PLAN CHATHAM

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2017

BIG WOODS CONSERVATION DESIGN GUIDE

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DESIGN GUIDE

Contents

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CONSERVATION DESIGN GUIDE

OVERVIEW

During the development of the Chatham County Comprehensive Plan, funding from Partners for Green Growth was received from the North Carolina Wildlife Resources Commission (NCWRC). This program is a cost-share funding resource that is part of the Green Growth Toolbox and meant to provide support for local government planning projects that consider wildlife and natural resource conservation in land use and development planning, incentives and ordinances. To learn more about important natural resources in Chatham County, see the resources section.

The funding enabled the Chatham County Planning Department and a consultant team comprised of LandDesign and Nealon Planning to work with NCWRC staff to identify, analyze and make recommendations for an area of the county with a high conservation value and a high likelihood of development pressure as a way of demonstrating the benefits and opportunities of adhering to conservation design principles. The Big Woods area, which is generally defined as the Big Woods Upland Forest Natural Heritage Natural Area (NHNA) and existing wildlife corridors between Jordan Lake and the Haw River, was identified as the study area. A meeting was held with the Chatham Conservation Partnership (CCP) and area landowners in January of 2017 to discuss preliminary recommendations related to natural resources in the draft Comprehensive Plan and discuss a potential development pattern in the Study Area that would help minimize impacts on natural resources, while still protecting property rights. Based on the feedback received at that meeting and best practices included in the Green Growth Toolbox, recommendations were developed for the Study Area, including conceptual illustrations of a preferred development pattern.

Photo taken at the Chatham Conservation Partnership

SUMMARY OF RECOMMENDATIONS

As a result of examining the important natural resources in a portion of Chatham County, some locally-important best practices for resource conservation were considered. A more detailed, area-specific set of recommendations are provided later in this report. However, the following recommendations, which are consistent with those set forth in Plan Chatham, are key for natural resources throughout the county to remain intact and to continue to provide important ecosystem services.

- Chatham County should partner with land trusts and other conservation organizations to work with land trusts and other conservation organizations to work with interested landowners to permanently protect Natural Heritage Natural Areas (NHNAs), and other wildlife habitat hubs and corridors.
- Conservation Subdivisions should be strongly encouraged or required in the areas identified as Conservation Areas on the Plan Chatham Future Land Use and Conservation Plan Map.
- The GIS data highlighted and used in the Comprehensive Conservation Plan should be updated and used for land use planning and development review. The GIS data should also be updated on a regular basis.
- Avoiding or minimizing impacts to important natural resources should be encouraged and designing toward a more connected landscape will be a priority.
- Incentives should be considered for inclusion in land development regulations to encourage clustering and/or the reservation of conservation space, including in very low density (gross density), small-scale subdivisions. Ideally, such conservation space will include natural space that contributes to positive ecological benefits beyond the development site.
- Natural space in new development should prioritize the following:
  - Lands within and adjacent to NHNAs.
  - Riparian areas.
  - Vulnerable habitats and unique natural features, particularly those described in this document.
  - Priority Habitats defined by the NC Wildlife Commission (NCWRC).
- Landscape connectivity should be a priority throughout the design process.

*To learn more, see the Conservation Plan Inventory of Natural Areas NCWRC guidelines.

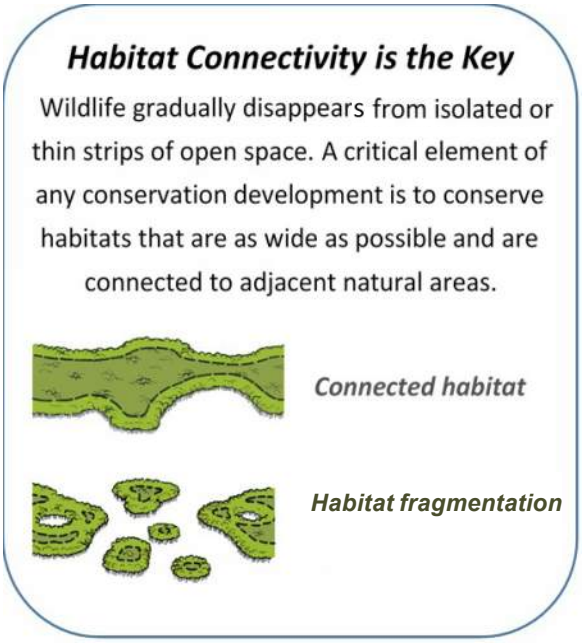
GREEN GROWTH

What is Green Growth?

Green Growth is a land use planning framework that conserves wildlife habitat and other valuable natural resources as communities continue to grow. For more information, visit www.ncwildlife.org/greengrowth.

Why Green Growth?

Over one third of our 1,000 wildlife species in North Carolina are declining, largely due to habitat fragmentation and loss. Green growth also protects important resources for our communities, including areas of passive recreation, cleaner air and water, and rural character. To "keep common species common" and off of endangered species lists, the N.C. Wildlife Resources Commission developed the Green Growth Toolbox.



SOURCE: NCWRC

GUIDING PRINCIPLES OF GREEN GROWTH

Plan the Green before the Gray

Communities often develop around 'gray' infrastructure (i.e., roads, sewer, water lines, etc.) without looking at the 'green' infrastructure (i.e., forests, streams, farms, etc.), Green Growth aims to minimize development impacts by encouraging communities to first identify their important natural areas and then guide growth away from these areas, and toward areas that are already impacted. After sensitive natural areas are identified, communities should aim to:

- **Protect** - Protect sensitive natural areas. Communities want to protect natural areas that provide multiple important benefits, such as clean water, wildlife habitat, areas for passive recreation, farmlands, and scenic views.
- **Bigger is better** - The larger the protected natural area, the more habitat it will provide for a greater diversity of wildlife. Area-sensitive species are especially vulnerable to habitat fragmentation. Habitat fragmentation is the division of large, continuous habitats into smaller, more isolated fragments.
- **Buffer** - Buffer sensitive natural areas from human impacts, including housing developments. Aim to protect core habitat areas and minimize edge effects. Edge effects are the boundary between natural habitats and developed or disturbed land. Edge effects can have a positive or negative influence on nearby wildlife.
- **Connect** - Connect sensitive natural areas through the use of riparian and upland corridors. Isolated natural areas are less viable over time and rely upon landscape connections to remain viable. Riparian corridors also function to protect aquatic habitat and clean water.

WHY CHATHAM? WHY NOW?

Chatham County is the 2nd fastest growing county in the state of North Carolina. The number of housing units in the County grew by 7,395 between 2000 and 2014 (an increase of 37%). As growth occurs, farms and forests are giving way to subdivisions.

Mature forests and habitats are being fragmented with roadways and residential development, and water quality is impacted as impervious surfaces increase. There are 52 (see NC NHP) designated Natural Heritage Natural Areas (NHNAs), both terrestrial and aquatic, located in the county. A NHNA is an area of land or water that is important for the conservation of the natural biodiversity of North Carolina, and is delineated by the NCNHP based on field surveys. More than 2,500 natural areas have been identified in North Carolina, and 52 have been identified in Chatham County. These represent natural habitats that, in combination with other green spaces in the county, harbor at least 49 rare, threatened or endangered species, including the Cape Fear shiner (Notropis mekistocholas), an endangered fish species endemic to the Upper Cape Fear River Basin. Preserving these resources and the benefits they provide, while addressing other land use and economic needs, will be a defining challenge in the future.

Chatham County has been at the forefront of conservation efforts with the development of the Chatham County Comprehensive Conservation Plan in coordination with the Chatham County Conservation Partnership (see https://chathamconservation.wikispaces.com/Comprehensive+Conservation+Plan for the full document). In addition, the county has a number of policies and regulations that are intended to safeguard environmental quality, including a Watershed Protection Ordinance, Jordan Lake Buffer Rules, erosion control and stormwater requirements, and a Conservation Subdivision option with guidelines for conservation space selection. Plan Chatham, the Chatham County Comprehensive Plan, builds on these existing efforts with a new Future Land Use and Conservation Plan; Parks, Recreation and Open Space Concept Map; and new policies and strategies to foster the creation of a connected network of important natural resources.

BENEFITS OF CONSERVATION DESIGN

The benefits of Conservation Design and integrating parks, greenways and open space into the development pattern are numerous. Studies have shown significant environmental, health and economic benefits of open space. Specifically, Conservation Design and Open Space:

INCREASES...

Property values.

Generally, homes in conservation subdivisions sell faster and for higher prices than similar homes in traditional neighborhoods. On average, home values increase by 20% when they are within walking distance to a natural park (B, p. 10). In South Kinston, Rhode Island, homes within a conservation subdivision sold in half the time of those in nearby traditional subdivisions (A, p. 3).

Economic activity and competitiveness.

