

MITIGATION PLAN

**INDIAN CREEK SITE
LINCOLN COUNTY, NORTH CAROLINA
TIP NUMBER: R-0617WM**

Prepared for:

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL
ANALYSIS BRANCH
RALEIGH, NORTH CAROLINA**



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1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) plans to use onsite mitigation to offset the impacts to existing streams from construction of NC 150 (TIP Project Number R-0617) in Lincoln County, North Carolina. The 20.0-acre parcel (hereinafter referred to as "the Indian Creek Site" or "the site") is located adjacent to Indian Creek along NC 150, southwest of Lincolnton in Lincoln County (Figure 1).

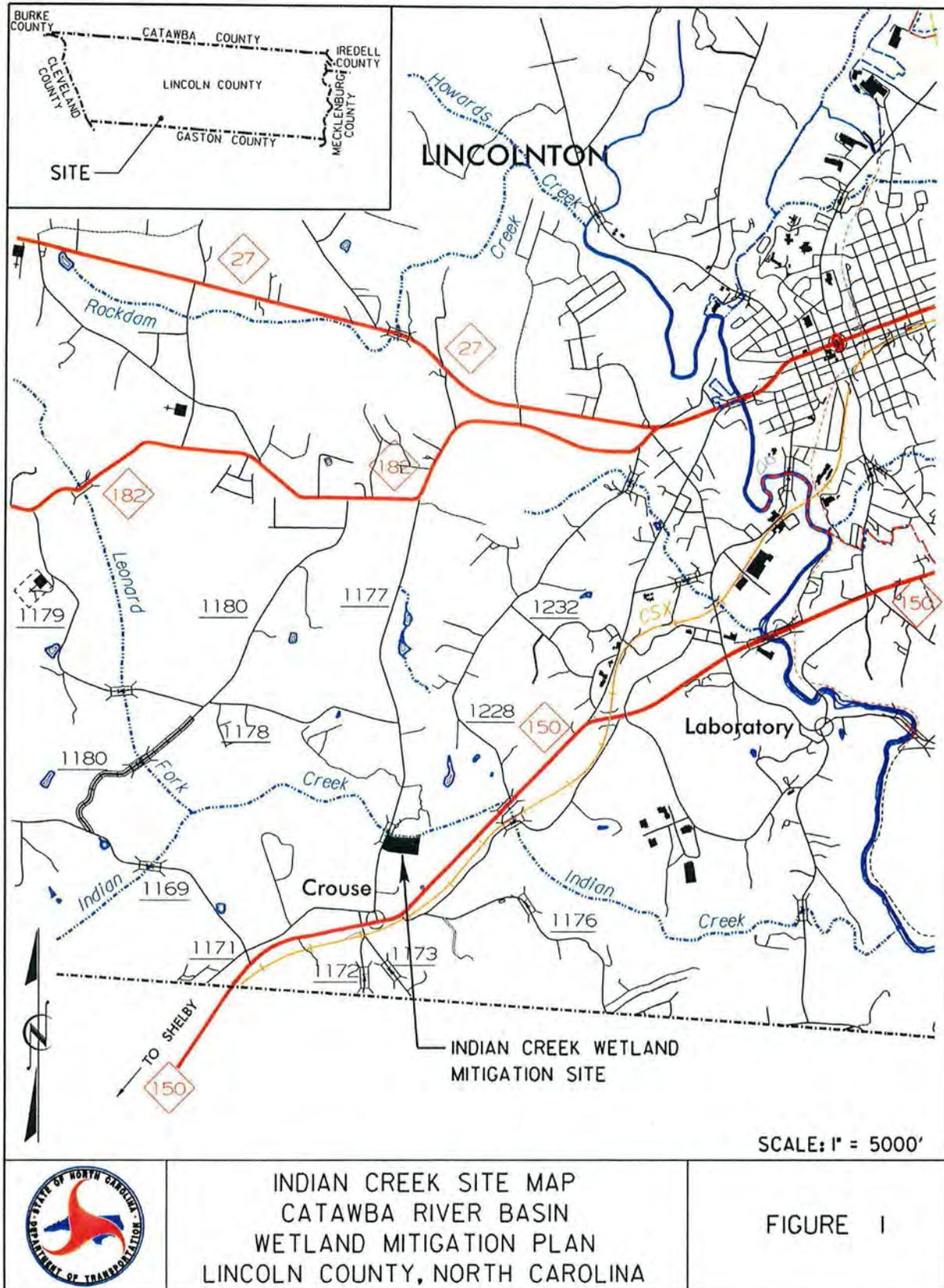
The Indian Creek Site is owned by the NCDOT and has recently been used for horse pasture. The Site is bordered to the north by Indian Creek, to the west by SR 1177 (Pleasant Grove Church Road), and to the south and east by maintained yard or pasture.

Mitigation components planned for the Indian Creek Site consist of the conversion of certain deforested uplands to wetland communities, enhancement of emergent wetlands, preservation of headwater wetlands, restoration and preservation of riparian buffer, enhancement and preservation of uplands, and the placement of conservation easements on mitigation areas.

Immediate plans to provide onsite mitigation credits consist of:

- Creation of approximately 1.5 acres of headwater wetlands from presently deforested uplands through minor grading,
- Enhancement of approximately 1.7 acres of existing emergent wetlands through planting,
- Enhancement of existing wetlands through in-stream grade control in a non-jurisdictional intermittent tributary to Indian Creek,
- Preservation of approximately 4.5 acres of headwater wetlands and scrub-shrub wetlands; 3.9 acres and 0.6 acres respectively,
- Enhancement of approximately 1,280.0 feet (3.0 acres) of stream through 480.0 feet (0.6 acres) of buffer restoration and 800 feet (2.4 acres) of buffer preservation, and
- Enhancement of 6.4 acres of uplands through planting and preservation of 4.4 acres of existing forested uplands for a total of 10.8 acres of upland buffer.

