6. NATURAL ENVIRONMENT

Section 6 discusses the natural environment within the project study area, including soils and geology, water resources, biotic communities and wildlife, jurisdictional resources, and protected species. Each subsection presents the affected environment, as well as the potential environmental impacts of the Detailed Study Alternatives.

6.1 SOILS, GEOLOGY, AND MINERAL RESOURCES

6.1.1 SOILS AND GEOLOGY IN THE PROJECT STUDY AREA

Union and Mecklenburg counties are situated in the Southern Piedmont physiographic province of North Carolina. The hilly Piedmont separates the flat coastal plain of eastern North Carolina from the Blue Ridge and Appalachian Mountains to the west. The western part of the Piedmont, where the project is located, is known as the Carolina Slate Belt ecoregion, a narrow band of heated and deformed volcanic and sedimentary rocks that extends from central Georgia to central Virginia.

The topography of the project study area is characterized as gently sloping, with steep areas occurring along drainage ways. Elevations in the immediate project study area range from a high elevation of 640 feet along an upland ridge near the intersection of Wesley Chapel-Stouts Road (SR 1377) and Old Charlotte Highway (SR 1009) (US Geological Survey [USGS] Bakers quadrangle), to a low elevation of 450 feet at Richardson Creek near Wingate (USGS Watson quadrangle).

The US Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS) has published soil surveys for all counties within North Carolina. The surveys for the project study area, *Soil Survey of Union County, North Carolina* (USDA, January 1996) and *Soil Survey of Mecklenburg County, North Carolina* (USDA, June 1980), provide maps showing the soil types within Union County and Mecklenburg County and information on soil properties that can affect land use. The soil surveys identify 31 soil types within the Detailed Study Alternatives (DSA). Properties of soils within the DSAs are shown in **Table 6-1**.

TABLE 6-1: Soils Within the Detailed Study Alternatives

Soil Series (Symbol)	Suitability for Road Construction	Suitability as Roadfill	Shrink-Swell Potential
Chewacla silt loam (ChA)	Severe	Poor	Low
Colfax sandy loam (CoA)	Severe	Poor	Low-Moderate
Helena fine sandy loam (HeB)	Severe	Poor	Low-High
Secrest-Cid complex (ScA)	Severe	Poor	Low
Appling sandy loam (ApB)	Moderate	Fair	Low
Appling sandy loam (ApD)	Moderate	Fair	Low
Badin channery silt loam (BaB)	Severe	Poor	Low-Moderate
Badin channery silt loam (BaC)	Severe	Poor	Low-Moderate
Badin channery silty clay loam (BdB2)	Severe	Poor	Low-Moderate
Badin channery silty clay loam (BdC2)	Severe	Poor	Low-Moderate
Badin-Urban land complex (BuB)	Severe	Poor	Low-Moderate

TABLE 6-1: Soils Within the Detailed Study Alternatives

Soil Series (Symbol)	Suitability for Road Construction	Suitability as Roadfill	Shrink-Swell Potential
Cecil gravelly sandy clay loam (CeB2)	Moderate	Fair	Low
Cecil gravelly sandy clay loam (CeC2)	Moderate	Fair	Low
Cecil sandy clay loam (CeD2)	Moderate	Fair	Low-Moderate
Cecil-Urban land complex (CuB)	Moderate	--	Low-Moderate
Cid channery silt loam (CmB)	Severe	Poor	Low-Moderate
Cid-Urban land complex (CnB)	Severe	Poor	Low-Moderate
Enon sandy loam (EnB)	Severe	Poor	Low-High
Georgeville silty clay loam (GfB2)	Moderate	Good	Low
Goldston very channery silt loam (GoC)	Moderate	Poor	Low
Goldston very channery silt loam (GoE)	Severe	Poor	Low
Goldston-Badin complex (GsB)	Moderate	Poor	Low
Goldston-Badin complex (GsC)	Moderate	Poor	Low
Goldston-Badin complex (GsE)	Severe	Poor	Low
Misenheimer-Cid complex (MhA)	Moderate	Poor	Low
Tatum gravelly silt loam (TaB)	Severe	Poor	Low-Moderate
Tatum gravelly silty clay loam (TbB2)	Severe	Poor	Moderate
Tatum gravelly silty clay loam (TbC2)	Severe	Poor	Moderate
Tatum-Urban land complex (TuB)	Severe	Poor	Moderate
Udorthents, loamy (Ud)	--	--	--
Zion gravelly loam (ZnB)	Severe	Poor	Low-High

Source: *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008), *Soil Survey of Mecklenburg County, NC* (USDA, June 1980), *Soil Survey of Union County, NC* (USDA, January 1996).

6.1.2 MINERAL RESOURCES

According to the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Land Resources, there are several active and inactive permitted mines in Mecklenburg and Union Counties (NCDENR Division of Land Resources Web site: www.dlr.enr.state.nc.us/pages/permittedmines.html). Mecklenburg County has six active mines for crushed stone and Union County has two active mines within the project study area, one for crushed stone (Bakers Quarry) and one for brick clay (Kendrick Mine). Both of these mines are located south of US 74 between Wesley Chapel-Stouts Road (SR 1377) and Rocky River Road (SR 1007).

The Southern Piedmont physiographic province of North Carolina contains gold deposits. A dense concentration of inactive gold mines parallels the Mecklenburg-Union county line. Most of the area's gold mines were opened before the Civil War and were abandoned sometime in the early 1900's. The approximate locations of abandoned gold mines are shown in **Figure 2-10a-cc**.

6.1.3 SOILS AND MINERAL RESOURCE IMPACTS

> ***Soils***
> *The soils in the area underlain by the DSAs are rated "moderate" or "severe" for road construction. The expected soil limitations can be overcome through proper engineering design.*

Soils. The properties of soils, including shrink-swell potential, erosion hazard, risk of corrosion, and suitability as roadfill, can affect the engineering design of a roadway. As shown in **Table 6-1**, the entire area underlain by the DSAs is rated "moderate" or "severe" for road construction. This means that the soil properties indicate that special planning, design, or maintenance is needed to overcome soil limitations. The concern cited in the soil surveys was low strength (i.e., the soil is unable to support loads). Some soils also had shrink-swell potential. Shrink-swell potential is the potential for a soil volume to change with a loss or gain of moisture. Shrinking and swelling can cause damage to structures and roads, if either lack, special design (USDA, January 1996).

