCNHP records (as of December 2008), no federally protected species occur within a 3-mile radius of the PSA. Based on preliminary field investigations, habitat for protected species may occur within the PSA and review of additional available information and/or comprehensive surveys may be required by the USFWS.

Red-cockaded woodpecker – Endangered

USFWS optimal survey window: year round; November-early March (optimal)

Habitat Description: The red-cockaded woodpecker (RCW) typically occupies open mature stands of southern pines, particularly longleaf pine (*Pinus palustris*), for foraging and nesting/roosting habitat. The RCW excavates cavities for nesting and roosting in living pine trees, aged 60 years or older, and which are contiguous with pine stands at least 30 years of age to provide foraging habitat. The foraging range of the RCW is normally no more than 0.5 miles.

Based on preliminary field investigations, the project *may affect, but is not likely to adversely affect* the red-cockaded woodpecker. The PSA does not contain suitable stands of open mature pines for foraging or nesting/roosting.

Dwarf wedgemussel – Endangered

USFWS optimal survey window: year round

Habitat Description: In North Carolina, the dwarf wedgemussel is known from the Neuse and Tar River drainages. The mussel inhabits creek and river areas with a slow to moderate current and sand, gravel, or firm silt bottoms. Water in these areas must be well oxygenated. Stream banks in these areas are generally stable with extensive root systems holding soils in place.

The PSA has streams which exhibit some of the characteristics for dwarf wedgemussel habitat, but is located within the Cape Fear River Basin and therefore will have *no effect* on the dwarf wedgemussel.

Michaux's sumac – Endangered

USFWS optimal survey window: May-October

Habitat Description: Michaux's sumac, endemic to the inner Coastal Plain and lower Piedmont, grows in sandy or rocky, open, upland woods on acidic or circumneutral, well-drained sands or sandy loam soils with low cation exchange capacities. The species is also found on

sandy or submesic loamy swales and depressions in the fall line Sandhills region as well as in openings along the rim of Carolina bays; maintained railroad, roadside, power line, and utility rights-of way; areas where forest canopies have been opened up by blowdowns and/or storm damage; small wildlife food plots; abandoned building sites; under sparse to moderately dense pine or pine/hardwood canopies; and in and along edges of other artificially maintained clearings undergoing natural succession. In the central Piedmont, it occurs on clayey soils derived from mafic rocks. The plant is shade intolerant and, therefore, grows best where disturbance (e.g., mowing, clearing, grazing, periodic fire) maintains its open habitat.

The PSA contains many instances of suitable habitat for Michaux's sumac. Maintained clearings include roadway and powerline right-of-ways, as well as maintained sewer easements that extend through the majority of the greenway corridor. Surveys for this species will likely be required during the recommended survey window of May through October.

Smooth coneflower – Endangered

USFWS optimal survey window: late May-October

Habitat Description: Smooth coneflower, a perennial herb, is typically found in meadows, open woodlands, the ecotonal regions between meadows and woodlands, cedar barrens, dry limestone bluffs, clear cuts, and roadside and utility rights-of-way. In North Carolina, the species normally grows in magnesium- and calcium- rich soils associated with gabbro and diabase parent material, and typically occurs in Iredell, Misenheimer, and Picture soil series. It grows best where there is abundant sunlight, little competition in the herbaceous layer, and periodic disturbances (e.g., regular fire regime, well-timed mowing, careful clearing) that prevents encroachment of shade-producing woody shrubs and trees. On sites where woody succession is held in check, it is characterized by a number of species with prairie affinities.