FIGURE 1 – SITE LOCATION MAP

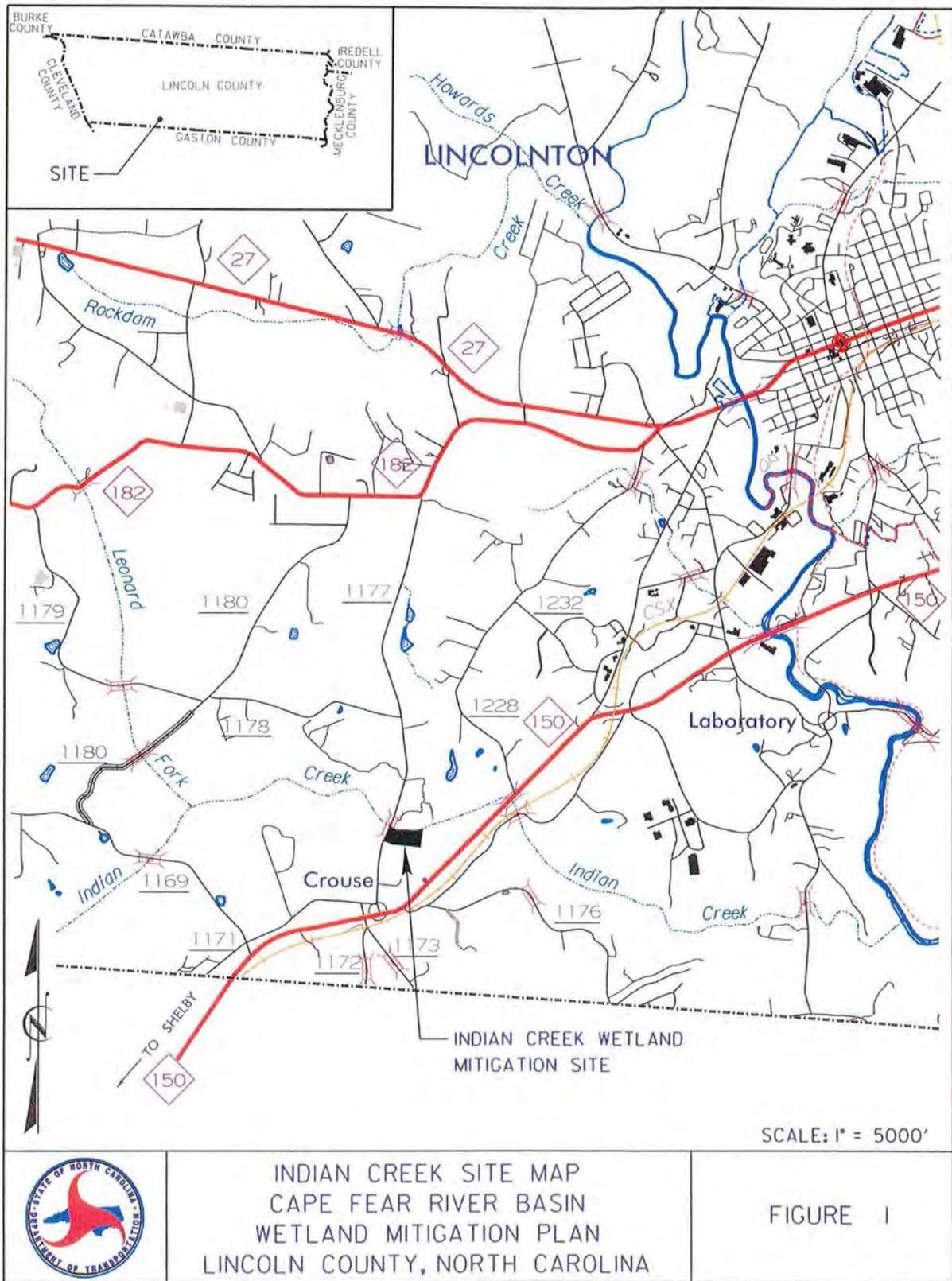


INDIAN CREEK SITE MAP
 CATAWBA RIVER BASIN
 WETLAND MITIGATION PLAN
 LINCOLN COUNTY, NORTH CAROLINA

SCALE: 1" = 5000'

FIGURE 1

FIGURE 1 – SITE LOCATION MAP



2.0 EXISTING CONDITIONS

2.1 PHYSIOGRAPHY, SITE HISTORY, AND LAND USE

The Indian Creek Site is located in the south-central portion of the Southern Piedmont Physiographic Province of North Carolina. Elevations on the Site range from approximately 760.0 feet above mean sea level (msl) along Indian Creek to approximately 800.0 feet above msl. The Site is bordered to the north by Indian Creek, to the west by SR 1177 (Pleasant Grove Church Road), and to the south and east by maintained yard or pasture. The property is currently used for pasture. Historical aerial photography from 1938 indicates the same land use on the site that is present today.

2.2 WATER RESOURCES

2.2.1 Water Bodies

One small ephemeral pool, located in the scrub-shrub community, exists on the Indian Creek Site. It is located in the northwestern portion of the site approximately 150.0 feet east of Pleasant Grove Church Road and 100.0 feet south of Indian Creek. It comprises an area of less than 0.1 acre.

The regional water table remains within several feet of the ground surface throughout much of the year. Because of this sustained high water table, the water level within the ephemeral pool is maintained primarily via groundwater discharge. At the time of the site investigation, the water level in the pool ranged from approximately 1.0 to 15.0 inches. The water level is supplemented by precipitation and, less frequently, by major periodic flooding when Indian Creek overtops its banks. The ephemeral pool does not have a direct outlet to Indian Creek.

2.2.2 Waterways

The Site is bounded to the north by Indian Creek. Indian Creek is a fourth order perennial stream where it adjoins the property. Indian Creek has a sandy substrate with a bankfull depth of approximately 5.0 feet, bankfull width of approximately 39.0 feet, and a depth from the top of bank to the channel bed of approximately 10.0 feet. It appears that Indian Creek is incised within the historic floodplain. Consequently, overbank flooding is rare.

2.2.3 Groundwater

The *Soil Survey of Lincoln County, North Carolina* (USDA, 1995) reports depths to the seasonal high water table ranging from 0.5 foot (in areas underlain by Chewacla loam) to greater than 6.0 feet (in areas underlain by Pacolet sandy clay loam).

2.3 SOILS

According to the *Soil Survey of Lincoln County, North Carolina* (USDA, 1995) soil mapping, the Indian Creek Site is entirely underlain by non-hydric soils, some of which have hydric inclusions. Non-hydric soil units mapped within these areas by the Lincoln County Soil Conservation Service (SCS) consist of Chewacla loam (0 to 2 percent slopes), Helena sandy loam (1 to 6 percent slopes), Pacolet sandy clay loam (2 to 8 percent slopes), Rion sandy loam (2 to 8 and 8 to 15 percent slopes), and Riverview loam (0 to 2 percent slopes) (Figure 2).

Soil borings taken during field investigations confirmed the SCS soil mapping. The soil borings taken within the jurisdictional wetlands were hydric and therefore assumed to be a hydric inclusion of the mapped Chewacla soil. Mitigation activities will primarily involve the Chewacla soils. Chewacla soils are somewhat poorly drained with a seasonal high water table at a depth of 0.5 to 1.5 feet. The main limitations of this soil series are wetness and frequency of flooding.

Mitigation activities are not recommended in the Riverview soil series that is located on the levee adjacent to Indian Creek. This soil type is a very deep well drained soil. It consists mostly of depositional material from historic overbank flooding. Attempts to include these areas in wetland creation risk the drainage of the existing wetlands.