The expected soil limitations can be overcome through proper engineering design, including the incorporation of techniques such as soil modification, appropriate choice of fill material, use of non-corrosive subgrade materials, and design of drainage structures capable of conveying estimated peak flows. Decisions regarding soil limitations and methods to overcome them would be determined during the final design phase.

Mineral Resources. None of the active or inactive mines permitted by the NCDENR Division of Land Resources would be impacted by the DSAs. Geotechnical surveys conducted during the final design phase would identify abandoned mine shafts in the area that could affect construction activities. It is expected that abandoned mine shafts can be accommodated in the design and construction of the roadway under any of the DSAs.

6.2 WATER RESOURCES

6.2.1 WATER RESOURCES DESCRIPTIONS

This section discusses water resources in the project study area, existing water quality, and potential impacts to water resources from the DSAs. Details are documented in the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008), incorporated by reference and available on the NCTA Web site (www.ncturnpike.org/projects/monroe).

6.2.1.1 River Basins and Streams

River Basins. The DSAs are located within the Catawba and Yadkin-Pee Dee River Basins (USGS Hydrologic Units 03050103 and 03040105). The majority of the area comprising the DSAs is located within Subbasins 03-07-12 and 03-07-14 of the Yadkin-Pee Dee River Basin, with a small portion west of I-485 located within Subbasin 03-08-34 of the Catawba River Basin. Subbasins 03-07-12 and 03-07-14 are located in the Rocky River watershed, the largest tributary to the Yadkin-Pee Dee River. Subbasin 03-08-34, which includes much of the City of Charlotte metropolitan area, is in the most heavily urbanized region of the Catawba River Basin and is affected by urban runoff as well as discharges from several large wastewater treatment plants

(NC Department of Environment and Natural Resources - Division of Water Quality [NCDENR-DWQ] Web site: http://h2o.enr.state.nc.us/basinwide/documents/CTBB-5.pdf).

Streams. Named streams in the project study area are shown in **Figure 4-4a-c**. The named streams within the Yadkin-Pee Dee River Basin portion of the project study area include the North Fork Crooked Creek, South Fork Crooked Creek, Stewarts Creek, East Fork Stewarts Creek, Richardson Creek, Stumplick Branch, Ray's Fork, Bearskin Creek, Lick Branch, Meadow Branch, and Negro Head Creek. These streams also have numerous unnamed tributaries.

The only streams within the Catawba River Basin portion of the project study area are unnamed tributaries to Fourmile Creek, located to the northwest of the existing I-485/US 74 interchange in the McAlpine Creek Watershed. Streams are discussed in greater detail in **Section 6.4.3**.

There are two types of streams in the Rocky River Watershed: those having sandy substrates and generally consistent summer flows, and those having low summer flows, extensive bedrock formations, and a prevalence of boulder and cobble substrate. This latter stream type is called a "Carolina Slate Belt stream" and is typical of the streams within the project study area.

The width of most streams in the project study area ranges from 1-5 feet, while bankfull depth ranges from 0.5 to 5.0 feet. "Bankfull depth" is the depth during the average storm event that occurs once every 1.2 years.

6.2.1.2 Water Supply Resources

Surface Water Supplies

Lake Twitty is a designated surface water supply.

There is one water body near the DSAs that is designated as a water supply resource. Lake Twitty, northeast of the City of Monroe, is classified as a Water Supply III (WS-III) water supply by the NCDENR-DWQ (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/bims/reports/basinsandwaterbodies/hydroYadkin.pdf).

WS III watersheds are used as sources of water supply for drinking, culinary, or food processing purposes in areas where a more protective WS-I or WS-II classification is not feasible. WS-III waters are generally located within areas of low to moderate development.

As shown in **Figure 4-4b-c**, the eastern portion of the project study area is within the protected area of the water supply watershed for the Lake Twitty reservoir, but outside the critical area. In the WS-III watershed protected area, dischargers must obtain General Permits (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/wswp/wsclasses.html). All DSA corridors also pass through the southern end of the Lake Twitty hazardous spill basin area.

An aeration system is in operation at the lower end of Lake Twitty near the dam. Based upon previous monitoring by NCDENR-DWQ staff, conditions in this reservoir (including elevated nutrients, dissolved oxygen, and pH values) indicate elevated algae productivity. Lake Twitty was sampled ten times from May through September 2006 by NCDENR-DWQ staff to determine if its designated use as a water supply source is being fully supported or if additional management strategies are needed to protect that use.

Lake Twitty was rated as "impaired" based on exceedances of the chlorophyll *a* standard. Lake-wide mean chlorophyll *a* values were greater than the state water quality standard of 40 micrograms per liter (μg/L) from June through September 2006. The highest chlorophyll *a* concentrations were observed at the sampling sites in the arms of the lake (Stewarts Creek and Chinkapin Creek) (*Lake and Reservoir Assessments–Yadkin Pee Dee River Basin,* NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/esb/Basinwide/YadkinLakes2006v7.pdf).

6.2.2 WATER QUALITY

6.2.2.1 Impaired Waters

Section 305(b) of the Clean Water Act (CWA) requires each state to report biennially to the US Environmental Protection Agency (USEPA) on the quality of the waters found in that state. In general, 305(b) reports describe the quality of surface waters, groundwaters, wetlands, and existing programs to protect water quality. The 305(b) report also describes whether the waters support their designated uses (e.g., swimming, aquatic life support, and water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment.

Section 303(d) of the CWA requires states to develop a list of waters, derived from the 305(b) report, that are not meeting water quality standards or which have impaired uses. USEPA's water quality planning and management regulations that implement section 303(d) of the CWA can be found in 40 CFR 130. The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/tmdl/documents/ 2006IR_FINAL_000.pdf).

The portions of North Fork Crooked Creek, South Fork Crooked Creek, and Richardson Creek within the project study area are listed on the 2006 *Final North Carolina 303(d) List* (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/tmdl/documents/303d_Report.pdf). The impaired use is aquatic life, and the potential sources of impairment are urban runoff, agriculture, and construction.

303(d)-Listed Streams in the Project Study Area

North Fork Crooked Creek, South Fork Crooked Creek, Stewarts Creek, and Richardson Creek are listed as having "impaired use" for aquatic life.

In addition to the water bodies on the 2006 list, Stewarts Creek is included on the *Draft 2008 303(d) List* (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/tmdl/documents/B.Draft2008303dList.pdf).