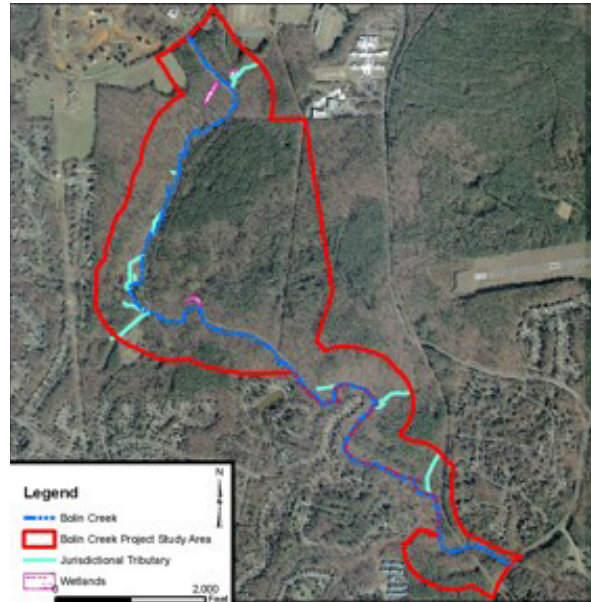
The PSA contains substantial areas of Georgeville and Iredell soils, which are known to be pH-neutral at or near the soil surface. Suitable habitat is likely to occur where these soil areas intersect maintained roadway or utility easements. Detailed surveys for this species will likely be required during the recommended survey period of late May through October.



Looking south down easement along Carolina North Forest property.

Jurisdictional Areas and Permitting

A jurisdictional delineation was not performed as a part of this preliminary constraints evaluation. However, potential jurisdictional areas were documented during field investigations. Streams, wetlands, and waters of the U.S. were observed within the PSA. Town of Carrboro and NC Division of Water Quality (NCDWQ) staff walked the corridor from Estes Dr. to Homestead Rd. in October, 2009. NCDWQ staff intend to return to the area and provide jurisdictional determinations for stream features.



Section 404 Resources within the Bolin Creek PSA



Section 404 Resources within the Jones Creek PSA

Prior to any construction activity, written justification for impacts and potential compensatory mitigation will be required for 404/401 permit issuance by the United States Army Corps of Engineers (USACE) and NCDWQ, respectively. A series of nationwide permits are available through the USACE for minor, specific activities. Nationwide Permit #42 (for Recreational Facilities) may be appropriate, along with the accompanying NCDWQ General Certification 3705. If less than 300 linear feet of stream and less than 0.5 acre of total wetlands and open waters are impacted due to proposed construction activities, a Nationwide Permit (NWP) may be issued by the USACE with an associated 401 Water Quality Certification issued by NCDWQ. Proposed impacts exceeding the above-mentioned thresholds will likely require an Individual Permit (IP).

UNC staff reported that UNC is in the process of applying for an individual permit for the Carolina North property. The Town and UNC are encouraged to coordinate permitting activities with regard to the alignment on UNC property.

Summary of Green Infrastructure Assessment

- Suitable habitat for federally protected species (Michaux's sumac and smooth coneflower) may be present within the PSA. The USFWS may require additional information and/or comprehensive field surveys to evaluate for the presence of protected species habitat and individuals during Section 404 permitting, if applicable. Current NCNHP records do not indicate the presence of any occurrences of federally protected species within a 3-mile radius of the PSA.
- The PSA contains jurisdictional streams, wetlands, and other waters of the U.S. A jurisdictional delineation of these systems is recommended along the preferred design corridor for the greenway segments once those alignments have been identified.
- Although North Carolina State Historic Preservation Office (SHPO) records were not reviewed for the purposes of this preliminary constraints evaluation, historic and other cultural resources may be present within the PSA. For example, the John Castlebury Mill, built ca. 1763 resides on southern UNC property. Other sites include the Weaver House on the edge of the Adams Tract which served as a tavern in colonial days and was the home of the Adams family; and the Iron Mine located in Ironwoods neighborhood. The Lloyd-Andrews Historic Farmstead is located near the headwaters of Bolin Creek. This was one of the original land-grants from Lord Grandville in the mid 1700's. 125 acres have been put in a conservation easement held by TLC for preservation. A review of SHPO records is recommended during design development.
- Phase I Environmental Assessment (EA) tasks were not undertaken for the purposes of this evaluation. Thus, the PSA was not examined for the presence of hazardous waste sites, underground storage tanks (USTs), or any other similar potential constraints. While some junk piles and an old car were identified within the PSA, no visible sources of contamination were observed.