FIGURE 2 – SOILS

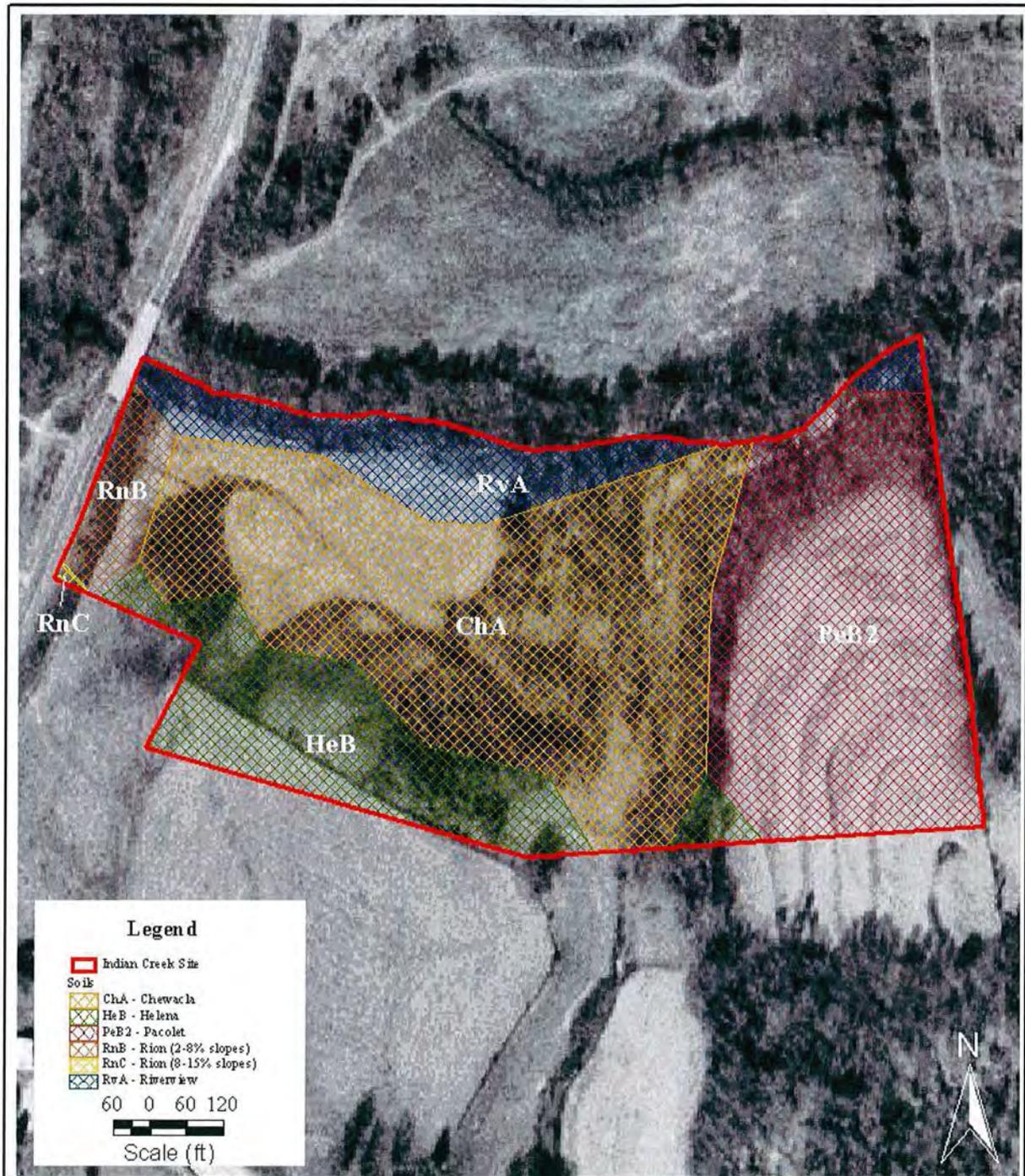


Figure 2
Soils

2.4 NATURAL VEGETATION COMMUNITIES

Classification of the Natural Communities of North Carolina, Third Approximation (Schafale and Weakley, 1990) was utilized to categorize the site's natural vegetation communities. Natural communities identified during site investigations consist of Piedmont/Low Mountain Alluvial Forest and Mesic Mixed Hardwood Forest (Piedmont Subtype). Disturbed and less developed areas, not categorized by Schafale and Weakley, include scrub-shrub, emergent, and pasture communities. The communities and the acreages of wetlands and uplands in each community are presented in Table 1.

TABLE 1 – NATURAL COMMUNITIES

NATURAL COMMUNITIES	WETLANDS (AC)	UPLANDS (AC)	TOTAL (AC)
Piedmont/Low Mountain Alluvial Forest	3.9	2.8	6.7
Mesic Mixed Hardwood Forest	-	2.1	2.1
Scrub-Shrub Community	0.6	-	0.6
Emergent Community	1.7	-	1.7
Pasture Community	-	8.9	8.9
TOTAL	6.2	13.8	20.0

2.4.1 Piedmont/Low Mountain Alluvial Forest

The Piedmont/Low Mountain Alluvial Forest is located in the floodplain of Indian Creek (Figure 3) and comprises an area of approximately 6.7 acres. Approximately 3.9 acres of this community is a delineated wetland (verified April 29, 1997 by Steve Chapin of the US Army Corp of Engineers (USACE) (Figure 3). The hydrology of the wetland in this community is largely driven by groundwater and supplemented by over-land flow and precipitation. Vegetation along the south bank of Indian Creek from the bridge to approximately 480.0 feet downstream consists of only a narrow strip, approximately 10 feet wide. Consequently, it is proposed that 50 feet from the top of bank (0.6 acres) be restored to a Piedmont/Low Mountain Alluvial Forest Community to provide an effective riparian buffer. The soils in this area include Chewacla and Riverview.

The canopy is composed of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), water oak (*Quercus nigra*), river birch (*Betula nigra*), sweet-gum (*Liquidambar styraciflua*), and black walnut (*Juglans nigra*). Saplings and shrubs within this community consist of ironwood (*Carpinus caroliniana*), tag alder (*Alnus serrulata*), Chinese privet (*Ligustrum sinense*), red maple, eastern red cedar (*Juniperus virginiana*), green ash, box elder (*Acer negundo*), and sweet-gum. Herbs and vines include wild onion (*Allium canadense*), strawberry (*Fragaria* sp.), false nettle (*Boehmeria cylindrica*), Christmas fern (*Polystichum acrostichoides*), microstegium (*Microstegium vimineum*), bamboo (*Smilax laurifolia*), and grape (*Vitis* sp.).

2.4.2 Mesic Mixed Hardwood Forest (Piedmont Subtype)

As described under *Classification of the Natural Communities of North Carolina* (Schafale and Weakley, 1990), Mesic Mixed Hardwood Forests (Piedmont Subtype) occur on lower slopes, steep north-facing slopes, ravines, and occasionally drained small stream bottoms, on acidic soils.

On the Indian Creek Site, the Mesic Mixed Hardwood Forest (Piedmont Subtype) occurs largely on slopes grading to the Piedmont/Low Mountain Alluvial Forest (Figure 3) and comprises an area of approximately 2.1 acres. There are no jurisdictional wetlands within this community. The soils are composed of Pacolet sandy clay loam.

The canopy of the Mesic Mixed Hardwood Forest is dominated by post oak (*Quercus stellata*), mockernut hickory (*Carya tomentosa*), sweet-gum, red maple, willow oak (*Quercus phellos*), princess tree (*Paulownia tomentosa*), rock chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), pignut hickory (*Carya glabra*), American beech (*Fagus grandifolia*), scarlet oak (*Quercus coccinea*), and sourwood (*Oxydendrum arboreum*). Dominant saplings include ironwood, persimmon (*Diospyros virginiana*), eastern red cedar, American holly (*Ilex opaca*), and black cherry (*Prunus serotina*). The shrub layer is not well developed. Where present, the herbaceous layer is comprised of rattlesnake fern (*Botrychium virginianum*), strawberry bush (*Euonymus americanus*), Japanese honeysuckle (*Lonicera japonica*), wild onion, Christmas fern, aster (*Aster* sp.), St. John's-wort (*Hypericum* sp.), crane-fly orchid (*Tipularia discolor*), bloodroot (*Sanguinaria canadensis*), and spotted wintergreen (*Chimaphila maculata*).