6.2.2.2 Best Usage Classifications

The NCDENR-DWQ classifies stream segments according to their highest supportable use. Unnamed tributaries with no designated best-usage classification share the classification of their respective receiving waters.

Of the eleven named streams within the project study area, eight are classified as Class C waters (*North Carolina Waterbodies Reports*, NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/bims/reports/basinsandwaterbodies/hydroYadkin.pdf). Class C waters are designated for aquatic life propagation and survival, fishing, wildlife, secondary recreation

and agriculture. Secondary recreation refers to any activity involving human body contact with water on an infrequent or incidental basis. Class C waters are the lowest classification of non-degraded waters and are typical of urban watersheds with point and non-point sources, and unrestricted rural watersheds with livestock production.

Stewarts Creek, Lick Branch, and Stumplick Branch, as well as their respective tributaries, have a best-usage classification of WS III. The WS III designation applies to waters protected as water supplies that are generally in watersheds of low to moderate development. Point source discharges of treated wastewater are permitted pursuant to national drinking water regulations and North Carolina rules governing public water supplies. Local programs to control nonpoint source and stormwater discharge of pollution are required. WS III waters are suitable for all Class C uses.

There are no water resources within the project study area classified as "High Quality Waters" or "Outstanding Water Resources."

6.2.2.3 National Pollutant Discharge Elimination System Discharges

The National Pollutant Discharge Elimination System (NPDES) regulates the construction, alteration, and/or operation of any sewer system, treatment works, or disposal system, and certain stormwater runoff which would result in a discharge into surface waters. In North Carolina, the NPDES program is administered by NCDENR-DWQ and all dischargers are required to obtain a permit. As shown in **Table 6-2**, there are currently six permitted discharges into streams that run through the project study area (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/NPDES/documents/BIMS_100608.xls).

TABLE 6-2: Active NPDES Permits with Discharges to Streams in the Project Study Area

Permit #	Owner	Facility Name	Permitted Flow (gpd)	Subbasin	Receiving Stream
NC0069841	Union County	Crooked Creek WWTP #2	1,900,000	03-07-12	East Fork Stewarts Creek
NC0024333	City of Monroe	Monroe WWTP	10,400,000	03-07-14	Richardson Creek
NC0030597	Union County Public Schools	New Salem Elementary School	3,000	03-07-14	Richardson Creek
NC0045993	Allvac	Monroe Plant	Not limited	03-07-14	Richardson Creek
NC0080381	City of Monroe	John Glenn WTP	Not limited	03-07-14	Stewarts Creek
NC0087858	Equipment and Supply, Inc.	Union County Remediation site	21,600	03-07-14	Stewarts Creek

Source: NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/NPDES/documents/BIMS_100608.xls.

6.2.2.4 Water Quality Monitoring and Basin-Wide Assessments

Basinwide water quality plans were prepared for the Yadkin-Pee Dee River Basin in 1998, 2003, and 2008. The draft of the 2008 plan was made available for public review in July 2008 (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/basinwide/Neuse/2008/Yadkin2008.htm). The *1998 Yadkin-Pee Dee River Basinwide Water Quality Plan* identified low dissolved oxygen, excess nutrients, and sedimentation in Richardson Creek and recommended that no new discharges of oxygen-consuming wastes be permitted above the Monroe Wastewater Treatment

Plant (WWTP) discharge. This plant is located west of Monroe-Ansonville Road and approximately 0.5 miles south of DSA Segment 36 (DSAs A, B, C, D, A2, B2, C2, D2).

Biological samples collected during the planning period for the *2003 Yadkin-Pee Dee River Basinwide Water Quality Plan* revealed improvements in the bioclassification at sampled sites. Water chemistry samples revealed low dissolved oxygen concentrations upstream of the Monroe WWTP discharge, and slightly decreased oxygen concentrations downstream of the WWTP discharge. Water chemistry data also revealed high levels of nutrients, nitrate/nitrite nitrogen, and total phosphorus (*2003 Yadkin-Pee Dee River Basinwide Water Quality Plan,* NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/basinwide/yadkin/YadkinPD_wq_dt_management_plan0103.htm). The 2003 Plan also reported that the City of Monroe had worked to upgrade its WWTP and, except for two instances of violations in 2000, had maintained full compliance with its NPDES permit.

A *Basinwide Assessment Report for the Yadkin River Basin* was prepared by NCDENR-DWQ in April 2007 (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/esb/Basinwide/YADBasinwide2007.pdf). The report referenced a new fish sampling site that was added in 2006 along Bearskin Creek at NC 200, which is within the project study area. The site was sampled in July 2006 and received a bioclassification rating of "fair."

A *Basinwide Assessment Report for the Catawba River Basin* was prepared in April 2008 by NCDENR-DWQ (NCDENR-DWQ Web site: http://h2o.enr.state.nc.us/esb/documents/2008CTBBAUrptweb.pdf). No sample sites were identified within the project study area.

6.2.3 WATER RESOURCES IMPACTS AND MITIGATION

Stormwater runoff from roadways carries silt, heavy metals, petroleum products, nitrogen, and phosphorous. These materials can potentially degrade water quality and aquatic habitat integrity. The effects on water quality depend on the size of the waterways crossed, the number of such crossings and the season of construction. Streams with low flow are more severely affected since they have less volume to dilute the runoff. However, construction during periods of low precipitation can result in reduced impacts since stormwater does not carry the pollutants downstream.

Short-term impacts on water quality within the project area may result from soil erosion and sedimentation. Uncontrolled erosion and sedimentation can potentially destroy aquatic algae, eliminate benthic (bottom-dwelling) macroinvertebrate habitat, eradicate fish-spawning habitat and remove food resources for many stream species. Construction impacts to water quality may not be restricted to the communities in which the construction activity occurs, but may also affect downstream communities. Long-term impacts on water quality also are possible due to the particulates, heavy metals, organic matter, pesticides, herbicides, nutrients, and bacteria that are often found in highway runoff. Potential indirect impacts and cumulative effects to water quality resulting from this project are discussed in **Section 7**.