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Railroad overpass at Estes Dr.

3. Grey Infrastructure Assessment

Manmade elements, such as existing buildings, structures, utilities, roadways, and railroads, were observed and documented along the study area.

Utilities

The Orange County Water and Sewer Authority (OWASA) sewer easement makes up a large portion of the corridor offering open cleared areas suitable for trail development. Sewer trunk lines traverse the corridor in some areas near the Bolin Forest and Spring Valley neighborhoods, as well as Carolina North Forest. If utilized for trail routing, these easements will require negotiations with OWASA with respect to their facilities.

Railroad Rights-of-Way

Railroad routes adjacent to or intersecting a trail present a significant situation within trail development. The rights-of-way associated with rail lines are typically very wide and their owners fear the liability associated with public access. The proposed Bolin Creek trail will encounter the Norfolk Southern rail line, which parallels and then traverses the southern portion of the corridor. Depending on final trail alignment, negotiations will need to be made with Norfolk Southern as to the degree of public access allowed within their right-of-way.

Roadways

Major roadway intersections are the most hazardous trail intersection. Although less frequent along the corridor, two major roadways occur at Homestead Road to the north and Estes Drive Extension at the south of the study area. Turtleback Crossing, a residential thoroughfare within Lake Hogan Farms, also crosses the corridor but is a local roadway with lower speed limits. These roadway intersections present significant challenges to the development of the greenway, and providing a safe and environmentally sound solution for crossing these roadways warrant further analyses.

- *Homestead Road* -High motor vehicle speeds (frequently over 40 miles per hour), and two lanes of traffic make up this roadway which connects northern Carrboro to western Chapel Hill. Poor site lines at grade make a crossing unlikely. Below-grade conditions present feasibility for a trail underpass with ample vertical clearance.



Typical sewer trunk line along Bolin Creek



Homestead Rd. at grade.



Bridge at Homestead Rd.

- *Estes Drive Extension* - A highly trafficked, north-south thoroughfare connecting Chapel Hill to Carrboro. Roadway crossing is approximately 30-feet above Bolin Creek with 3:1 slopes presenting a topographical challenge for at-grade crossing conditions. Poor site lines at north and south ends present dangerous at-grade crossing conditions.



Estes Dr. at grade.



The box culvert beneath Estes Dr. extension.

- *Turtleback Crossing* -A residential connector, this roadway is two lanes and has a speed limit of 25 miles per hour. At-grade crossings are more feasible at this location because site lines are open and topography surrounding the roadway crossing is suitable for trail development.