2.4.3 Scrub-Shrub Community

The scrub-shrub community occurs on the western portion of the Indian Creek Site and comprises an area of approximately 0.6 acre. The entire 0.6-acre area is a jurisdictional wetland (verified April 29, 1997 by Steve Chapin, USACE) (Figure 3). The wetlands are surrounded by a pasture community to the north, west, and south, and an emergent wetland community to the east (Figure 3). The soils in this community are mapped as Chewacla loam (UDSA, 1995).

The sapling and shrub layer in this community is composed of tag alder, elderberry (*Sambucus canadensis*), green ash, red maple, silky dogwood (*Cornus amomum*), black willow (*Salix nigra*), rose (*Rosa multiflora*), giant cane (*Arundinaria gigantea*), and button bush (*Cephalanthus occidentalis*). The herbaceous layer is dominated by soft rush (*Juncus effusus*), false nettle, sedge (*Carex* sp.), tearthumb (*Polygonum sagittatum*), jewelweed (*Impatiens capensis*), and meadow-beauty (*Rhexia mariana*). The edges of this community are dominated by blackberry (*Rubus* sp.).

2.4.4 Emergent Community

On the Indian Creek Site, jurisdictional emergent wetlands occur as a successional community within the northwestern and central portion of the Site and comprise an area of approximately 1.7 acres (verified April 29, 1997 by Steve Chapin, USACE) (Figure 3). It occurs in the central portion of the property between the scrub-shrub community and the Piedmont/Low Mountain Alluvial Forest (Figure 3). This community is degraded due to horse grazing. As a result of this degradation, it is proposed that this community be enhanced by removal of the horses, gating access points to limit outside disturbance, and planting of vegetation. All horses have been removed from the property since March 2002.

The shrub and herbaceous layer of this community consists primarily of rose, blackberry, bulrush (*Scirpus* sp.), rush, aster, nightshade (*Solanum carolinense*), knotweed (*Polygonum* sp.), false nettle, and sedges.

FIGURE 3 – NATURAL COMMUNITIES

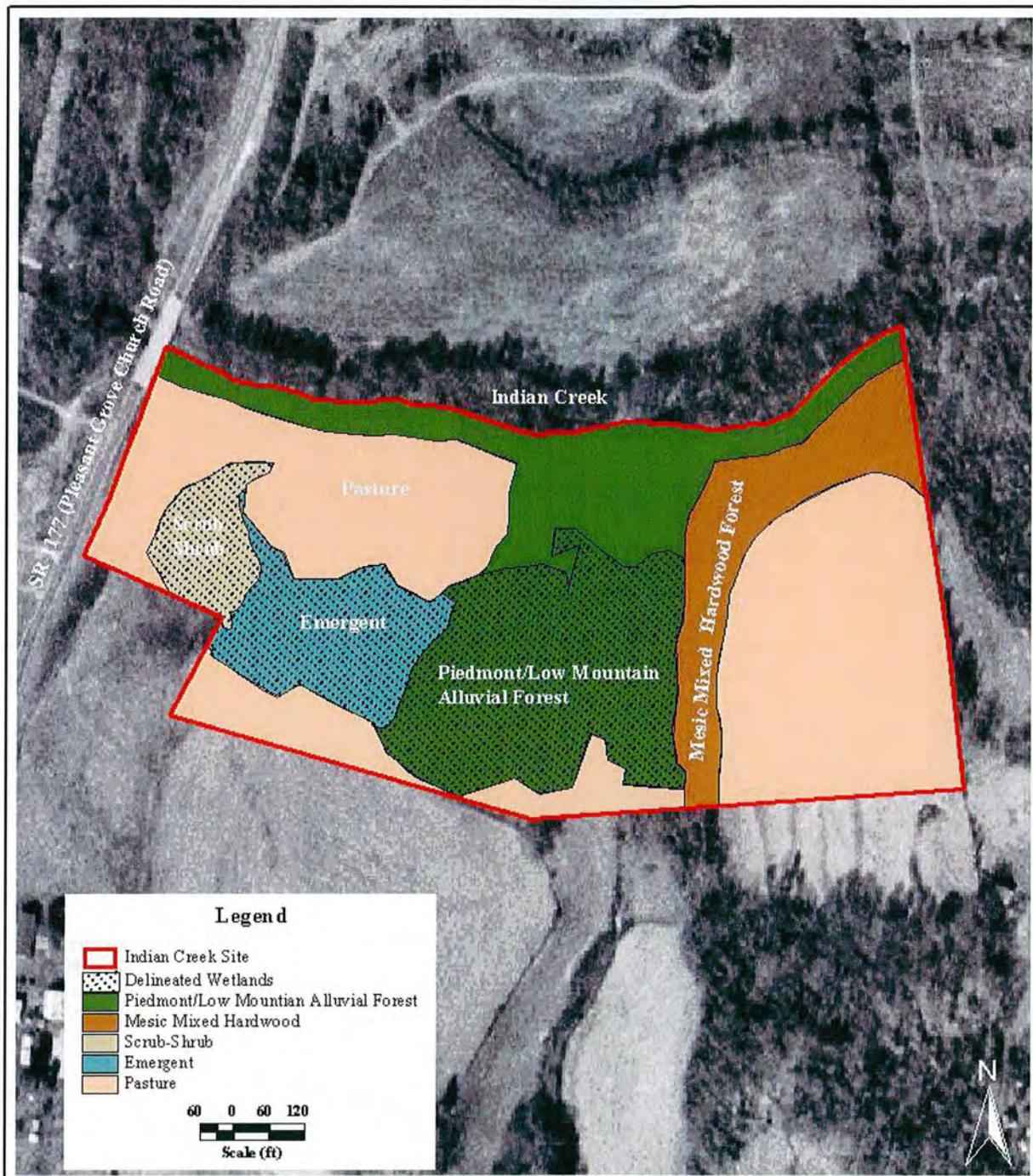


Figure 3
Natural Communities

2.4.5 Pasture Community

The pasture community includes 8.9 acres of open, grassy area (Figure 3). The pasture community is typified by grass (Poaceae), nightshade, blackberry, foxtail grass (*Alopecurus* sp.), dandelion (*Taraxacum* sp.), dog-fennel (*Eupatorium capillifolium*), aster, broom sedge (*Andropogon virginicus*), wild onion, and thistle (*Carduus* sp.).

2.5 WILDLIFE AND HABITAT

Wildlife habitat on the Indian Creek Site consists of open, forested, and edge areas. Although fragmented the forested areas provide good cover. The riparian area is the only portion of the Site that provides a forested wildlife corridor to off-site forested areas.

Mammalian species directly observed or indicators of mammalian species observed (tracks, burrows, and scat) on the Indian Creek Site include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), striped skunk (*Mephitis mephitis*), and various small rodents.