Surveys have shown that environmental quality and natural amenities are a higher priority than housing cost, cost of living, schools, and public safety to businesses in the new economy when considering where to locate (B, p. 9). Preserving high-quality natural areas also increases opportunities for greenway development. Every greenway is thought to generate $2.7 million in economic activity (B, p. 9).

Tourism.

In 2011, residents and visitors spent $3.3 billion on nature related activities in North Carolina and accounted for 30% of the state's overnight visits (A, p. 11). Preserving natural areas through conservation design is a worthwhile investment when considering the potential boost to tourism.

Safety due to accessible, connected design. Fire officials have reported being able to reach houses easier in cluster developments than in traditional neighborhoods. Strong community ties also increase safety by increasing 'eyes on the street' (C, p. 92).

Social interaction thanks to the clustering of households and access to shared green space. People are most likely to meet their neighbors on footpaths and trails, which are typically not feasible in conventional subdivisions given the lack of open space (C, p. 94). Outdoor exercise is also linked to increased social connections (C, p. 235).

Public Health through increased outdoor recreation opportunities. Access to natural space benefits both physical and mental health – with increased proximity to natural space resulting in lower rates of obesity in NC and time spent in nature showing reduced stress and depression levels (B).

REDUCES...

Cost of development related to clearing and grading a site, paving, and stormwater management. According to the National Association of Home Builders, cluster developments cost an average of 34% less to develop (A, p. 3).

Cost to Municipalities through decreased spending on parks and recreation, utility extension, road maintenance and emergency services. Neighborhoods offering their own high-quality recreation space takes the burden off of the municipality and tax payers to provide those areas. The compact and interconnected nature of conservation developments reduces the service area for utilities and emergency services - reducing transportation costs, response time, infrastructure and maintenance (A, B).

Air pollution.

Conservation developments strive to protect high-quality ecosystems and mature forests within them to reduce air pollutants like ozone, sulfur dioxide, and carbon monoxide through photosynthesis and other filtration processes. The compact nature of conservation design also encourages residents to take more trips on foot or bicycle than by car. The decrease in automobile trips, or even just miles traveled during those trips, reduces emissions (C, p. 235).

Stormwater Runoff.

The North Carolina Triangle region lost between 9.4 and 21.9 billion gallons of water to runoff from impervious surfaces between 1982 and 1997 (B, p. 9). The amount of impervious surface added with new development can be reduced through conservation design - with the average project having 31% less impervious surface and a 38% reduction in runoff than traditional developments (A, p. 3).

PRESERVES...

Natural wildlife habitat through the protection of high-quality ecosystems and focus on minimal site disturbance. Habitat loss and fragmentation is the primary threat to wildlife species in NC (both common and rare (A, p. 3)). Also, 8 of the 21 most endangered ecosystems occur in North Carolina, with urban development posing the largest threat (A, p. 3).

Food-producing Farmland.

North Carolina has been rapidly losing farmland to development, with the number of farms in the state decreasing by 500 from 2007 to 2008 (A, p. 3). Traditional residential development costs local governments more than they produce in revenue, whereas farm and forestland generate more revenue than costs. Farm and forest land in Chatham County generates $1.72 for every dollar spent on services (D). Conservation development's compact nature reduces development site size and preserves rural character, by supporting the preservation of working lands.

Ecosystem Services like flood control, water and air filtration, crop pollination, groundwater recharge, carbon sequestration and climate adaptation (B, p. 18). Globally, these services are valued at $33 trillion per year. When ecosystems are degraded by traditional development, money must be spent to replicate and replace these costly services.

Sources:

(A) Conservation Subdivision Handbook, NC State Forestry and Environmental Outreach Program

(B) Green Growth Toolbox, NC Wildlife Resources Commission, 2013

(C) Rural By Design, Randall Arendt, 2015

(D) Chatham County Cost of Services Study, NC State, 2007

IDENTIFYING CANDIDATE SITES

During the early stages of this Partners for Green Growth project, GIS data were gathered and analyzed to identify landscape level concentrations of green infrastructure. The Biodiversity & Wildlife Habitat Assessment (BWHA) from the Comprehensive Conservation Plan was used along with other datasets (parcel density, distance from roads, proximity to NHEOs, proximity to NHNAs, proximity to protected lands (using MAREA data from NCNHP), steep slopes, and other environmentally sensitive lands to create the "green infrastructure" analysis. These datasets are regularly updated and publicly available through the NC Natural Heritage Program Data Explorer (https://ncnhde.natureserve.org/). Green infrastructure analysis was combined with a land use suitability analysis that identified areas with high levels of residential growth pressure. The result was a map that shows where conflicts between new residential development and sensitive natural areas are likely. Lands in the northeastern part of the county are closest to regional employment centers and concentrations of recent residential and commercial development. Significant natural resources exist in areas, such as the Natural Heritage Natural Areas along the Haw River, the Jordan Lake State Game Lands and in the Haw River Aquatic Habitat NHNA. Other high-quality upland habitats include Boothe Hilll, Bennett Mountain, Terrell's Mountain, Collins Mountain, the Pittsboro Wilderness (Future Chatham Park) and the Big Woods Road Upland Forests. Aquatic NHNAs provide habitat for rare fish and mussels, and rare aquatic insects.