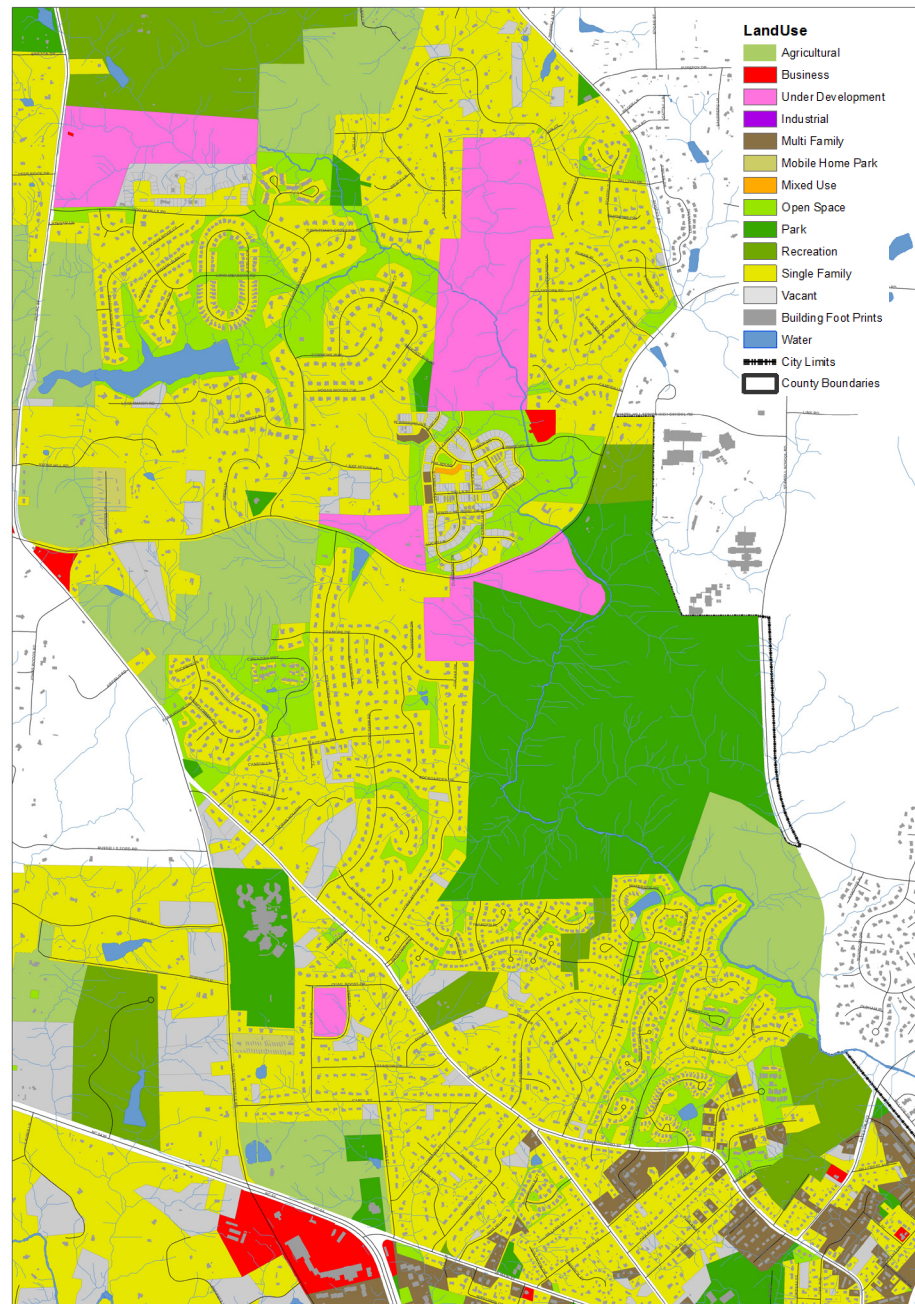
Turtleback Crossing at grade.



Creek crossing conditions beneath Turtleback Crossing.

4. Land Use

Residential land use makes up the majority of the study corridor. Although much of the property along the corridor is zoned for and used for residential purposes, Carrboro's land use regulations require protection of 40% open space. These conservation areas include stream corridors. Per the Town of Carrboro's land use ordinance, connections to these open space areas are expected through greenway development along stream corridors. A vast amount of open space is found along the corridor and owned by the University of North Carolina (UNC), as well as undeveloped privately owned property near Bolin Creek. The State of North Carolina also owns land along the corridor that is leased for the local school system and government use. The corridor is adjacent to the following neighborhoods: Ironwoods, Bolin Forest, Spring Valley, Cates Farm, Claremont, Cobblestone, Winmore, Lake Hogan Farms, Pacifica, Fair Oaks, Wexford, and Fox Meadow. A sewer trunk line parallels Bolin Creek with connecting lines extending into adjacent neighborhoods.



Map showing various land use along study corridor.

5. Accessibility and Circulation

The Bolin Creek corridor is a tremendous resource to the Town of Carrboro, providing a contiguous naturalized corridor throughout most of the study area. Due to the high attraction of this resource, neighborhoods surrounding the creek have generated a large network of social trails. In addition, UNC has worked closely with community recreational clubs such as the Trailheads and Triangle Off Road Cyclists (TORC) to build miles of trails throughout the Carolina North Forest and adjacent open space. Ladder bridges, steps, pavilions, play areas and signage have been installed at various locations along the corridor by surrounding home owner's associations (HOA's).