Birds observed onsite include Carolina wren (*Thryothorus ludovicianus*), red-bellied woodpecker (*Melanerpes carolinus*), downy woodpecker (*Picoides pubescens*), belted kingfisher (*Ceryle alcyon*), eastern bluebird (*Sialia sialis*), northern mockingbird (*Mimus polyglottos*), blue jay (*Cyanocitta cristata*), great blue heron (*Ardea herodias*), red-tailed hawk (*Buteo jamaicensis*), mourning dove (*Zenaida macroura*), tufted titmouse (*Baeolophus bicolor*), common flicker (*Colaptes auratus*), American crow (*Corvus brachyrhynchos*), song sparrow (*Melospiza melodia*), white throated sparrow (*Zonotrichia albicollis*), golden-crown kinglet (*Regulus satrapa*), eastern towhee (*Pipilo erythrophthalmus*), northern bobwhite (*Colinus virginianus*), northern cardinal (*Cardinalis cardinalis*), eastern meadowlark (*Sturnella magna*), gull (Laridae), American goldfinch (*Carduelis tristis*), eastern phoebe (*Sayornis phoebe*), Canada goose (*Branta canadensis*), common grackle (*Quiscalus quiscula*), and American woodcock (*Scolopax minor*).

Reptiles and amphibians observed onsite include northern water snake (*Nerodia sipedon*), southern leopard frog (*Rana sphenoccephala*), upland chorus frog (*Pseudacris triseriata*), and spring peeper (*Hyla crucifer*). Invertebrate species observed include crayfish (Cambaridae), Asiatic clam (*Corbicula fluminea*), and mayfly larvae (Ephemeroptera).

2.6 FEDERALLY PROTECTED SPECIES AND FEDERAL SPECIES OF CONCERN

Plants and animals with federal classifications of endangered, threatened, proposed endangered, and proposed threatened are protected under provisions of Section 7 and Section 9 of the Endangered Species Act of 1973, as amended. As of 31 May 2002, the US Fish and Wildlife Service lists two federally protected species for Lincoln County (Table 2). No reports of federally protected species on or in the vicinity of the Indian Creek Site are contained within the current database maintained by the North Carolina Division of Natural Heritage (as updated through April of 2002). A brief description of the characteristics and habitat requirements for this species is provided in the following section.

TABLE 2 – FEDERALLY PROTECTED SPECIES FOR LINCOLN COUNTY, NC

Scientific Name	Common Name	Status
<i>Hexastylis naniflora</i>	Dwarf-flowered heartleaf	Threatened
<i>Rhus michauxii</i>	Michaux's sumac	Endangered

- "Endangered" denotes a species in danger of extinction throughout all or a significant portion of its range.
- "Threatened" denotes a species likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

2.6.1 Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

Plant Family: Aristolochiaceae

Date Listed: April 14, 1989 (Threatened)

Characteristics:

This species has the smallest flowers of any North American plant in the genus *Hexastylis*. The flowers of most individuals are less than 0.4 inch (1.0 centimeter) long, and their sepal tubes are narrow, never more than 0.2 to 0.3 inch (0.6 to 0.7 centimeter) wide even in flower. Flower color usually ranges from beige to dark brown; sometimes it is greenish or purplish. The flowers are jug-shaped, and the plant's dark green leaves are heart-shaped, evergreen, and leathery. Plant stalks are long and thin, originating from an underground root. Another name for this species is dwarf-flowered wild ginger.

Habitat:

Dwarf-flowered heartleaf grows in acidic, sandy loam soils along bluffs and nearby slopes (usually north facing); in boggy areas adjacent to creekheads and streams; and along the slopes

of hillsides and ravines. Soil type is the most important habitat requirement. The species needs Pacolet, Madison gravelly sandy loam, or Musella fine sandy loam soils to grow and survive. Provided the soil type requirement exists, the plant can survive in either dry or moderately moist habitat. For maximum flowering, the plant needs sunlight in early spring. Creekheads where shrubs are rare and bluffs with light gaps are the habitat types most conducive to flowering and high seed production. Seed output is lowest in bluff populations with a lot of shade.

Threats to Species:

Timber harvesting, urbanization, conversion from woodlands to pasture, reservoir construction, pond construction, trash, and insecticide use are threatening the remaining populations. The eight populations in Greenville, South Carolina are all endangered by residential, industrial, and commercial expansion. The largest population in South Carolina (1,400 plants) once contained over 4,000 plants, but this population was reduced by reservoir construction in Spartanburg. Any use of insecticides in or around plant populations could reduce flies, thrips, and ants, thus decreasing the likelihood of plant pollination.

Investigation:

The North Carolina Natural Heritage Program's database of rare species and unique habitats was reviewed (as updated through April 2002), and no populations of the species were recorded in the project vicinity. The project area was investigated on July 9 and 10, 1992 and May 21 and 22, 2002 in areas of suitable habitat. Suitable habitat is present in the form of north facing slopes on Pacolet soils in the Mesic Mixed Hardwood Forest described in Section 2.4.2. This area of suitable habitat will not be affected by grading activities or other forms of manipulation. There were no findings of dwarf-flowered heartleaf (*Hexastylis naniflora*) at the time of the field surveys. Consequently, the biological conclusion is "No Effect".

Biological Conclusion:

No Effect

2.6.2 Michaux's Sumac (*Rhus michauxii*)

Plant Family: Anacardiaceae

Date Listed: September 28, 1989 (Endangered)

Characteristics:

Michaux's sumac is a dioecious shrub growing to a height of 0.06 to 0.31 feet. Plants flower in June, producing a terminal, erect, dense cluster of 4 to 5 parted greenish-yellow to white flowers.

Fruits, produced from August through September, are red, densely short-pubescent drupes, 0.25 inch across. Most populations, however, are single sexed and reproduce only by rhizomes. The entire plant is densely pubescent. The deciduous leaves are composed of 9 to 13 sessile, oblong leaflets on a narrowly winged or wingless rachis. The acute to acuminate leaflets have rounded bases and are 1.5 to 3.5 inches long and 1.0 to 2.0 inches wide. They are simply or doubly serrate.

Habitat:

This species prefers sandy, rocky, open woods and roadsides. Its survival is dependent on disturbance (mowing, clearing, fire) to maintain an open habitat. It is often found with other members of its genus as well as with poison ivy (*Toxicodendron radicans*). There is no longer believed to be an association between this species and specific soil types.

Threats to Species:

This species is threatened by loss of habitat. Since its discovery, 50 percent of Michaux's sumac habitat has been lost due to its conversion to silvicultural and agricultural purposes and development. Fire suppression and herbicide drift have also negatively impacted this species.

Investigation:

The North Carolina Natural Heritage Program's database of rare species and unique habitats was reviewed (as updated through April 2002) and no populations of the species were recorded in the project vicinity. The project area was investigated on July 9 and 10, 1992 and May 21 and 22, 2002 in areas of suitable habitat. Suitable habitat is present in the form of maintained roadside and disturbed edge in the pasture areas adjacent to existing forest and fence lines. These areas of suitable habitat will not be affected by grading activities or other forms of manipulation. There were no findings of Michaux's sumac (*Rhus michauxii*) at the time of the field surveys. Consequently, the biological conclusion is "No Effect".