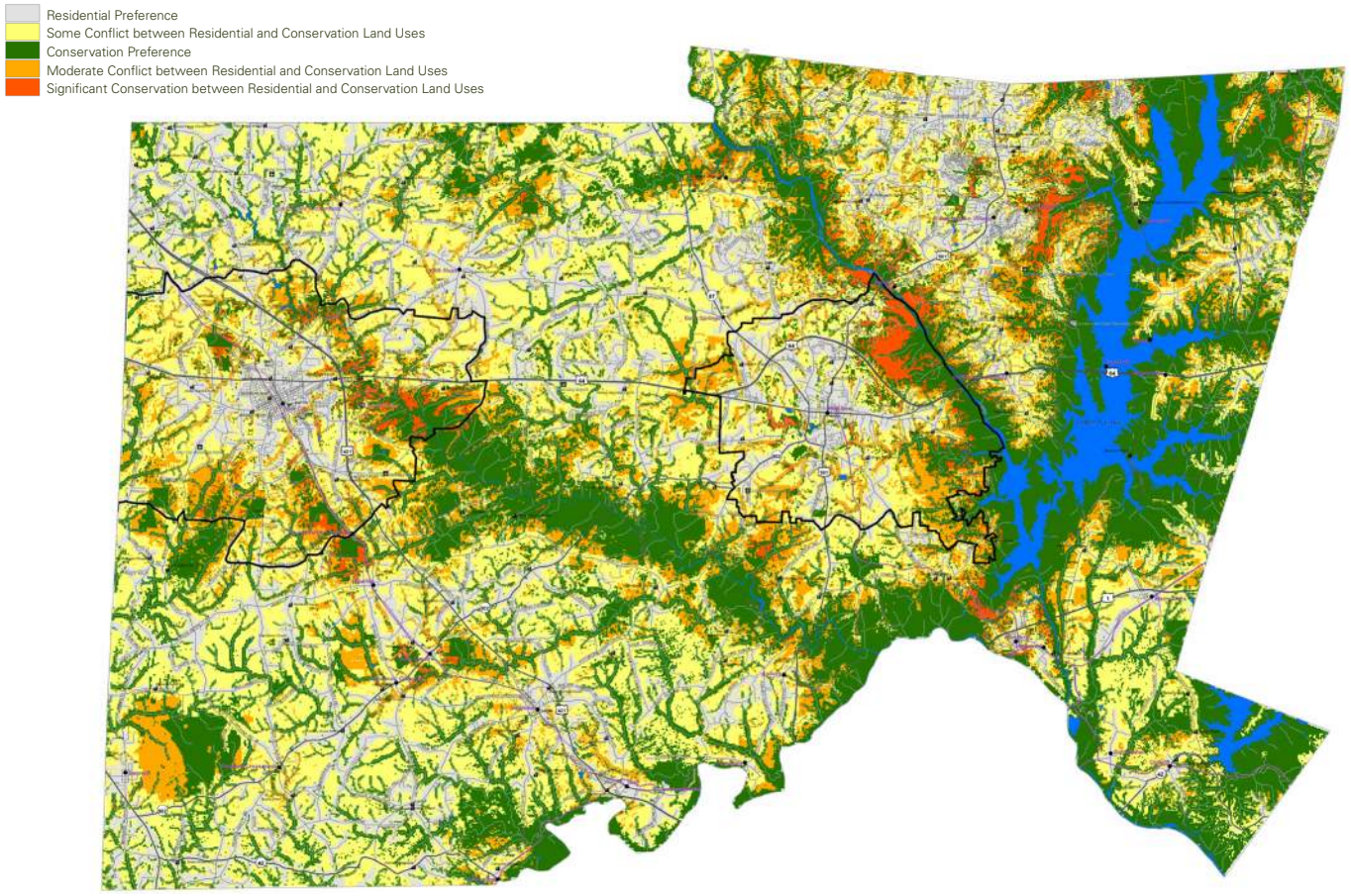


FIGURE 1: RESIDENTIAL AND CONSERVATION CONFLICT AREA MAP

THE BIG WOODS AREA

The "Big Woods" area is significant because it is a landscape of (relatively) unfragmented habitat for area-sensitive wildlife and represents a regionally significant landscape for wildlife and is located in an area of county that has experienced tremendous growth in the recent past. The "Big Woods Study Area" shown in Figure 2 includes 5,000 acres and connects three Natural Heritage Natural Areas: the Haw River Aquatic Habitat, the Big Woods Road Upland Forests, and the Bush Creek Marshes. The "Study Area" spans Bush Creek NHNA to the Haw River and Jordan Lake. This is significant for landscape connectivity. The Big Woods Road Upland Forests NHNA, also known as the Big Woods Wilderness, is one of the largest tracts of unfragmented uplands in the entire Triangle Region. It contains maturing hardwood forest, rock outcrops, and upland depressions, and it is home to species such as wild turkey, quail, bobcat, hawk, bald eagle, and the Carolina ladle crayfish. The Pokeberry Creek drainage flows to the Haw River Aquatic Habitat NHNA where rare, federally-listed species can be found, such as the Cape Fear shiner, Septima's clubtail, spine-crowned clubtail, and yellow lampmussel. (See the next section for a full description of priority habitats located in the area.) The "Big Woods Focus Area," also depicted in Figure 2, extends from the Big Woods NHNA across Mount Gilead Church Road to Pokeberry Creek and to Bynum Ridge Road. This area includes historic farms and homes as well as scenic views from US 15-501 and Mount Gilead Church Road. The southwestern corner of the area, just south of Bynum Ridge Road, is part of The Retreat at Haw River, an approved development that is planned as a conservation subdivision that maintains land west of Pokeberry Creek as conservation space.

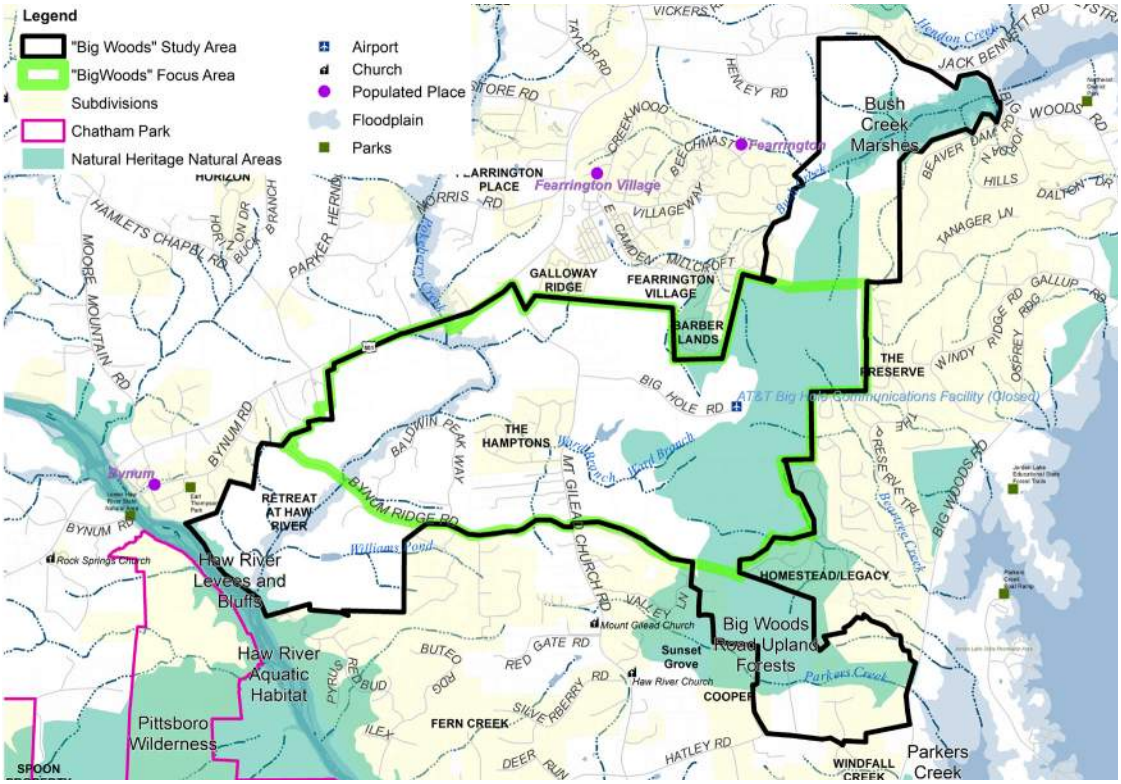


FIGURE 2: "BIG WOODS" STUDY AREA AND FOCUS AREA MAP (STUDY AREA CONNECTS BUSH CREEK, HAW RIVER AND JORDAN LAKE)

SITE ANALYSIS

The following maps show the "Big Woods" Focus Area. The eastern side of the area is anchored by the Big Woods NHNA with rolling topography and some steep slopes. Patches of evergreen forest mark land that has been logged during the last 20 or 30 years on the edges of the Big Woods NHNA. The Big Hole Communications Facility, a remnant from the Cold War, sits nestled between forested monadnocks at the end of Big Hole Road. It once acted as a communications bunker for the federal government, but now the facility sits vacant. Patches of farmland provide rural vistas along Mount Gilead Church Road that runs north to south from US 15-501 to US 64 through the focus area. A new large-lot subdivision (The Hamptons) is approved to be built on farmland on Ward Branch. Pokeberry Creek crosses beneath US 15-501 and takes a hard turn to the southwest. This stretch of land is marked by a large floodplain and steep slopes on the northeast side. Two hardwood forest patches, each with more than 75 acres, sit on each side of Bynum Ridge Road on the west side of Pokeberry Creek.