The following are potential impacts to water resources that would occur under any of the DSAs:

- Increased sediment loading and siltation as a consequence of watershed vegetation removal, erosion, and/or construction.
- Decreased light penetration/water clarity from increased sedimentation.
- Changes in water temperature with vegetation removal.
- Changes in the amount of available organic matter with vegetation removal.
- Increased concentration of toxic compounds from highway runoff, construction activities and construction equipment, and spills from construction equipment.
- Alteration of water levels and flows as a result of interruptions and/or additions to surface and groundwater flow from construction.

In accordance with the *North Carolina Sedimentation Pollution Control Act of 1973* (GS Chapter 113A, Art. 4), as amended, and NC Administrative Code Title 15A, Chapter 4 (Sedimentation Control), an erosion and sedimentation control plan must be prepared for land-disturbing activities that cover one or more acres to protect against runoff from a ten-year storm.

Water Quality Mitigation

Impacts from erosion and sedimentation will be minimized by implementing control measures in accordance with NCDENR and NCDOT guidance and BMPs.

Prior to construction, an erosion and sedimentation control plan will be developed for the Preferred Alternative in accordance with the NCDENR Division of Land Resources publication *Erosion and Sediment Control Planning and Design* (June 2006) (NCDENR Division of Land Resources Web site: www.dlr.enr.state.nc.us/pages/publications.html) and the NCDOT's *Best Management Practices for Protection of Surface Waters*. Examples of Best Management Practices (BMP) for erosion and sedimentation control include, but are not limited to, the following activities during construction and maintenance:

- Use of dikes, berms, silt basins, silt fencing, and other containment measures to control runoff during construction. Regular maintenance and inspection of these structures is recommended to ensure effectiveness.
- Elimination of construction staging areas in floodplains or adjacent to streams and tributaries will help reduce the potential for petroleum contamination or discharges of other hazardous materials into receiving waters.
- Rapid re-seeding of disturbed sites to help alleviate sediment loading and reduce runoff. Increased runoff from new highway surfaces can be partially mitigated by providing for grassed road shoulders and the limited use of ditching.
- Careful management and use of herbicides, pesticides, de-icing compounds, or other chemical constituents will minimize potential negative impacts on water quality. Roadside maintenance crews should be well versed in the use of these chemicals.
- Avoidance of direct discharges into streams whenever feasible. Runoff effluent should be allowed to filter through roadside vegetation in order to remove contaminants and to minimize runoff velocities.

In addition, because all DSAs pass through the hazardous spill basin area for Lake Twitty, all DSAs would need to incorporate hazardous spill basins in this area during final design.

The *Standard Specifications for Roads and Structures* requires proper handling and use of construction materials (NCDOT, January 2002) (NCDOT Web site: www.ncdot.org/doh/preconstruct/ps/specifications/dual/). The contractor would be responsible for taking every reasonable precaution throughout the construction of the project to prevent the pollution of any body of water. The contractor also shall be responsible for preventing soil erosion and stream siltation.

6.3 NATURAL COMMUNITIES AND WILDLIFE

Natural communities include terrestrial (land-based) communities and aquatic communities, and their respective wildlife resources. The following information is summarized from the *Natural Resources Technical State Report for the Monroe Connector/Bypass* (ESI, December 2008). All work was conducted in accordance with *Natural Resource Technical Report Format Guidance* (NCDOT Web site: http://www.ncdot.org/doh/preconstruct/pe/NEU/NEUProcedures/New_NRTR_Format_Guidance.pdf). Field work was conducted from February 20 to April 24, 2008.

6.3.1 TERRESTRIAL COMMUNITIES

Seven terrestrial communities were identified within the DSAs: urban/disturbed, mesic mixed hardwood forest, basic mesic forest, pine forest, piedmont/low mountain alluvial forest, agriculturally maintained, and successional/agriculturally unmaintained.

Figure 6-1 shows the location and extent of identified terrestrial communities within the DSAs. A brief description of each community type follows. Details about these communities are provided in the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008).

Urban/Disturbed. Urban/disturbed areas occupy a large percentage of land within the DSAs, especially along the existing roads. This category includes areas with disturbed vegetation and/or soils with man-made structures (e.g., buildings, roadways, parking lots, maintained yards, and similar areas where other human activities dominate). Maintained roadside right-of-way areas, powerline corridors, road frontages, private home sites, residential communities, and commercial complexes are included in this category. Ornamental trees, shrubs, and grasses intermix with native pines, hardwoods, and occasionally invasive weeds in a landscaped setting.

Mesic Mixed Hardwood Forest. The mesic mixed hardwood forest community is found within the DSAs along lower slopes, ravines, and occasionally well-drained small-stream bottoms, on acidic soils. The community is dominated by white oak (*Quercus alba*), southern red oak (*Quercus falcate*), tulip poplar (*Liriodendron tulipifera),* red maple (*Acer rubrum*), and eastern red cedar (*Juniperus virginiana*), with an occasional American beech (*Fagus grandifolia*). Pines, mostly loblolly (*Pinus taeda*), may be present, but represent less than 20 percent of the canopy coverage. The understory varies in density and includes saplings of the canopy species, flowering

dogwood (*Cornus florida*), American holly (*Ilex opaca*), and deerberry (*Vaccinium stamineum)*, with an occasional winged elm (*Ulmus alata).*

Basic Mesic Forest. The basic mesic forest community is found within the DSAs on basic soils along lower slopes, ravines, and occasionally well-drained small-stream bottoms. These areas are usually associated with base-loving plants and plants more characteristic of bottomlands. The community is dominated by tulip poplar, American beech, red maple, sweetgum (*Liquidambar styraciflua)*, and red oak. The understory varies in density and includes saplings of the canopy species, flowering dogwood, ironwood (*Carpinus caroliniana*), and slippery elm (*Ulmus rubra).*

Pine Forest. The pine forest community is found within the DSAs along interstream uplands and is characterized by predominance (greater than 80 percent cover) of pines in the canopy. Many pine stands are plantings managed for timber or pulpwood production, while others represent natural pine woodland communities resulting from old field succession or timber management. In addition to a dominance of loblolly pine, common hardwood species present may include sweetgum, red maple, and tulip poplar. The understory varies in density depending upon the age of the stand and includes saplings of the canopy species, flowering dogwood, and eastern red cedar.