The Adams Tract, a Town-owned parcel dedicated to open space and recreational use adjacent to Estes Dr., connects to Wilson Park. This park provides parking, an athletic field, a tennis court pavilion, a tot lot, and restroom facilities. Foot trails lead to Bolin Creek through forested portions of Adams Tract. The southern portion of Adams Tract along Estes Dr. is currently an informal parking area which creates potential safety concerns and contributes to erosion in this area.

Other areas along Seawell School Rd. and within the Fair Oaks neighborhood have trail access areas with kiosks, waste and recycling, and gates that have been installed by the University. North of Carolina North Forest, neighborhoods with existing paved trails provide the potential for greenway network tie-ins. Winmore, Claremont, and Lake Hogan Farms have installed paved trails within their neighborhoods.



Trail conditions behind Chapel Hill-Carrboro schools.



Foot trails behind Tallyho Trail.



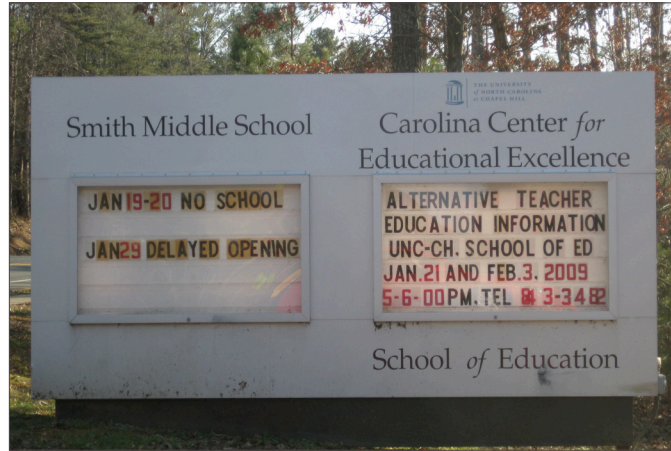
Foot trails leading down to Bolin Creek from Wild Oak Dr.



Paved trail behind Morris Grove Elementary School.

6. Destinations

The Bolin Creek corridor experiences high levels of recreational use within Carolina North Forest as well as targeted travel for commuting patterns. Nearby residents use the sewer easement frequently to connect to adjacent pedestrian facilities leading to downtown Carrboro and Chapel Hill/Carrboro schools. Other surrounding destinations and potential connections include Morris Grove Elementary off Eubanks Rd., MLK Park off Hillsborough Rd., the Frances Shetley Bikepath off Greensboro Rd., and future phases of Chapel Hill's Bolin Creek Greenway, and the Carolina North development, which is currently in design review.



One of five schools along the corridor.



Wilson Park in Carrboro, NC.

7. Corridor Impacts

The wide, cleared surface of the sewer easement east of Bolin Creek provides innumerable opportunities for walking, mountain biking, running, jogging, dog walking and hiking. This high level of foot and bicycle traffic, combined with maintenance vehicle access, has caused the easement surface to become severely eroded and worn down. Deep ruts caused by bicycle and automobile tires create inundated conditions during storm events, thereby encouraging trail braiding along the path of travel. This sequence of events, in combination with

continuous high use, widens the area of disturbance over time. The agitated surface conditions created by foot and bike traffic lead to increased erosion and sedimentation along the corridor, which has the potential to impact water quality during storm events.



Maintenance vehicles and overuse have contributed to erosion along the corridor.



Visible signs of overuse along Bolin Creek.



Hardscape materials imported onsite have furthered erosion problems.