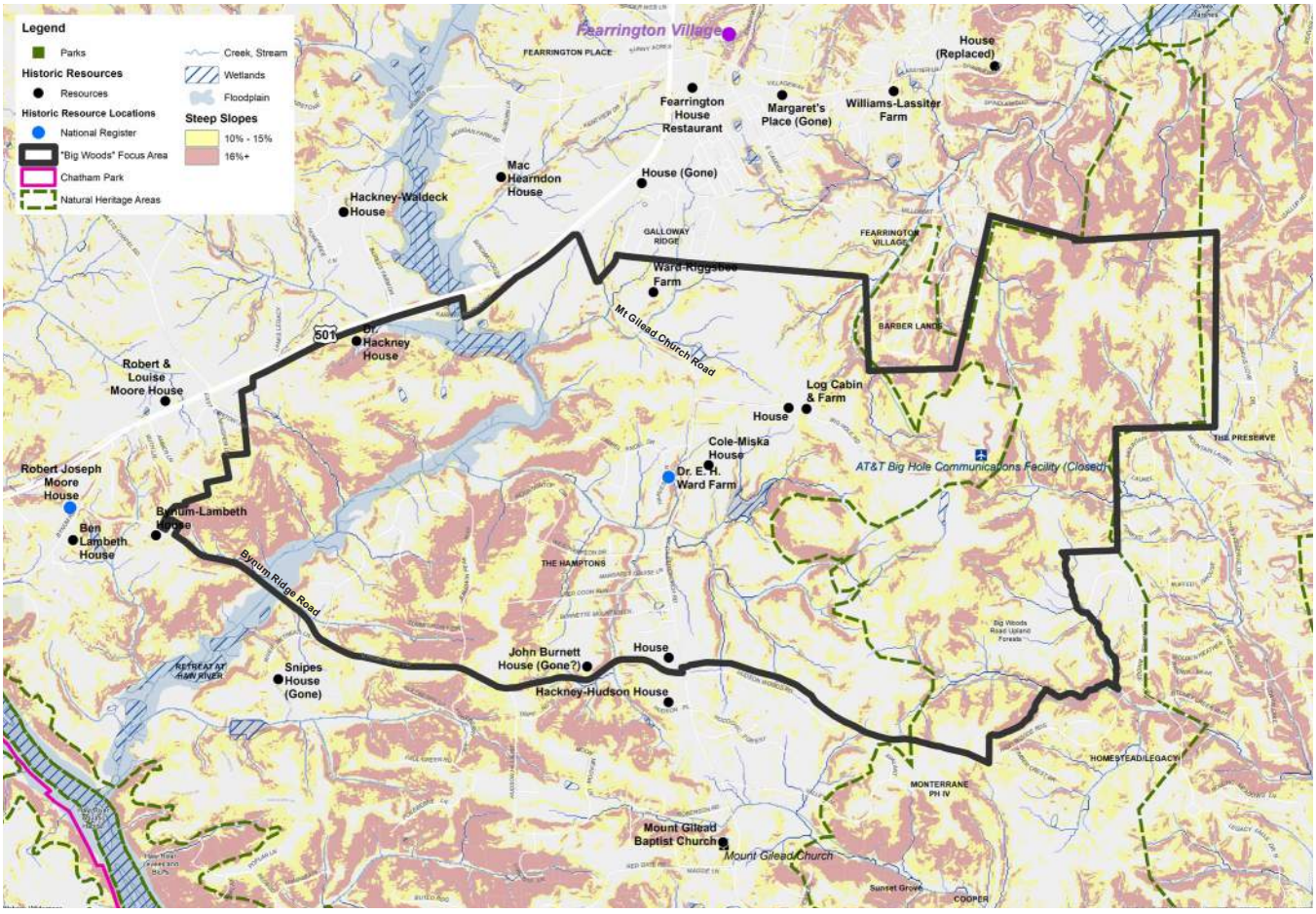


FIGURE 3: SITE ANALYSIS MAP

BIODIVERSITY & WILDLIFE HABITAT VALUE

Biodiversity is the variation of life, with differences both big and small, that exist in our world, or in a particular habitat or ecosystem. The conservation of various types of habitats will subsequently protect and preserve an area's biodiversity (See Conservation Plan for more info on biodiversity). Habitats are environments that provide ecological value in the form of wildlife populations, nutrient cycling, water purification and climate control. As shown in Figure 4 below, the areas ranked highest (10 having the most value) in biodiversity and wildlife habitat include:

- Areas adjacent to Pokeberry Creek, Ward Branch and headwater streams
- Big Woods Upland Forest NHNA and surrounding intact wildlife habitat, including forest lands
- Forests surrounding the confluence of Pokeberry Creek and Ward Branch

The uplands along the northwest bank of Pokeberry Creek and the early successional habitat along utility easements are also identified as being moderately valuable for biodiversity and habitat. The Biodiversity & Wildlife Habitat Assessment considered rare species and high quality natural communities, important wildlife habitats and their connectivity, and priority watersheds and streams and wetlands, as well as NCWRC Priority Habitats (Conservation Plan, pg. 110).

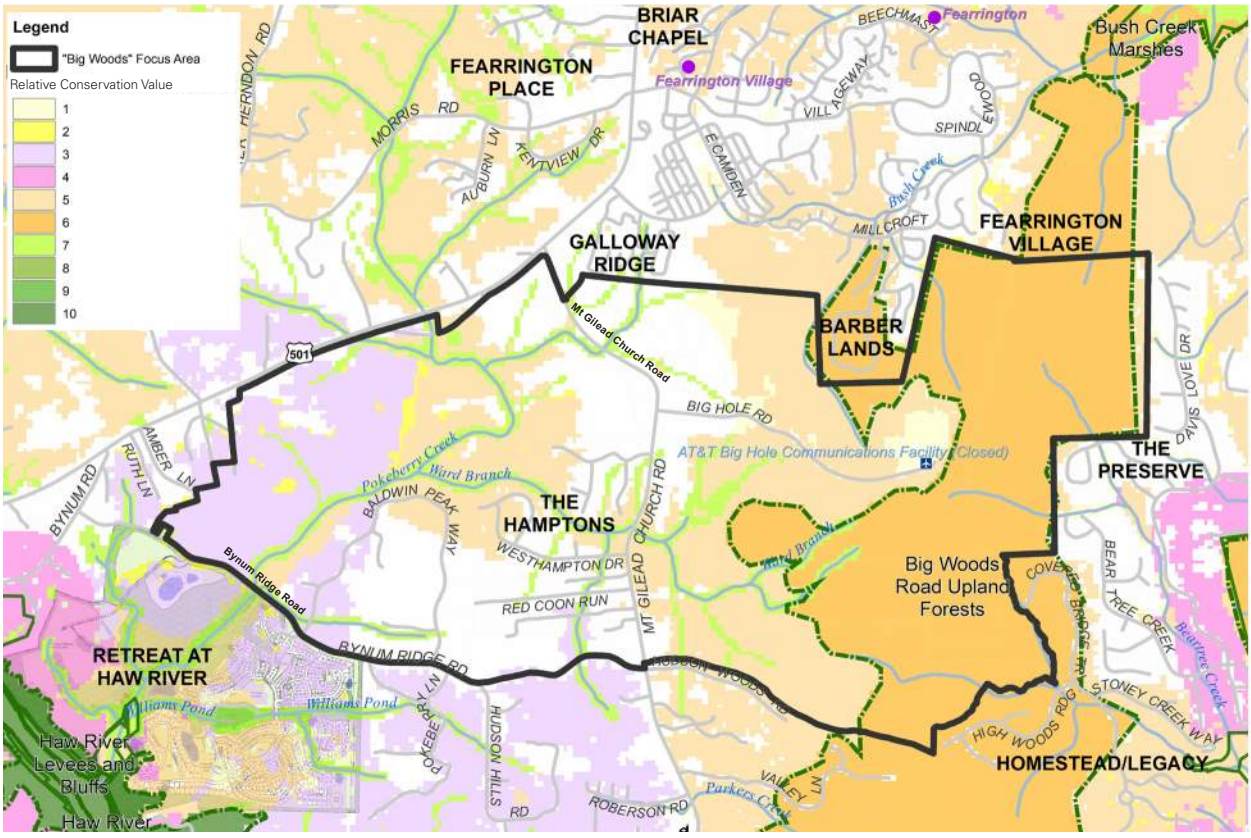


FIGURE 4: BIODIVERSITY & WILDLIFE HABITAT ASSESSMENT MAP (SOURCE: CHATHAM COMPREHENSIVE CONSERVATION PLAN)

PRIORITY HABITATS


Eastern Box Turtle


Brown-headed Nuthatch


Northern Bobwhite


Upland Chorus Frog


Wetland

Priority habitats (NCWRC, 2012) have high biodiversity and are important for both common and rare species. Unfortunately, these habitats are also highly threatened, making them a priority for conservation. Most of these habitat types also provide important ecosystem services such as clean air and water, decomposition, pollinator habit, carbon sequestration, among many others.

Unfragmented Upland Hardwood Oak and Mixed Hardwood/Pine Forests

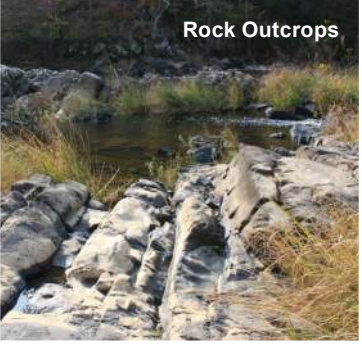
The Big Woods area (study area) is primarily over 4,000 acres of contiguous Upland Hardwood and Mixed Hardwood/Pine Forests. These forests were once the most common natural habitat type in the Piedmont ecoregion, occurring over most of the uplands. These forests provide habitat for many species, both common and rare. Eastern box turtles, red-headed woodpeckers, wild turkey, and brown-headed nuthatch are some of the species living in our oak and mixed hardwood/pine forests. Many species are considered "area-sensitive species", meaning that they will only persist in large contiguous patches of forests. When these forests become fragmented by development, there is less usable habitat available. This results in increased predation. Barriers to movement of species are also created, which increases mortality, reduces reproductive success, and leads to species declines. Habitat fragmentation is the leading cause of species decline in NC. In the Piedmont, the NCWRC recommends that communities aim to conserve connected blocks of upland hardwood and mixed pine/hardwood forest that are at least 75 acres.

Early Successional Communities

While the Big Woods area is mostly forested, there are patches of early successional habitats. These are uplands dominated by herbaceous vegetation and/or shrub cover because most trees have been removed, either through natural means or by human activity such as harvesting managed loblolly pines. These habitats provide food and cover for wildlife but need to be maintained by mowing, grazing, or burning to be conserved. Because early successional habitats require some level of disturbance to be maintained on the landscape, they are one of the most rapidly declining habitats in the Piedmont of NC, and in our country. Species associated with these threatened, early successional habitats include the Northern bobwhite and loggerhead shrike.

Wetlands

Within the Big Woods area, there are forested wetlands, impoundments (i.e., dammed streams that develop into ponds), and marshes. Many types of wildlife use these habitats. In upland depression swamps, which are isolated from streams and only hold water in wetter parts of the year, amphibians, like spotted salamander and upland chorus frogs, lay their eggs in fish-free ponds that are safe from predation. Marshes, such as those along Bush Creek, will usually have fish in them and are important places for young fish to mature. There may be


Rock Outcrops


Prothonotary Warbler


Louisianna Waterthrush


Deep River


Double-crested Cormorant


Freshwater Mussels


Mole Salamander

upland seeps in this area; these are wetlands that occur on sloping uplands. These seeps are generally small and contrast sharply with adjacent communities. They are fed by groundwater, but they are seldom, if ever, flooded. Some animals, such as salamanders, use the wetlands for breeding and nesting, but need adjacent upland forests for other life stages. Research suggests that 750 feet is a recommended buffer on wetlands to maintain adjacent upland forest habitat (a minimum buffer of 150 feet is considered critical to protect this habitat).