Biological Conclusion:

No Effect

3.0 MITIGATION PLAN

Mitigation components planned for the Indian Creek Site consist of the conversion of certain deforested uplands to wetland communities, enhancement of emergent wetlands, preservation of headwater wetlands, restoration and preservation of riparian buffer, enhancement and preservation of uplands, and the placement of conservation easements on mitigation areas (Table 3). Immediate plans to provide onsite mitigation credits consist of:

- Creation of approximately 1.5 acres of headwater wetlands from presently deforested uplands through minor grading,
- Enhancement of approximately 1.7 acres of existing emergent wetlands through planting,
- Enhancement of existing wetlands through in-stream grade control in a non-jurisdictional intermittent tributary to Indian Creek,
- Preservation of approximately 4.5 acres of headwater wetlands and scrub-shrub wetlands; 3.9 acres and 0.6 acres respectively,
- Enhancement of approximately 1,280.0 feet (3.0 acres) of stream through 480.0 feet (0.6 acres) of buffer restoration and 800 feet (2.4 acres) of buffer preservation, and
- Enhancement of 6.4 acres of uplands through planting and preservation of 4.4 acres of existing forested uplands for a total of 10.8 acres of upland buffer.

TABLE 3 – AVAILABLE MITIGATION AREAS

MITIGATION COMPONENT	AMOUNT
Wetlands	7.7 acres
Wetland Creation	
<i>Headwater Forest</i>	1.5 acres
Wetland Enhancement	
<i>Emergent Wetlands</i>	1.7 acres
Wetland Preservation	
<i>Headwater Forest</i>	3.9 acres
<i>Scrub-shrub Wetlands</i>	0.6 acres
Stream	1,280 feet (3.0 acre)
Stream Enhancement (Riparian Buffer)	
<i>South Bank of Indian Creek</i>	480 feet (0.6 acre)
Stream Preservation	
<i>South Bank of Indian Creek</i>	800 feet (0.9 acre)
<i>North Bank of Indian Creek</i>	1,280 feet (1.5 acres)
Uplands	10.8 acres
Enhancement	6.4 acres
Preservation	4.4 acres

3.1 WETLANDS

On the 20.0-acre Indian Creek Site, there is opportunity for preservation, enhancement, and creation of wetlands.

3.1.1 Creation

Approximately 1.5 acres of headwater wetlands will be created on the Indian Creek Site through excavation (approximately 1.0 to 2.0 feet) (Table 3). Excavation will take place immediately north of the existing emergent wetlands extending 50.0 to 150.0 feet toward Indian Creek. The proposed wetland creation areas are shown in Figure 4.

The elevations of the creation areas will be graded to the approximate elevation of the existing wetlands, thus the targeted hydrologic regime will be that of the existing wetlands.

3.1.1.1 Hydrology

A seasonally inundated or saturated hydroperiod will be the primary hydrologic regime provided for the proposed headwater wetlands community. In accordance with Table 5 of the *Corps of Engineers' Wetlands Delineation Manual*, field criteria to be used to determine the presence of this seasonally inundated to saturated hydrologic regime will be saturated conditions within a major portion of the root zone (i.e., within 12.0 inches of the surface) for between 5.0 to 12.5 percent of the growing season in most years.

The dominant component of the water budget for these areas will be groundwater provided by grading to intercept the seasonal high water table. Groundwater monitoring during the growing season will be required to determine the groundwater elevation across the site. The remainder of the water budget will be derived from precipitation and effective utilization of drainage from the proposed highway. To maximize the stormwater contribution and prevent drainage from the site, it is recommended that the lateral drainage adjacent to SR 1177 be filled, and a clay plug inserted at its confluence with Indian Creek.

3.1.1.2 Soils

No new soils will be introduced to the Indian Creek Site for mitigation. It is recommended that the existing topsoil be utilized for planting substrate within the proposed mitigation areas by removing, stockpiling, and replacing it after grading activities. This procedure is recommended because the existing soil holds seed stock of the existing flora, and it will provide a nutrient rich soil for planting, thereby reducing the need for excessive fertilization or the transportation of topsoil to the site. If additional topsoil is needed, it may be possible that some can be removed from the location of the proposed new alignment of NC 150.

3.1.1.3 Vegetation

The proposed headwater wetlands will be planted with a mix of trees in the form of bare root seedlings. Planting of species using dormant plant stock will be performed between December 1 and March 15. Trees will be planted within proposed headwater wetlands to provide a minimum stem count of 680 stems per acre. This translates to plantings roughly on 8.0-foot centers. Tree species to be planted will be derived from the following list (as available):

- River birch (*Betula nigra*)
- Green ash (*Fraxinus pennsylvanica*)
- Water oak (*Quercus nigra*)
- American elm (*Ulmus americana*)
- Ironwood (*Carpinus caroliniana*)
- Willow oak (*Quercus phellos*)
- Black walnut (*Juglans nigra*)
- Sycamore (*Platanus occidentalis*)

3.1.2 Enhancement

Enhancement is proposed in the 1.7 acres of existing emergent wetlands and in the Piedmont/Low Mountain Alluvial Forest (Figure 4). In the emergent areas, enhancement will entail diversion of drainage and the planting of hydrophytic vegetation. Hydrology will be enhanced through roadway design, increasing the existing drainage area by approximately 3.0 acres. This diversion of drainage into the existing wetland will aid in the filtration of the runoff before it reaches Indian Creek. Vegetation will be enhanced by planting the same tree species recommended in the creation areas (Section 3.1.1.3). Vegetation enhancement in these emergent wetlands will enhance wildlife habitat in terms of both food and cover. Vegetation enhancement

3.3 UPLANDS

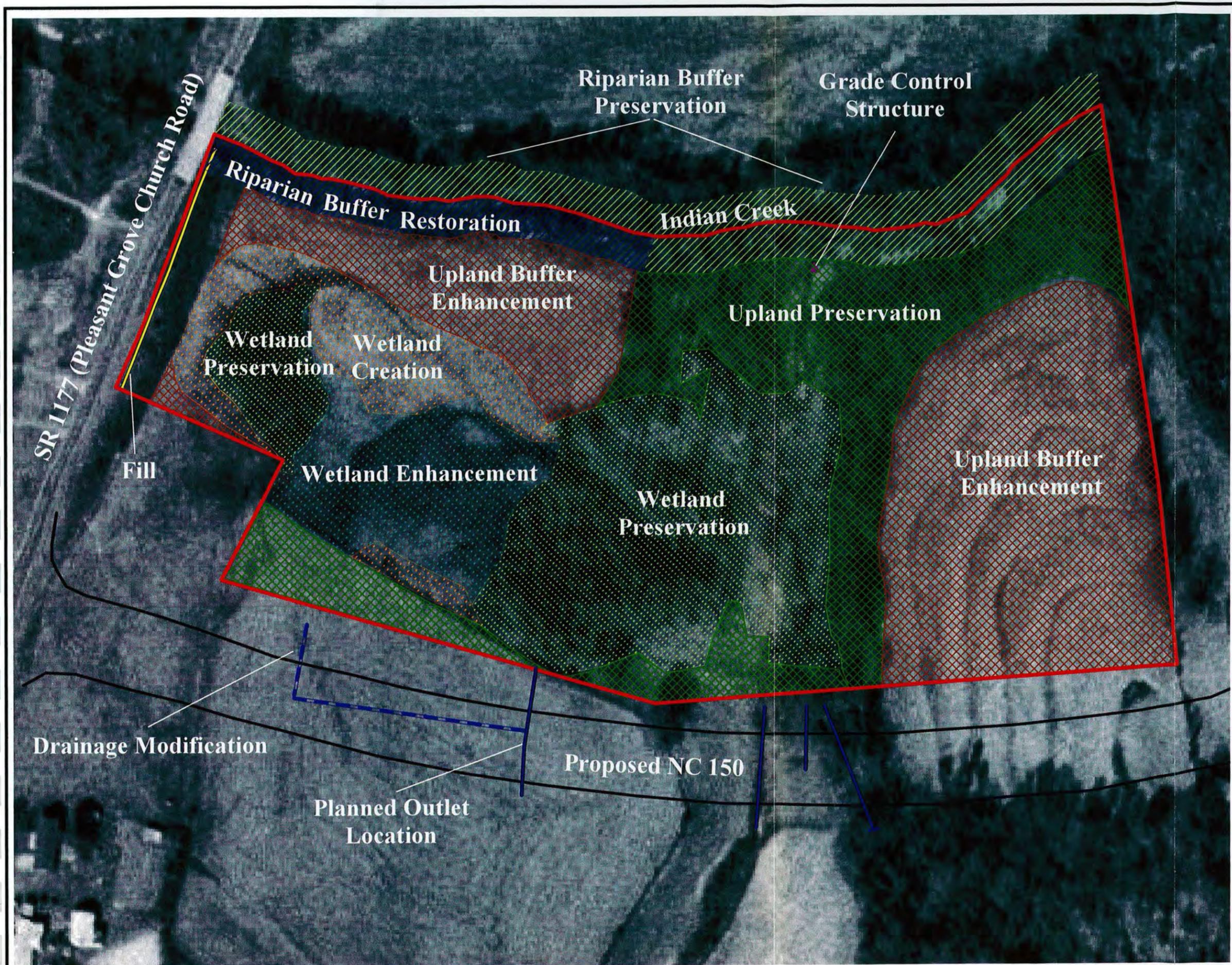
The upland areas are located in the Piedmont/Low Mountain Alluvial Forest, Mesic Mixed Hardwood Forest (Piedmont Subtype), and pasture community. Presently the upland areas total 10.8 acres (Figure 4).