8. Trail Feasibility

Key factors contributing to the feasibility of trail development, such as vertical and horizontal corridor clearance, surrounding land use and property ownership, and ancillary features for future trail use (such as crossing areas and trailheads) were observed and noted while in the field. Some areas of the corridor may be more suitable for trail alignment, from a cost standpoint or an environmental perspective. Constraints were also documented. Both opportunities and constraints are presented in the next chapter.

A significant challenge to trail development along the corridor will be bridge crossings; either across Bolin Creek or its associated tributaries. These and study area wetlands will require permitting costs and impact mitigation as well as further engineering studies. For the purposes of this report, PBS&J performed a preliminary evaluation of several potential pedestrian bridge crossing areas along the corridor and the results of their findings are presented in the next section.

9. Preliminary Evaluation of Possible Hydraulic Impacts of Pedestrian Bridge Locations along Bolin and Jones Creeks

Description

The defined reach of Bolin Creek is located on Flood Insurance Rate Map (FIRM) Panel 9779 in Orange County, NC, Map Number 3710977900J, effective date February 2, 2007. Greenway development along Jones Creek is primarily captured on FIRM Panel 9870 in Orange County, NC, Map Number 3710987000J, effective date February 2, 2007. The recommended alignment for the greenway will most likely fall within Zones AE and X as well as the floodway and non-encroachment area. Zone AE represents a special flood hazard area (SFHA), or 100-year floodplain, that has been studied in detail by the North Carolina Floodplain Mapping Program (NCFMP) through the Federal Emergency Management Agency's (FEMA) Cooperative Technical Community partnership initiative; this zone contains base (100-year) flood elevations (BFEs). Zone X represents the 500-year floodplain, areas of 100-year floodplain with average depths less than one (1) foot or drainage areas less than one (1) square mile, or areas of 100-year floodplain protected by levees. The floodway is the stream channel and adjacent floodplain areas required to permit passage of the base flood event without cumulatively increasing the water surface elevation (WSEL) greater than one (1) foot. Similar to a floodway, a non-encroachment area is designated in areas which are studied in limited detail by NCFMP, and are considered enforceable by a community in prohibiting development.

Purpose

The purpose of this study is to qualitatively assess the hydraulic impacts of potential pedestrian bridge locations for the proposed greenway along Bolin and Jones Creeks. The extent of work performed included data collection, office research, one field visit and generation of this data. Once the trail design (including all bridge locations) is complete, coordination with the North Carolina Floodplain Mapping Program (NCFMP) will be required to address possible impacts to the base floodplain and associated floodway/encroachment area. Such coordination will most likely require a more detailed flood study.

Hydraulic Impacts

The following paragraphs will address each potential crossing site individually and correspond to the locations shown on the included exhibits. An overall map is shown with each location on the next page.

Evaluated Pedestrian Bridge Locations along Bolin and Jones Creek



A. Buckhorn Branch Crossing

This site is located on Buckhorn Branch (tributary to Jones Creek) and currently has rip-rap lined banks with additional rock in channel to facilitate the crossing of vehicles to gain access to a sanitary sewer easement. The channel's confluence with Jones Creek occurs immediately downstream. This site is presently located within the SFHA (~ 120 ft wide) and stream buffer, appears to be contained within a non-encroachment area (~ 40 ft), and experiences a 100-year flood discharge of approximately 450 cubic feet per second (cfs). PBS&J recommends the implementation of a low-flow, curbed concrete bridge connecting the stream banks of Buckhorn Branch, which would permit the greenway to utilize the existing sanitary sewer easement northward.

**B. Homestead Roadway Bridge**

This site is located on Bolin Creek at the Homestead Road Bridge with a large sanitary sewer ductile iron pipe (SSDIP) crossing immediately downstream of the bridge. This site is presently located within the SFHA (~ 130 ft wide) and stream buffer, is contained within a floodway (~ 60 ft), and experiences a 100-year flood discharge of approximately 2,790 cfs. PBS&J recommends utilizing the existing sanitary sewer easement along the west bank of Bolin Creek as the proposed greenway alignment and excavating the west bank underneath the bridge to establish an underpass for pedestrian access north and south of Homestead Road.