Rock Outcrops

Rock outcrops are exposed rocks, often large enough to create a gap in the tree canopy, that have unique plant communities. They also provide important habitat (monadocks with rock outcrops (escarpment between Carolina Slate Belt and Trassic Basin)) for many reptiles . These rare habitats should be buffered from development by 600 feet.

Riparian and Floodplain Communities

Riparian and floodplain communities are adjacent to streams and rivers; they provide important services, such as collecting floodwaters and filtering run-off before it enters our streams. They are also important habitats for wildlife, such as prothonotary warbler, Louisiana waterthrush and Pokeberry Creek salamanders will breed in floodplain pools. Floodplain habitat occurs along Bush Creek, where beavers have dammed up streams. It is important to protect the 100-year floodplain in its entirety from development in order to protect property and lives in the event of a flood. Protecting the 500-year floodplain should be encouraged to mitigate future risks.

Streams and Rivers

There are many headwater, ephemeral, intermittent, and perennial streams - some of which drain into the Haw River where federally listed species occur. The headwater streams in this area are also habitat for the rare Carolina Ladle crayfish. In order to protect the habitat for the rare, threatened and endangered species, 100-foot buffers on intermittent and 200-foot buffers on perennial streams that drain into the Haw River are ideal (See NCWRC 2002, pg. 11). The streams in this area also drain into Jordan Lake, which is an important water source for many of Chatham County's residents.


Headwater Stream

SPECIES OF GREATEST CONSERVATION NEED

WITHIN THE BIG WOODS AREA

Wildlife species that are identified as priority for conservation effort by the Wildlife Resources Commission are called 'species of greatest conservation need.' These were identified through consultation with species experts and scientific literature. (See conservation plan for more info, pg. 51-53)

Species of Greatest Conservation Need**	
Common Name	**Scientific Name**
AMPHIBIANS	
1. Chamberlain's Dwarf Salamander	*Eurycea chamberlaini*
2. Four-Toed Salamander	*Hemidactylium scutatum*
3. Mole Salamander	*Ambystoma talpoideum*
4. Northern Slimy Salamander	*Plethodon glutinosus*
5. Northern Two-Lined Salamander	*Eurycea bislineata*
BIRDS	
6. Acadian Flycatcher	*Empidonax virescens*
7. American Black Duck	*Anas rubripes*
8. American Kestrel	*Falco sparverius*
9. Bald Eagle	*Haliaeetus leucocephalus*
10. Bobolink	*Dolichonyx oryzivorus*
11. Brown-headed nuthatch	*Sitta pusilla*
12. Double-crested Comorant	*Phalacrocorax auritus*
13. Gadwall	*Anas strepera*
14. Hermit Thrush	*Catharus guttatus*
15. Hooded Merganser	*Lophodytes cucullatus*
16. Loggerhead Shrike	*Lanius ludovicianus*
17. Louisiana Waterthrush	*Parkesia motacilla*
18. Northern Bobwhite	*Colinus virginianus*
19. Prairie Warbler	*Setophaga discolor*
20. Prothonotary Warbler	*Protonotaria citrea*
21. Red-Headed Woodpecker	*Melanerpes erythrocephalus*
22. Rusty Blackbird	*Euphagus carolinus*
23. Yellow-throated Warbler	*Setophaga dominica*
CRAYFISH	
24. Carolina Ladle Crayfish	*Cambarus davidi*
MAMMALS	
25. Little Brown Bat	*Myotis lucifugus*
26. Tricolored Bat	*Perimyotis subflavus*
REPTILES	
27. Eastern Box Turtle	*Terrapene carolina carolina*
28. Spotted Turtle	*Clemmys guttata*
29. Common Musk Turtle	*Sternotherus odoratus*
30. Eastern Slender Glass Lizard	*Ophisaurus attenuatus*
31. Eastern Ribbon Snake	*Thamnophis sauritus*
32. Mole Kingsnake	*Lampropeltis calligaster*
33. Queen Snake	*Regina septemvittata*
34. Scarlet Kingsnake	*Lampropeltis elapsoides*
35. Southeastern Crown Snake	*Tantilla coronata*
FISH	
28. Cape Fear Shiner	*Notropis mekistocholas*
MUSSELS	
29. Yellow Lampmussel	*Lampsillis cariosa*

** The habitat for these species exists in the study area, and they are likely to be present. However, not all species listed here have been documented in the Big Woods area.

	Habitats				
	Upland Hardwood/ Mixed Pine Hard-wood	**Early Successional**	**Streams and Rivers**	**Wetlands**	**Floodplains**
	X		X		X
	X			X (Isolated wetlands)	X
	X			X (Isolated wetlands)	X
	X		X		X
	X		X		X
	X		X		
			X	X	X
	X	X			
			X		
		X			
	X				
			X	X	X
			X	X	X
	X				
	X		X	X	X
		X			
			X		X
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			X		X
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	X	X			
			X	X	X
	X				
	X	X			
			X		
			X		

CONVENTIONAL VS. CONSERVATION DESIGN

Current Zoning and Implications

Current zoning for the majority of the "Big Woods" Study Area is R1 – Residential District. This zoning district allows for single family homes with a minimum lot area of 40,000 square feet. The typical development pattern associated with R1 zoning without access to public sewer is large lot conventional subdivisions with lots ranging in size from one to three acres. These subdivisions typically have very limited amount of open space set aside. If these conventional subdivisions are at a small scale and are designed appropriately, they can fit reasonably well in rural areas of the county. Piecemeal conversion of the forests and farmland to conventional subdivisions at any scale, however, presents habitat connectivity problems, as habitats that remain are fragmented. Land—and habitat—fragmentation can lead to species decline and local extinction. Such fragmentation also makes forestry and agriculture less viable on remaining lands.

The lack of utilities may keep actual density of future residential developments that rely on septic tanks for wastewater treatment low. Soils in this area of the County are classified as being "Somewhat Limited" and "Very Limited"for their ability to be used as septic tank absorption fields (Source: NRCS Soil Data). Larger lots are created in order to accommodate a septic tank and associated drainage fields.

Of the 3,000 ac in the focus area, only 300 acres are developed. There are approximately 2,700 acres of agricultural and forest land remaining. Population projections indicate that there will be a demand for 25,000 new homes in Chatham County between now and 2040. It is a reasonable assumption that the land in the Big Woods Focus Area that is not permanently protected will be developed by 2040. If the area is built out with conventional subdivisions, the existing habitat may be reduced to areas within regulated stream buffers, wetlands and floodplain areas.

Typical development pattern in R1 zoning without access to sewer. This subdivision encompasses 165 acres and includes 89 lots. The average lot size is 1.85 acres.

Conservation Design Alternative

County water is generally available in the study area with mains that run along Mount Gilead Church Road and Bynum Ridge Road. The availability of public water allows opportunities for clustering development in ways that are not feasible when all new homes have to be on wells.

Conservation subdivisions (CSDs) are a design strategy that places development in the most suitable areas while conserving large portions of development sites (typically 40-70%) as natural open space. This design strategy preserves property rights and accommodates development, while also allowing the preservation of unique natural features as amenities.

By encouraging voluntary land preservation through conservation easements and incentives, it is possible to envision a future for the Big Woods area where a connected system of open space is maintained.

FIGURE 5: CONCEPTUAL CONVENTIONAL SUBDIVISION ILLUSTRATION

FIGURE 6: CONCEPTUAL CONSERVATION SUBDIVISION ILLUSTRATION

Conservation Subdivisions

Two of the last four approved major residential developments in Chatham County have been conservation subdivisions. The County currently provides a density bonus of 10% if at least 40% of the site is preserved as conservation space. The goal of the Conservation Subdivision option is to create large, contiguous areas of natural space across Chatham County for the benefit of both human and natural environments.