This mitigation component requires the removal of horses from the site, gating access points to the property to limit outside disturbances, and the planting of 6.4 acres of the upland pasture areas. Vegetation enhancement of the upland areas will provide a buffer to all wetlands and enhance wildlife habitat by providing a more expansive forest ecosystem. Approximately 1.2 acres of uplands will be left open to encourage early successional old field plant species, as well as provide edge habitat for animals. Additionally, 4.4 acres of forested uplands can be preserved on the site.

Trees will be planted within the recommended upland areas to provide a minimum stem count of 680 stems per acre. This translates to plantings roughly on 8.0-foot centers. Tree species to be planted will be derived from the following list (as available):

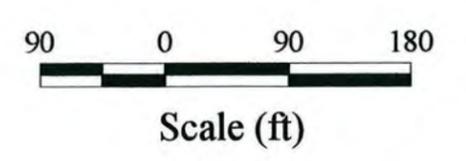
- White oak (*Quercus alba*)
- Tulip poplar (*Liriodendron tulipifera*)
- Scarlet oak (*Quercus coccinea*)
- Mockernut hickory (*Carya tomentosa*)
- Willow oak (*Quercus phellos*)
- Black walnut (*Juglans nigra*)
- Pignut hickory (*Carya glabra*)
- Black cherry (*Prunus serotina*)

Figure 4 Mitigation Plan



Legend

- Indian Creek Site
- Wetland Creation
- Wetland Enhancement
- Wetland Preservation
- Upland Buffer Enhancement
- Upland Preservation
- Riparian Buffer Restoration
- Riparian Buffer Preservation
- Drainage Outlet
- Fill
- Proposed NC 150
- Grade Control Structure



4.0 REFERENCE WETLANDS

The reference wetlands for the proposed headwater wetlands creation component consists of the wetlands within the Piedmont/Low Mountain Alluvial Forest and the existing emergent wetlands located within the central portion of the site, as described previously in Sections 2.4.1 and 2.4.4 (Figure 5) respectively. The Piedmont/Low Mountain Alluvial Forest wetlands and the emergent wetlands references comprise an area of approximately 3.9 acres and 1.7 acres respectively. The Piedmont/Low Mountain Alluvial Forest wetlands will be a reference for vegetation due to its current level of succession or mature canopy. The emergent community will be a hydrology reference due to its proximity to the proposed creation areas. To date, hydrologic monitoring within the reference wetland consists of data from groundwater monitoring gauges monitored February through May (2002).

5.0 MONITORING PLAN

Monitoring of wetland compensation (creation) efforts will be performed for five years or until success criteria are satisfied. Monitoring is proposed for two wetland components, hydrology and vegetation.

5.1 HYDROLOGY

Automated groundwater monitoring gauges utilized to monitor hydrology on the Indian Creek Site were designed and placed in accordance with specifications in the Corps of Engineers' *Installing Monitoring Wells/Piezometers in Wetlands* (WRP Technical Note HY-IA-3.1, August, 1993). Groundwater monitoring gauges installed are Remote Data Systems, Inc. model RDS WL-40® automated groundwater monitoring gauges. These automated groundwater monitoring gauges will continuously record water level data along a 40.0-inch gradient.

To monitor groundwater levels, RDS WL-40® (40.0-inch) automated groundwater monitoring gauges have been installed within potential creation areas (proposed headwater wetlands), enhancement areas, and existing wetlands (Figure 5). To monitor surface water elevations, one RDS WL-40® groundwater monitoring gauge was mounted above-grade on a wooden pole. The pole was appropriately anchored to ensure its stability. The bottom of the unit was set at ground level. In this configuration, the RDS WL-40® groundwater monitoring gauge is capable of