Piedmont/Low Mountain Alluvial Forest. The piedmont/low mountain alluvial forest community is found within the DSAs in areas usually associated with small stream floodplains and/or floodplains in areas of deeply cut intermittent streams. The community is dominated by river birch (*Betula nigra)*, American sycamore (*Platanus occidentalis)*, tulip poplar, red maple, and sweetgum, with an occasional winged elm. The understory varies in density and includes saplings of the canopy species, box elder (*Acer negundo)*, American holly, ironwood, Chinese privet (*Ligustrum sinense)*, and silky dogwood (*Cornus amomum)*, with an occasional pawpaw (*Asimina triloba).*

Agriculturally Maintained. Agriculturally maintained land is used for the cultivation of row crops and field crops, as well as for grazing pasture. The primary use noted for the areas identified within the DSAs was pasture dominated by grass and herb mixes.

Successional/Agriculturally Unmaintained. The successional/agriculturally unmaintained land within the DSAs includes early successional and fallow agricultural areas that are dominated by a mixture of ornamental and successional species.

6.3.2 TERRESTRIAL WILDLIFE

Terrestrial communities in the DSAs are comprised of both natural and disturbed habitats that may support a diversity of wildlife species. In the lists that follow, species observed during field reviews are indicated with an asterisk (*).

Mammal species that commonly exploit forested habitats and stream corridors found within the DSAs include species such as gray squirrel* (*Sciurus carolinensis*), Virginia opossum* (*Didelphis virginiana*), eastern cottontail* (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), beaver* (C*astor canadensis*), gray fox (*Urocyon cinereoargenteus*), and white-tailed deer* (*Odocoileus virginianus*).

Birds commonly found in agricultural and other maintained or disturbed areas within the DSAs include turkey vulture* (*Cathartes aura*), mourning dove (*Zenaida macroura*), Canada goose* *(Branta Canadensis)*, American robin*(*Turdus migratorius*), European starling (*Sturnus vulgaris*), chipping sparrow* (*Spizella passerine*), brown-headed cowbird (*Molothrus ater*), and American crow* (*Corvus brachyrhynchos*). Birds that typically inhabit forested areas found within the DSAs include many of these species as well as wild turkey* (*Meleagris gallopavo)*, red-headed woodpecker* (*Melanerpes erythrocephalus*), red-bellied woodpecker (*Melanerpes carolinus*), red-shouldered hawk* (*Buteo lineatus*), red-tailed hawk* (*Buteo jamaicensis*), Carolina wren* (*Thryothorus ludovicianus*), gray catbird* (*Dumetella carolinensis*), and orchard oriole (*Icterus spurious*).

Species that may generally be observed in or near aquatic habitats within the DSAs include mallard* (*Anas platyrhynchos*), wood duck* (*Aix sponsa*), great blue heron* (*Ardea herodias*), and prothonotary warbler (*Protonotaria citrea*). Reptile and amphibian species that may use terrestrial communities located in the DSAs include eastern box turtle* (*Terrapene carolina*), Carolina anole (*Anolis carolinensis*), black racer* (*Coluber constrictor*), copperhead* (*Agkistrodon contortix*), five-lined skink (*Eumeces fasciatus*), rat snake (*Elaphe obsolete*), eastern garter snake (*Thamnophis sirtalis*), American toad* (*Bufo americanus*), common gray treefrog (*Hyla versicolor*), red salamander (*Pseudotriton rubber*), marbled salamander (*Ambystoma opacum*), and spring peeper (*Pseudocris crucifer*).

6.3.3 AQUATIC COMMUNITIES AND WILDLIFE

Aquatic communities in the DSAs include both intermittent and perennial piedmont streams, as well as still-water ponds. Perennial streams in the DSAs could support golden shiner (*Notemigonus crysoleucas*), bluegill (*Lepomis macrochirus*), eastern mosquitofish (*Gambusia holbooki*), spottail shiner (*Notropis hudsonius*), sandbar shiner (*Notropis scepticus*), swallowtail shiner (*Notropis procne*), white sucker (*Catostomus commersonii*), creek chubsucker (*Ermyzon oblongus*), greenfin shiner (*Cyprinella chloristia*), whitefin shiner (*Cyprinella nivea*), bluehead chub (*Nocomis leptocephalus*), and tessellated darter (*Etheostoma olmstedi*). The larger streams within the DSAs would be expected to support populations of game fish such as white catfish (*Ameiurus catus*), flat bullhead (*Ameiurus platycephalus*), largemouth bass (*Micropterus salmoides*), and several sunfish species (*Lepomis spp.*) including redbreast sunfish, green sunfish, and bluegill. Ponds in the DSAs may support populations of bluegill and largemouth bass, as well as other species.

Streams within the DSAs provide riparian and benthic habitat for amphibians, aquatic reptiles, crustaceans and various aquatic invertebrates. Aquatic reptiles expected within the DSAs include snapping turtle* (*Chelydra serpentine*), mud turtle (*Kinosternon subrubrum*), and northern water snake (*Nerodia sipedon*). Aquatic amphibians expected within the DSAs include bullfrog* (*Rana* catesbeiana) and southern leopard frog (*Rana sphenocephala*). Crustaceans may include various species of crayfish*, while various benthic macroinvertebrates such as stonefly* and caddisfly* populate the streams.

6.3.4 INVASIVE PLANT SPECIES

Invasive plant species aggressively invade landscapes, out-competing native species and displacing them from their natural environments. Under Executive Order 13112 – *Invasive Species*, issued in 1999, federal agencies and federally-funded projects cannot cause the introduction or spread of invasive species unless all reasonable measures to minimize risk of harm have been analyzed and considered. Known invasive plants, as listed by the individual state in which the project occurs, cannot purposely be used for construction, revegetation, or landscaping.

The FHWA's policy is to fully participate in efforts to prevent the introduction and spread of invasive species. The FHWA's efforts include conducting research and analysis on the effects of invasive species, training personnel and educating the public, implementing beneficial landscaping, and encouraging innovative transportation system designs. The FHWA also coordinates with other federal agencies and state and local governments, as well as with international organizations, to implement control efforts.

Minimizing the Spread of Invasive Species

Federal agencies and federally-funded projects cannot cause the introduction or spread of invasive species unless all reasonable measures to minimize risk of harm have been analyzed and considered.

The NCDOT publication *Invasive Exotic Plants of North Carolina* divides invasive plant species into three main categories, depending upon their reported impact to natural areas: 1) threat to habitat and natural species, 2) moderate threat to habitat and natural areas, and 3) watch list. The species in the "threat" category are known to be invasive and to degrade habitat. Those species in the "moderate threat" category do not at present appear to be as significant a problem in natural areas. The "watch list" category includes species that have caused problems in neighboring states, are currently found in localized areas, but should be watched for expansion in range, and/or are state-listed noxious weeds (*Invasive Exotic Plants of North Carolina*, NCDOT, 2008).