See the Chatham County Conservation Subdivision Guidelines for more information:

Chatham County, NC. (2008). Chatham County Conservation Subdivision Guidelines for Conservation Space Selection. (2008, November 13). Retrieved from http://www.chathamnc.org/home/showdocument?id=11548

STEPS IN CONSERVATION DESIGN

STEP 1

Conservation Area Identification

The first step in the conservation design process is to map environmental features that are ecologically important. The resulting Environmental Conditions Inventory Map should include Primary Conservation Areas, such as Natural Heritage Natural Areas, Natural Heritage Element Occurrences, floodplains, wetlands, perennial and intermittent streams, riparian areas, ponds, steep slopes, mature forests, and priority habitats and wildlife corridors. The map should also identify Secondary Conservation Areas, such as lands adjacent to Natural Heritage Natural Areas, species occurrence areas, wetlands, and managed areas; moderate slopes, scenic views, historically or culturally important landscapes, and other open space assets that have been identified as locally significant.* Site visits by the property owner/developer, site designers (landscape architects and engineers assigned to the project), County (and municipal) staff, appointed officials, and elected officials are recommended during this step to examine the areas identified on the Environmental Conditions Inventory Map prior to finalizing the map.

** Refer to adopted ordinances for current listing of resources considered Primary and Secondary Conservation Areas. The lists above may differ from the County's accepted guidelines for conservation space selection.*

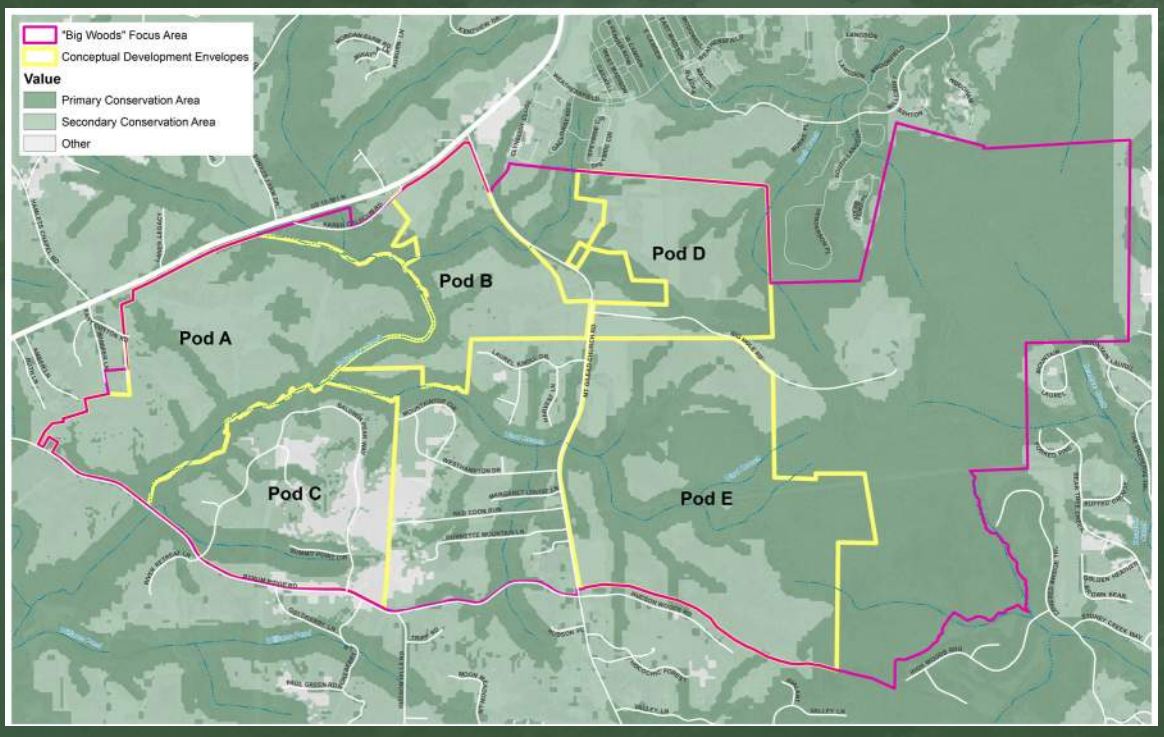


FIGURE 7: ENVIRONMENTAL CONDITIONS INVENTORY MAP

Photo source: Matthew Junker

STEP 2

Developable Area and Yield

The second step in the conservation design process is determining developable area and maximum yield (maximum number of dwelling units). For this example shown in the Yield Analysis Table below, environmental constraints (100-year floodplains, wetlands, and required riparian buffers) were excluded. The resulting "net" land area is then used to determine the minimum area for conservation as well as to calculate the maximum yield.

POD	GROSS ACRES	ENV CONSTR (AC)	NET LAND AREA (AC)	CONS SPACE REQ (AC)	ZONING	MAX DENSITY (DUA)	ALLOWABLE NUMBER OF UNITS	DENSITY BONUS (UNITS)	ADD DENSITY BONUS (UNITS)	MAX YIELD (UNITS)	DEV AREA (AC)	MIN LOT SIZE (AC)
A	404	50	352	141	R1	1	352	35	--	387	211	0.55
B	202	22	180	72	R1	1	180	18	9	207	108	0.52
C	298	34	264	106	R1	1	264	26	--	290	158	0.54
D	205	3	202	81	R1	1	202	20	--	222	121	0.55
E	535	38	497	199	R1 (or R5)	1	497	50	--	547	298	0.54

Notes:

- Yield analysis utilizes available GIS information and is not meant to be an exhaustive inventory of environmental constraints. Field surveys and additional research would be necessary to determine environmentally constrained lands.
- Net land area is the gross acreage of the site less the environmental constraints.
- Conservation space requirement is based on the existing county requirement for conservation subdivisions of 40%. The net land area is used to calculate the acreage comprising the 40%.
- Additional conservation space (above 40% minimum) may be delineated. In this example, only the 40% minimum is provided.
- Developable area is the acreage remaining after delineated conservation areas are subtracted from the net land area.
- The number of allowable units are calculated based on the following formula:
  Net land area * maximum dwelling units per acre or DUA
- The density bonus is calculated based on the current 10% density bonus allowed for conservation subdivisions, except for pod B where an additional 5% bonus for agricultural operation is included.
- Maximum dwelling unit yield calculated based on the following formula:
  O (Total acres - environmental constraints) * density + density bonus
- Minimum lot size is determined based on the maximum yield divided by the number of acres of developable area. Actual density would vary based on efficiency of lot layout, availability of water and sewer service, soils, etc.
- The existing Chatham County Conservation Subdivision Standards for Conservation Space Selection also require a certain percentage of conservation space to be "Natural" space. The concepts shown in this 4-step process do not distinguish between natural and other types of open space.

STEPS IN CONSERVATION DESIGN

STEP 3

Development Envelope Delineation

Based on the Environmental Conditions Inventory Map (Step 1) and the calculated conservation acreage (Step 2), a plan is created that shows areas of proposed development ("development envelopes") and areas of proposed conservation. Ideally, this plan should be drawn at the same scale as the Environmental Conditions Inventory Map. The resulting Development Envelope Map should depict a delineation of developable areas, demonstrating avoidance of the Primary and Secondary Conservation Areas identified in Step 1.