FIGURE 5 – DELINEATED WETLANDS, REFERENCE WETLAND, AND GAUGE LOCATIONS

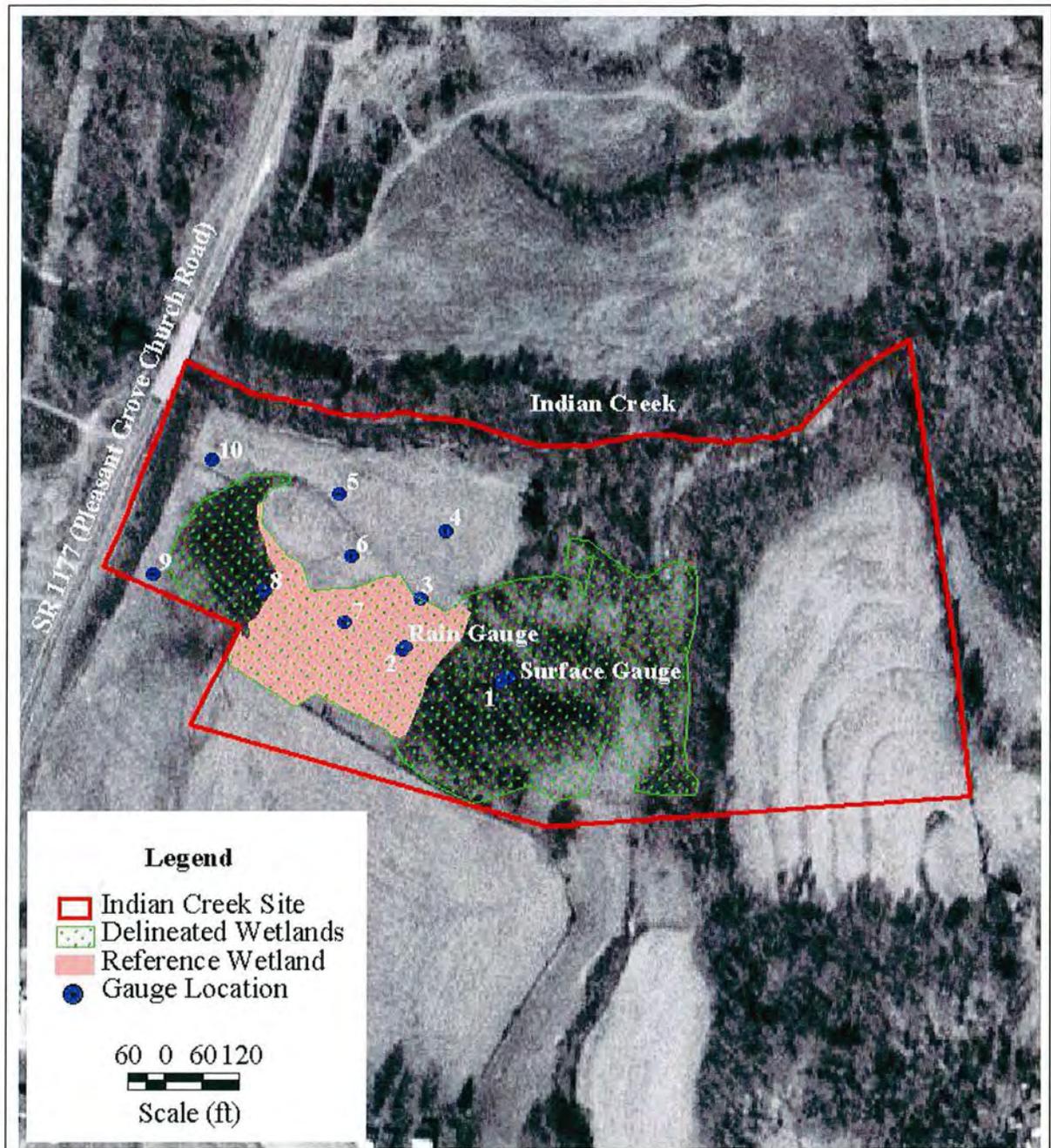


Figure 5
Delineated Wetlands, Reference Wetland, and
Gauge Locations

recording water levels 40.0 inches above the ground surface. The purpose of this above-grade unit is to monitor depth and duration of inundation in the existing wetlands. An Infinity® rain gauge was also installed onsite.

5.1.1 Monitoring

Following installation, the continuous-logging automated groundwater monitoring gauges, surface gauge, and the rain gauge were adjusted to record once daily. The gauges will be in operation throughout the year, and data will be downloaded at intervals sufficiently spaced to provide effective monitoring and assessment of success criteria for hydrology.

5.1.2 Success Criteria

For compensatory areas proposed to support headwater wetlands, hydrological success criteria will be defined as inundated or saturated soil conditions within a major portion of the root zone (i.e., within 12.0 inches of the surface) for greater than or equal to 10.0 percent of the growing season in most years. This is based on the approximate percentage of continuous wetland hydrology from groundwater gauge data available within the reference wetland from the beginning of the growing season, March 22, through May 29 (30 percent of the growing season). Areas supporting the aforementioned wetland hydrology regimes are required to support a prevalence of hydrophytic vegetation and hydric soils.

Groundwater monitoring gauges were installed in the existing wetlands. Groundwater monitoring gauges installed within the existing wetlands will be compared to groundwater data collected from those gauges installed within compensatory wetlands to assess the degree to which the wetland mitigation goals are met.

5.2 VEGETATION

Monitoring methods for vegetation within compensatory areas have been developed in accordance with the Army Corps of Engineers – Wilmington District *Compensatory Hardwood Mitigation Guidelines* (1993). A general discussion of the compensatory wetlands monitoring plan is provided in the following sections.

5.2.1 Monitoring

After planting has been completed, an initial evaluation will be performed to verify planting methods and to determine initial species composition and density. Permanent photography stations will be established at selected vantage points to provide a visual record of vegetation development over time.

During the first year after planting, the Indian Creek Site will receive cursory visual evaluation on a periodic basis to ascertain the degree of overtopping of planted trees by nuisance species. Subsequently, quantitative sampling of vegetation will be performed after each growing season until vegetation success criteria is achieved.

Vegetation sampling plots will be established within the compensatory mitigation areas. Monitoring plots will be established and permanently located, providing a representative sample of the site. Vegetation monitoring plots will be correlated with hydrological monitoring sites in most cases to allow for point-source data of hydrologic and vegetation parameters.

5.2.2 Success Criteria

Success criteria have been established to verify that wetland creation areas support vegetation necessary for a jurisdictional determination. Additional success criteria are dependent upon the density and growth of characteristic forest species. For the forested wetlands, a minimum count of 320 trees per acre must be achieved within three years of initial planting and a minimum count of 260 trees per acre must be achieved within five years of initial planting.

5.3 CONTINGENCY

In the event that vegetation or hydrology success criteria are not fulfilled, appropriate contingency measures will be identified and implemented. If success criteria are not satisfied, appropriate contingency measures will be identified in coordination with the appropriate agencies. In the event that the specified wetland hydrology success criteria are not achieved during the monitoring period, the only practicable contingency measure would entail minor grade adjustments. Should grade adjustment not be feasible, redefinition of mitigation goals and strategies will be required. Redefinition of mitigation goals and strategies would be carried out in close consultation with the Corps of Engineers and other involved agencies.

6.0 MITIGATION VALUE

The proposed compensation is to serve as flexible stream mitigation for impacts caused by NC 150 (TIP Project Number R-0617). With the construction of NC 150, the Indian Creek Site's functions and values increase even more due to the increase in impervious surface within the watershed. The primary value of the proposed mitigation is the enhancement, preservation, and creation of approximately 20.0 acres of riparian ecosystem. This riparian ecosystem, to be protected in perpetuity, will not only provide valuable habitat to a diverse assemblage of flora and fauna, but will also serve as a contiguous wildlife corridor along Indian Creek.

As contiguous components of a larger ecosystem, areas of proposed wetland creation and enhancement should be viewed from the perspective of their cumulative contribution to the overall value of the wetland ecosystem rather than their individual values. Presently the Indian Creek Site consists of communities of varying succession, with good aquatic habitat, water storage, and pollutant removal. However, with the creation and enhancement of additional wetlands, these functions and values will become even higher. These higher functions and values may result from being a larger, less fragmented community. This larger community will provide a more extensive area for forage and cover for wildlife as well as provide a larger capacity for water storage.

By restoring and preserving the riparian buffer along Indian Creek, connectivity will be restored between the wetlands and Indian Creek, a permanent surface water. This connectivity will provide a more extensive wildlife corridor on and off-site.

7.0 DISPENSATION OF THE PROPERTY

No plan for dispensation of the Indian Creek Site has yet been finalized. Parties, which could provide responsible stewardship of the site, include non-profit conservation organizations (such as the Nature Conservancy), local governments (Lincoln County), land trusts, or continued North Carolina ownership with state agency management. Covenants and/or deed restrictions will be implemented to ensure responsible management and protection of the site in perpetuity.

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