Seven species from the list were found in the DSAs. One species identified, Bradford pear (*Pyrus calleryana*), is in the "watch list" category. Three species are in the threat category: Chinese privet (*Ligustrum sinese*), multiflora rose (*Rosa multiflora*), and kudzu (*Pueraria montana*). Another three species are included in the "moderate threat" category: autumn olive (*Elaeagnus umbellata*), English ivy (*Hedera helix*), and Japanese honeysuckle (*Lonicera japonica*). NCTA will follow the BMPs recommended by NCDOT for the management of invasive plant species.

6.3.5 IMPACTS TO NATURAL COMMUNITIES AND WILDLIFE

Construction of any of the DSAs would have direct and indirect impacts to terrestrial and aquatic communities. This section summarizes the potential impacts to natural communities in terms of the area impacted and the plants and animals affected. Potential indirect impacts are further documented in the *Indirect and Cumulative Effects Assessment* (HNTB, January 2009) and summarized in **Section 7**.

Terrestrial Communities. Terrestrial communities would be impacted permanently by project construction from clearing and paving. **Table 6-3** provides the acreage of terrestrial

communities by habitat type that would be impacted by each DSA. The acreage represents the area within each DSA's proposed right-of-way limits.

As presented in **Table 6-3**, the predominant community types in all of the DSAs are agriculturally maintained areas and mesic mixed hardwood forest, followed by urban/disturbed areas. Basic mesic forest, piedmont/low mountain alluvial forest, pine forest, and open water together make up a small percentage (less than 6 percent each) of each DSA.

TABLE 6-3: Potential Impacts to Terrestrial Communities by Detailed Study Alternative

DSA	Agriculturally Maintained (acres)	Basic Mesic Forest (Piedmont Subtype) (acres)	Mesic Mixed Hardwood Forest (Piedmont Subtype) (acres)	Piedmont/ Low Mountain Alluvial Forest (acres)	Pine Forest (acres)	Suc-cessional (acres)	Urban/ Disturbed (acres)	Open Water (acres)	Total (acres)
A	546	29	433	26	19	101	230	10	1,394
B	552	27	430	22	19	97	234	8	1,389
C	494	20	400	24	16	105	208	10	1,277
D	499	17	397	20	16	101	211	8	1,269
A1	608	25	360	21	10	88	237	10	1,359
B1	613	22	357	17	10	84	240	8	1,351
C1	555	15	327	19	6	92	215	10	1,239
D1	560	13	324	15	6	88	218	8	1,232
A2	561	29	439	27	19	101	232	10	1,418
B2	566	27	436	23	19	97	235	8	1,411
C2	509	20	406	25	16	105	209	10	1,300
D2	514	17	403	21	16	101	212	8	1,292
A3	622	25	366	22	10	88	238	10	1,381
B3	627	22	363	18	10	84	241	8	1,373
C3	570	15	333	20	6	92	216	10	1,262
D3	575	13	330	16	6	88	219	8	1,255

Source: Data in table was calculated using GIS with data from the *Jurisdictional and Community Impacts Technical Memorandum for the Monroe Connector/Bypass* (ESI, January 2009) and functional engineering designs.

Terrestrial Wildlife. All the DSAs would have similar potential to directly and indirectly affect upland wildlife species due to habitat loss and fragmentation.

Destruction of natural communities along the DSAs' rights of way would result in the loss of foraging and breeding habitats for the various animal species that utilize the area. Animal species would be displaced into surrounding communities. Adult birds, mammals, and some reptiles are mobile enough to avoid mortality during construction. Young animals and less mobile species, such as many amphibians, may suffer direct loss during construction. The plants and animals that are found in the upland communities are generally common throughout central North Carolina.

Indirect impacts would occur from forest fragmentation. Forest fragmentation occurs when large, contiguous forests are divided into smaller patches by urbanization, roads, and agriculture. This process reduces the forest's function as a habitat for many plant and animal species and has

been shown to reduce biodiversity by altering the amount of forest interior habitat, thereby reducing the amount of habitat available for species requiring large uninterrupted tracts.

When habitat is fragmented, the amount of edge habitat increases at the expense of interior habitat. Under these circumstances, species dependent upon interior habitat suffer (such as many migratory or neo-tropical birds), while edge dependant species including invasive species and predators thrive. Highly fragmented forests do not provide the food, cover, or reproduction needs of interior forest species. The road itself can also provide a physical barrier to the movement of mammals, reptiles, and amphibians along wildlife corridors and from one forest patch to another.

Aquatic Communities and Wildlife. Impacts to aquatic communities include fluctuations in water temperature as a result of the loss of riparian (forest) vegetation. Impacts to terrestrial communities, particularly in locations having steep to moderate slopes, can result in the aquatic community receiving heavy sediment loads as a consequence of erosion. Construction impacts may not be restricted to the communities in which the construction activity occurs, but may also affect downstream communities. Temporary and permanent impacts to aquatic organisms may result from increased sedimentation. Sediments have the potential to affect fish and other aquatic life in several ways including by clogging and abrading gills and other respiratory surfaces, affecting the habitat by scouring and filling pools and riffles, altering water chemistry, and smothering different life stages.

The relative potential for impacts to aquatic communities can be related to the number of stream crossings for each DSA. More stream crossings mean a higher number of aquatic communities can be potentially impacted, either temporarily or permanently. Table 4 of **Appendix J** lists impacts to individual stream segments. Based upon this information, the numbers of stream crossings are similar, ranging from 104 crossings for DSA D to 124 crossings for DSA A3.

As outlined in **Section 6.2.3** (Water Resources Impacts and Mitigation), impacts to aquatic communities and wildlife from erosion and sedimentation will be minimized through implementation of a stringent erosion-control schedule and the use of BMPs.

6.4 WATERS RESOURCES IN FEDERAL JURISDICTION

6.4.1 WATERS OF THE UNITED STATES

Section 404 of the CWA prohibits discharges of dredged or fill material into Waters of the US, except when executed in accordance with a permit. The term Waters of the US has broad meaning and incorporates both wetlands and surface waters. The US Army Corps of Engineers (USACE) is responsible for issuing permits and enforcing permitting requirements under Section 404 of the Act. The USEPA issues the regulations – known as Section 404(b)(1) Guidelines – that the Corps must follow when issuing Section 404 permits. USEPA also participates in the permitting process and has authority to veto Section 404 permits.