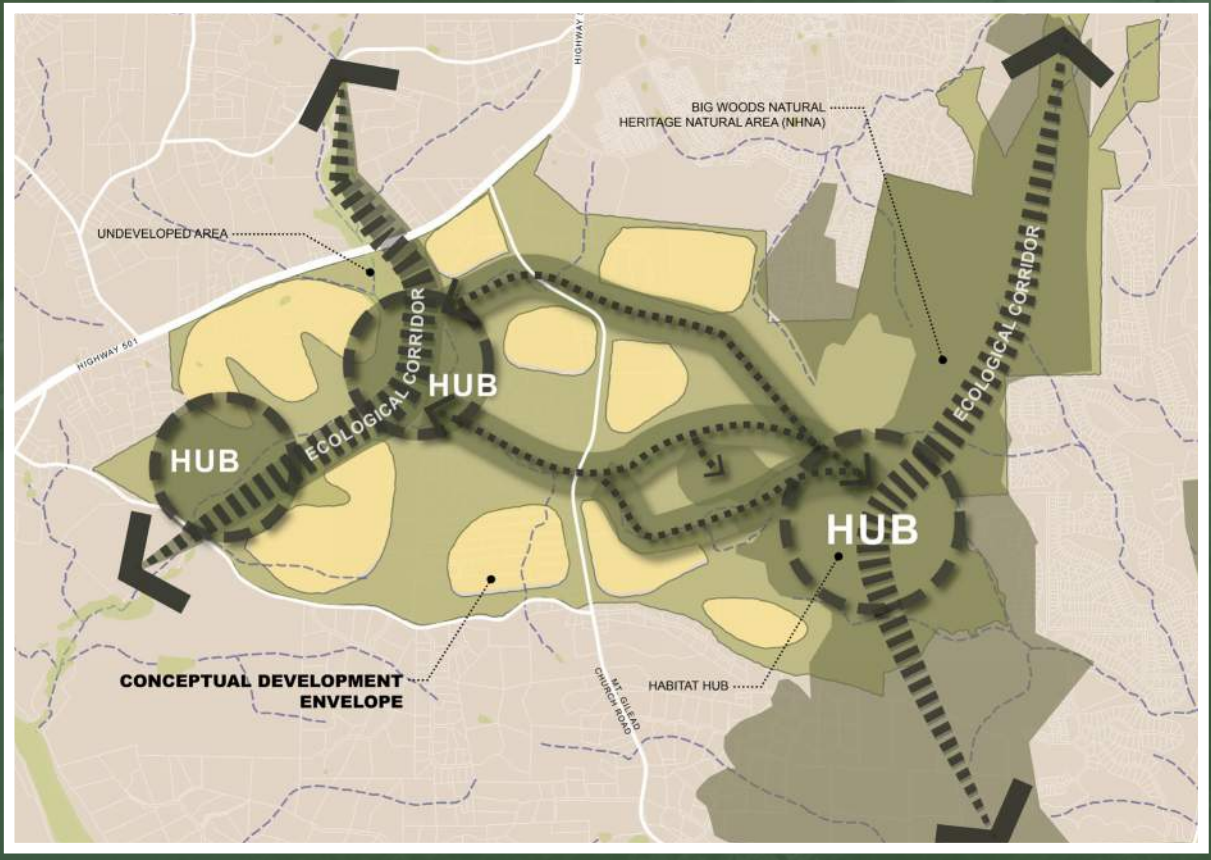


FIGURE 8: CONCEPTUAL DEVELOPMENT ENVELOPE MAP

Photo source: Matthew Junker

STEP 4

Subdivision Design

The final step in the conservation design process is to connect development areas with streets, draw lot lines and determine opportunities for greenways, other types of usable open space, and amenities. Here, the Conceptual Conservation Subdivision Plan depicts a conceptual layout for Pod A in the Big Woods Focus Area. This concept demonstrates how a conservation subdivision could be designed on the site while conserving over 40% of the land area, including a corridor along Pokeberry Creek, a 75-acre habitat hub on the southwest side of Pod A, and riparian buffers along key drainage ways. In addition, this concept minimizes road crossings of such conservation areas.

FIGURE 10: CONCEPTUAL CONSERVATION SUBDIVISION PLAN

BIG WOODS OPEN SPACE CONCEPT

This graphic shows a conceptual development pattern for the Big Woods area. **Ideally, many of the most sensitive areas would be permanently preserved through voluntary conservation efforts.** However, if development does take place, conservation subdivisions are preferred over conventional large-lot subdivisions due to the fact that development can be clustered and key wildlife hubs and corridors protected.

Highlights of the concept include:

- **Property rights protected** and a density bonus provided
- **>40% Conservation Area**

A Wildlife corridor and greenway along Pokeberry Creek

B Wildlife hubs

C Views preserved from US 15-501 and Mount Gilead Church Road

D Historic assets

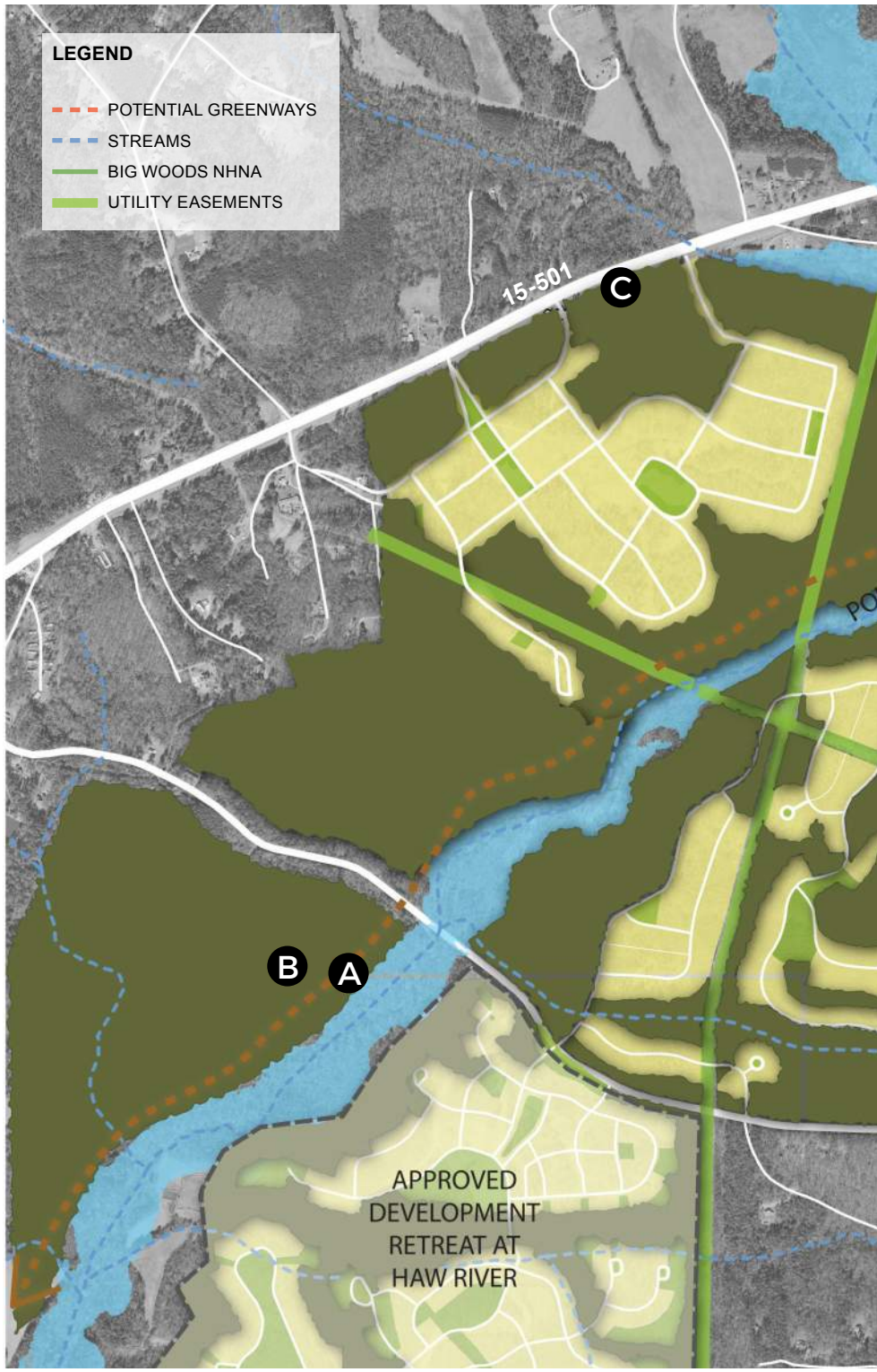
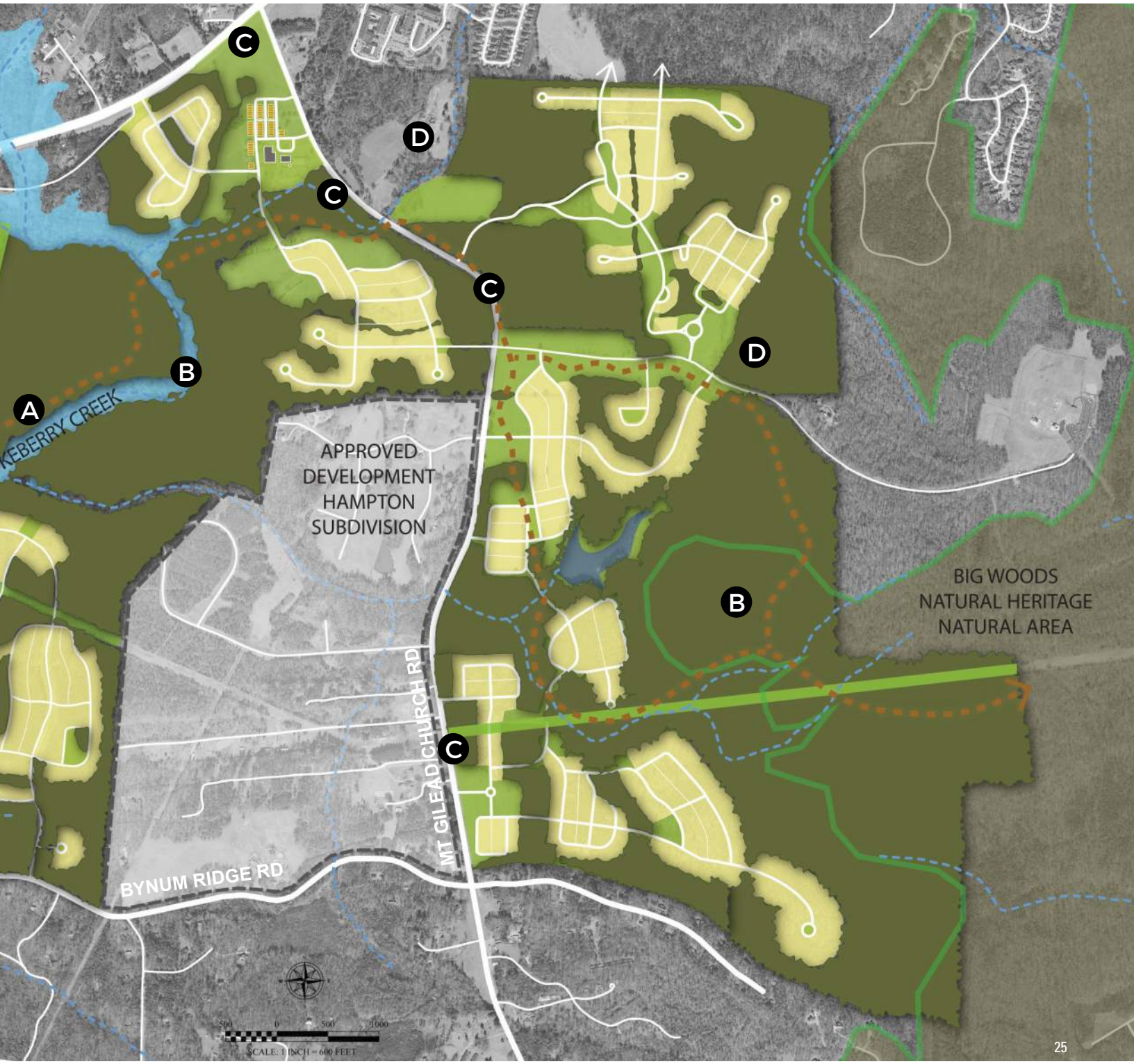