C. Crossing south of Homestead Roadway Bridge

This site is located on Bolin Creek at a SSDIP crossing and is presently located within the SFHA (~ 600 ft wide) and stream buffer, is contained within a floodway (~ 400 ft), and experiences a 100-year flood discharge of approximately 2,790 cfs. PBS&J recommends the implementation of an arched wooden bridge with guardrails that will connect the existing SS easement paralleling the east and west stream banks in such a way that will not hinder access to the SSDIP and its two associated manholes. Town staff, Sungate Engineering, and GWI visited this site after the initial field investigation, resulting in a recommendation to relocate the crossing upstream to minimize flood zone impacts.

**D. Crossing at Spring Valley Subdivision**

This site is located at the confluence of Bolin Creek and a tributary near a SSDIP crossing east of Spring Valley subdivision. This site is presently located within the SFHA (~ 240 ft wide) and stream buffer, is contained within a floodway (~ 90 ft), and experiences a 100-year flood discharge of approximately 3,600 cfs. A three-foot wide wooden footbridge currently provides access from the playground (west bank) to the existing SS easement on the east side of Bolin Creek. PBS&J recommends the implementation of a low-flow, curbed concrete bridge over the tributary immediately downstream of the SSDIP crossing and an arched wooden bridge with guardrails over Bolin Creek in vicinity of the existing footbridge to provide access from the playground.



E. Pathway Dr. Crossing

This site is located on Bolin Creek at a SSDIP crossing. This crossing area is accessed at the end of Pathway Dr. and represents an important potential pedestrian connection to Bolin Forest. The site is presently located within the SFHA (~ 140 ft wide) and stream buffer, is contained within a floodway (~ 110 ft), and experiences a 100-year flood discharge of approximately 3,600 cfs. One SS easement parallels the east bank, while another is perpendicular to the west bank. PBS&J recommends the implementation of an arched wooden bridge with guardrails over or adjacent to the SSDIP crossing.

***F. Crossing at Bolin Forest Subdivision***

This site is located on Bolin Creek at a SSDIP crossing east of Bolin Forest subdivision. This site is presently located within the SFHA (~ 55 ft wide) and stream buffer, contained within a floodway (~ 45 ft) and experiences a 100-year flood discharge of approximately 4,100 cfs. A three-foot wide wooden footbridge provides access between the playground and walking trail on the west to the existing SS easement on the east side of the creek. PBS&J recommends replacing the existing footbridge with an arched wooden bridge with guardrails.



G. Crossing near Estes Dr. Ext.

This site is located on Bolin Creek in between an upstream SSDIP crossing and triple box culvert at Estes Drive Extension. This site is presently located within the SFHA (~ 200 ft wide) and stream buffer, is contained within a floodway (~ 40 ft), and experiences a 100-year flood discharge of approximately 4,400 cfs. A SS easement exists along the west side of the creek and connects to another SS easement at the DIP crossing. At this crossing, both easements veer away from the creek towards Estes Drive Extension.

**Conclusions & Recommendations**

As is evident from the data presented in this preliminary evaluation, the potential bridge crossing locations will have to be studied in detail after final locations are determined in order to assess the impacts, if any, on the base flood elevation. While it is possible at this point to state that a curbed low water crossing will likely have less impact than an arched wooden structure with railings (depending on the depth of flow at the crossing), a definitive assessment will require the preparation of a hydraulic model and that is beyond the scope of this evaluation.

Given that there are numerous proposed crossing locations along Bolin Creek and that many of these will need to be arched bridges with railings, it should be noted that it will be very difficult to achieve a no-rise condition under these circumstances. This will likely mean that, at minimum, a LOMR (Letter of Map Revision, issued after construction is complete) will be necessary to gain approval for any increases in the base flood elevation throughout this project. It is not anticipated that these increases will be greater than one foot at any point, so a CLOMR (Conditional Letter of Map Revision, issued prior to construction and followed by a LOMR after construction) will not likely be necessary.

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