Clean Water Act

Section 404 prohibits discharges of dredged or fill materials into Waters of the US, except in accordance with a permit.

Section 401 requires an applicant for a Section 404 permit to obtain certification from the State that indicates that the project complies with State water quality standards

The USACE regulatory program is defined in 33 CFR 321-330. In addition, Executive Order 11990 requires that new construction in wetlands be avoided to the extent possible, and that all practical measure be taken to minimize or mitigate impacts to wetlands.

Water bodies such as rivers, streams, lakes, and ponds are subject to jurisdictional consideration under the Section 404 Program. By regulation, some wetlands also are considered Waters of the US; these wetlands are referred to as "jurisdictional wetlands" because they are under the permitting jurisdiction of the USACE, pursuant to Section 404 of the CWA. Jurisdictional wetlands are defined in the USACE's regulations as:

> "*Those areas that are inundated or saturated by groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated conditions. Wetlands generally include swamps, marshes, bogs, and similar areas*" (33 CFR 328.3(b)).

The USACE requires the presence of three parameters (hydrophytic vegetation, hydric soils, and evidence of hydrology) to support jurisdictional determinations.

The NCDENR-DWQ also has regulatory input through Section 401 of the CWA, Water Quality Certification. Section 401 requires an applicant for a Section 404 permit to obtain certification from the State indicating that the project complies with State water quality standards. The NCDENR-DWQ issues an Individual Water Quality Certification that corresponds to USACE Section 404 Individual Permit. Impacts to waters deemed isolated by USACE will require an isolated waters permit from NCDENR-DWQ.

6.4.2 CATAWBA RIVER RIPARIAN BUFFER RULES

The proposed project is located in the Yadkin-Pee Dee River Basin and Catawba River Basin. The Yadkin-Pee Dee River Basin does not have river basin buffer rules in effect at this time.

Permanent riparian buffer protection rules were enacted by the State for the main stem of the Catawba River and its main stem lakes below Lake James south to the North Carolina/South Carolina border (15 NCAC 02B.0243-0244). The main stem of the Catawba River is the western boundary of Mecklenburg County, and is not near the project study area. No streams within the project study area are subject to river basin buffer rules.

6.4.3 EXISTING JURISDICTIONAL RESOURCES

6.4.3.1 Surveys for Jurisdictional Resources

The DSA corridors were field-surveyed to identify Waters of the US. Stream surveys and wetland delineations were performed from February 20 to April 24, 2008. Locations of streams and wetlands were recorded using global positioning system (GPS) technology with reported sub-meter accuracy.

Streams were evaluated for perennial or intermittent status according to Version 3.1 of the *Identification Methods for the Origin of Intermittent and Perennial Streams* (NCDENR-DWQ,

2005). Jurisdictional wetlands were delineated and evaluated based upon criteria established in the *US Army Corps of Engineers Wetlands Delineation Manual* (USACE, Environmental Laboratory, 1987). Wetlands were classified based upon Cowardin *et al.* (*Classification of Wetlands and Deepwater Habitats of the United States,* 1979). Wetland functions were evaluated according to the Wetland Rating System, Fourth Version (NCDENR-DWQ, 1995).

Preliminary field jurisdictional verifications for streams and wetlands were performed by USACE and NCDENR-DWQ on May 28-29, 2008. Final jurisdictional verification will be provided for the Preferred Alternative and reported in the Final EIS.

6.4.3.2 Characteristics of Streams and Wetlands

Streams. More than 200 jurisdictional stream segments were identified within the DSAs. The locations of these streams are depicted on **Figure 2-10a-cc.** Table 1 of **Appendix J** lists each surveyed stream segment, whether it is perennial or intermittent, bank height, average width and depth, substrate (what the bed material is comprised of), water quality classification, and NCDENR-DWQ habitat assessment score. The USACE and NCDENR-DWQ stream delineation forms are included in Appendix C of the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008). All jurisdictional streams in the DSAs have been designated as warm water streams for the purposes of stream mitigation.

Wetlands and Ponds. Approximately 200 jurisdictional wetlands were identified in or near the DSAs. These wetlands are depicted on **Figure 2-10a-cc.** Table 2 of **Appendix J** lists each surveyed wetland, its type (Cowardin classification), and its NCDENR-DWQ rating. Wetland determination forms and rating worksheets are included in the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008). Table 3 of **Appendix J** lists each surveyed pond, its size, and whether or not it's connected to a stream.

Three types of wetlands were identified within the DSAs, and these types are briefly described below. It should be noted that not all the wetlands and ponds within the DSA corridor boundaries would be impacted by construction of the project.

- Palustrine (pertaining to marshes or swamps) forested (PFO) wetlands within the DSAs are located primarily within the mesic mixed hardwood, basic mesic forest, and piedmont/low mountain alluvial forest terrestrial communities.
- Palustrine scrub/shrub (PSS) wetlands within the DSAs are located primarily in the successional/ agriculturally unmaintained terrestrial community.
- Palustrine emergent (PEM) and unconsolidated bottom (PUB) wetlands (i.e., ponds) within the DSAs are located primarily in the agriculturally maintained, successional/agriculturally unmaintained, and urban/disturbed terrestrial communities. Approximately 70 ponds are located in or near the DSAs. Thirty-seven of these ponds consist of impounded stream systems with surface connections to other jurisdictional features. The remaining ponds are isolated with no jurisdictional connection.

6.4.4 IMPACTS TO JURISDICTIONAL RESOURCES

Project construction for any of the DSAs cannot be accomplished without infringing on surface waters, including streams, wetlands, and ponds. Anticipated surface water impacts are under the jurisdiction of the USACE and the NCDENR-DWQ. Streams may be filled, relocated, or placed in a culvert by project construction. Wetlands may be either partially or completely filled. In some instances, larger wetland areas may become hydraulically disconnected from an adjacent stream.