FIGURE 11: CONCEPTUAL OPEN SPACE NETWORK WITH DEVELOPMENT


C
D
C
C
D
B
A
KEBERRY CREEK
APPROVED
DEVELOPMENT
HAMPTON
SUBDIVISION
B
BIG WOODS
NATURAL HERITAGE
NATURAL AREA
C
MT GILEAD CHURCH RD
BYNUM RIDGE RD
500 0 500 1000
SCALE: 1 INCH = 600 FEET

KEY RECOMMENDATIONS

Open space preservation efforts should aim to conserve the most valuable natural resources in the county with an emphasis on protecting water quality as well as habitat hubs and corridors. The following recommendations are meant to guide land use decisions in areas of the county that have valuable natural resources. Many of the recommendations reinforce existing policies as well as new policies and strategies included in Plan Chatham, the Chatham County Comprehensive Plan. In general, conservation of land in the areas defined as Conservation Areas on the Plan Chatham Future Land Use and Conservation Plan Map should be promoted. Where development is likely to occur, clustering of development, to the degree possible, to avoid such natural resources should be encouraged. This can be accomplished through improved approaches to development design, particularly residential subdivision design, without diminishing landowners' property rights.

Recommendation 01

In all future conservation efforts by the public and private sectors, prioritize the following key habitat areas for conservation:

- Lands within and adjacent to NHNAs.
- Riparian areas. [Example: In the Big Woods area, Ward Branch (north of the intersection of West Hampton Drive and Mt. Gilead Church Road) and near the unnamed tributary and headwater stream that converge and pass beneath Mt. Gilead Church Road approximately ½ miles southwest of US 15-501.]
- Vulnerable habitats and unique natural features, particularly those described in this document.
- Priority Habitats defined by the NC Wildlife Resource Commission (NCWRC)
- Update and use GIS data highlighted in the Comprehensive Conservation Plan to identify key habitat areas to be prioritized. The GIS data should be updated on a regular basis.

Recommendation 02

Building on the work previously completed by the Chatham County Conservation Partnership, prepare a map of a proposed connected system of conservation space for the county. The resulting map will serve as resource material, informing decisions by landowners, developers, land trusts, and others involved in conservation efforts. The system should:

- Delineate the most valuable natural resources that should comprise the natural areas, as determined by local groups convened by Chatham County and partner organizations, such as the NC Wildlife Resources Commission and the Triangle Land Conservancy.
- Identify areas targeted for improved open space, such as greenways, that provide recreational opportunities and alternative transportation options while functioning as wildlife corridors. Such opportunities exist between Bynum, the Big Woods NHNA, and Jordan Lake Game Lands.

- Define the types of resources that should comprise Primary Conservation Areas and Secondary Conservation Areas. (Refer to Step 1 in Steps in Conservation Design section.)
- Recognize opportunities to protect large, intact open space areas so that, as development occurs, they continue to extend contiguously across property boundaries to maintain wildlife corridors and connect habitat hub areas.

Update and use GIS data highlighted in the Comprehensive Conservation Plan to help identify areas that should be targeted for conservation and open space.

Recommendation 03

Chatham County should partner with land trusts and other conservation groups to work with interested landowners, land trusts and conservation groups to permanently protect a network of wildlife habitat hubs and corridors, such as the Big Woods Upland Forest NHNA and working lands.

Recommendation 04

Modify land development regulations to facilitate—and incentivize open space conservation with new development. Such modifications should:

- Provide incentives to encourage the provision of conservation space in conventional subdivisions, including small-scale and low density subdivisions.
- Allow development types that, through design, effectively conserve natural resources while integrating a variety of open space amenities. Based on utility availability and soil suitability, encourage conservation subdivisions. Conservation subdivisions must have at least 40% of the net land area (gross area less 100-year floodplains, wetlands, and required riparian buffers) in conservation space in exchange for flexibility related to minimum lot sizes and density bonuses (additional increases in the number of units allowed). [This type of subdivision should be encouraged or required in the areas identified as Conservation Areas on the Plan Chatham Future Land Use and Conservation Plan Map.]

Recommendation 05

Raise awareness of and promote Green Growth principles in connection with new development and redevelopment.

General principles include:

- Protect sensitive natural areas.
- Protect large natural areas. The larger the protected natural area, the more habitat it will provide for a greater diversity of wildlife.
- Buffer sensitive natural areas from human impacts, including housing developments.
- Connect sensitive natural areas through the use of riparian and upland corridors.

KEY RECOMMENDATIONS

Specific design recommendations:

- Maintain native, forested riparian buffers of 100 feet or more for perennial streams and 50 feet for intermittent streams. [Note: Buffers wider than these are preferred for streams that drain to the Haw River where there are federally listed aquatic species and to maintain wildlife travel corridors and to provide access to upland breeding habitat. See the Green Growth Toolbox for specific recommendations.]
- Buffer wetlands in order to maintain connections to uplands that are utilized for seasonal occupation and access to breeding habitat. A critical habitat zone of 150 feet should be preserved and additional upland habitat buffer should be preserved if possible.
- Protect the 100-year floodplain in its entirety from development in order to protect property and lives in the event of a flood.
- Protect the 500-year floodplain to mitigate future risks associated with flooding.
- Conserve connected blocks of upland forest that are at least 75 acres in area.
- Encourage habitat variety by maintaining some early successional habitat. These habitats provide food and cover for wildlife but need to be maintained by mowing, grazing, or burning to be conserved.

Recommendation 06

Encourage infrastructure design that reduces potential impacts on the natural environment. Limit stream crossings and roads in new development projects, and, where appropriate, consider the utilization of bottomless culverts, spanning bridges, or other crossing structures to enable the movement of wildlife. This may be especially effective in avoiding impacts to aquatic habitats. Also, consider locating wastewater treatment systems, such as community septic systems or land application areas, outside of key habitat hubs and corridors. (see WRC letter dated 8/30/2017 re: roads)

Recommendation 07

Similar to the approach conceptually described the Big Woods area case study contained in this document, apply an approach to development design and open space conservation in areas adjacent to other NHNAs, including areas near the Bush Creek Marshes located to the northwest.

Recommendation 08

Impacts on wildlife populations can be reduced by avoiding building or widening roads through sensitive natural areas and large, connected acreages of mixed hardwood and pine forests. (See Comprehensive Plan WRC Comments, pg. 2)

- Limit road building projects in areas identified as conservation areas. When roads cannot be avoided in these areas, wildlife crossing structures can help with wildlife safely cross under or over roads.
- Use wild life crossing structures to provide a connection point. Wildlife crossing structures are helpful in preventing collisions with wildlife, and reducing associated injuries, deaths and vehicle repair costs. The NC Department of Transportation (NCDOT) will consider building wildlife crossing structures if land on either side of the road is permanently conserved. (See Comprehensive Plan WRC Comments, pg. 2)

Role of Roads

Roads are barriers to many of our wildlife species, causing significant mortality and isolating populations across the landscape. Large species, which tend to have larger roaming territories, also present a safety concern for the traveling public when they cross roads. Roads can also drive further development along to corridor, which will fragment wildlife habitats.

See the Comprehensive Plan WRC Comments for more information:
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Overview

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NC Wildlife Resources Commission

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