Table 6-4 presents the amount of streams, wetlands, and ponds estimated to be impacted by each DSA. These impact estimates take into account avoidance and minimization measures that have been incorporated into the project, including the bridging of streams and wetlands. Details of the wetlands and streams that are to be bridged can be found in **Section 4.7.3**. The highest and lowest values in each column are shown in **bold**. The impacts were calculated using the functional engineering design estimated construction limits plus 40 feet, in accordance with NCDOT procedures. Tables 4, 5, and 6 of **Appendix J** list the impacts to individual streams, wetlands, and ponds.

Based on the information presented in **Table 6-4**, DSA A2 would have the greatest intermittent stream impacts (totaling 13,020 linear feet), and DSA A3 would have the greatest perennial stream impacts (12,383 linear feet). DSA D1 would have the least intermittent stream impacts (10,767 linear feet), and DSA D would have the least perennial stream impacts (9,794 linear feet).

TABLE 6-4: Impacts to Waters of the US

DSA	Intermittent Stream Impacts (linear ft)[1,2]	Perennial Stream Impacts (linear ft)[1,2]	Total Stream Impacts (linear ft)[1,2]	Total Number of Stream Crossings	Wetland Impact Area (acres)[1,2]	Total Number of Wetlands Impacted	Pond Impact Area (acres)[1,2]
A	12,764	10,500	23,264	118	10.7	54	**2.5**
B	12,032	10,412	22,444	110	7.7	45	2.6
C	12,648	9,882	22,530	116	**11.0**	**56**	**2.5**
D	11,915	**9,794**	21,709	**104**	8.1	47	2.6
A1	11,616	11,085	22,701	122	10.3	53	3.7
B1	10,883	10,997	21,881	114	7.3	44	**3.8**
C1	11,499	10,467	21,966	116	10.7	55	3.7
D1	**10,767**	10,379	**21,146**	**104**	7.7	46	**3.8**
A2	**13,020**	11,798	**24,818**	119	9.5	52	**2.5**
B2	12,288	11,710	23,998	111	6.6	43	2.6
C2	12,904	11,180	24,084	113	9.9	54	**2.5**
D2	12,171	11,092	23,263	105	7.0	45	2.6
A3	11,872	**12,383**	24,254	**124**	9.2	51	3.7
B3	11,139	12,295	23,434	116	**6.2**	**42**	**3.8**
C3	11,755	11,765	23,520	118	9.5	53	3.7
D3	11,023	11,677	22,699	110	6.6	44	**3.8**

Source: Data in table was calculated using GIS with data from the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008) and functional engineering designs dated 12/31/08.
[1]Note: Highest and lowest values are indicated by bold font. [2] Impacts were calculated using the functional engineering designs' construction limits, with an additional 40-foot buffer, in accordance with NCDOT procedures.

DSA A2 would have the greatest total stream impacts (24,818 linear feet), while DSA D1 would have the least total stream impacts (21,146 linear feet). The difference between the highest and lowest total stream impacts is 3,672 linear feet.

DSAs A, C, and C1 would have the greatest wetland impacts (10.7 to 11.0 acres), and DSA B3 would have the least impact to wetlands (6.2 acres). DSAs B1, D1, B3, and D3 would have the greatest impacts to ponds (3.8 acres), and DSAs A, C, A2, and C2 would have the least impacts to ponds (2.5 acres).

6.4.5 PERMITTING AND MITIGATION

6.4.5.1 Section 404/401 Permit Issues

Permits will be required for roadway encroachment into jurisdictional wetlands and surface waters. The type of activity, extent of the impacts, and specific environmental impact will be considered by the Wilmington District of USACE before a determination is made whether or not to authorize use of a permit, as well as what requirements may be attached to the permit (if issued), and which type of permit might be issued by the agency.

Section 404 Permit

Implementation of any of the DSAs will require an Individual Permit from USACE and a Section 401 Water Quality Certification from NCDENR-DWQ for wetland and stream impacts.

The USACE, Wilmington District, issues an Individual Permit for projects that result in 0.5 acre or more of fill to wetlands or 300 linear feet or more of stream impacts, or if the project is considered by the agency to be a major action. An Individual Permit requires a full public-interest review, including public notices and coordination with involved agencies, interested parties, and the general public. This project's EIS process will serve the requirements for public coordination for the Section 404 Individual Permit.

Implementation of any of the DSAs would require issuance of an Individual 404 Permit from USACE, Wilmington District, for stream and wetland impacts. This project would also require a 401 Water Quality Certification from NCDENR-DWQ prior to issuance of the Individual 404 Permit. The NCDENR-DWQ issues an Individual Water Quality Certification which corresponds to the USACE Individual Permit. Impacts to waters deemed isolated by USACE require an isolated waters permit from NCDENR-DWQ.

In accordance with Section 404(b)(1) guidelines, "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences (40 CFR 230.10(a))."

Mitigation policy for jurisdictional wetlands has been established by USEPA and USACE regulations in 33 CFR Part 332 and 40 CFR Part 230, Subpart J. Requirements related to wetlands mitigation are also contained in the Section 404(b)(1) Guidelines (40 CFR 230, Subpart B), FHWA wetlands and natural habitat regulations (23 CFR Part 777), Executive Order 11990 (42 FR 26961 [1977]), USFWS mitigation policy directives (46 FR 7644-7663 [1981]), and the Council on Environmental Quality (CEQ) regulations (40 CFR Part 1500).

The USEPA and USACE regulations governing wetlands mitigation embrace the policy of "no net loss of wetlands" and sequential consideration of avoidance, minimization, and mitigation. The purpose of this policy is to restore and maintain the chemical, biological, and physical integrity of Waters of the US. Compensatory mitigation is sought only after all reasonable efforts have been made to avoid or minimize impacts.

6.4.5.2 Avoidance and Minimization of Impacts

Avoidance examines all appropriate and practical possibilities of averting impacts to Waters of the US. According to a 1990 Memorandum of Agreement (MOA) between USEPA and USACE, in determining appropriate and practical measures to offset unavoidable impacts, such measures should be appropriate to the scope and degree of those impacts and practical in terms of costs, existing technology, and logistics in light of overall project purposes.

Minimization includes the examination of appropriate and practical steps to reduce adverse impacts to Waters of the US. Implementation of these steps would be required through project modifications and permit conditions. Strict adherence to BMPs would assist in minimizing project impacts. Minimization methods typically include:

- Decreasing the footprint of the proposed project through the reduction of median width, right-of-way widths, fill slopes, and/or road shoulder widths.
- Installation of temporary silt fences, earth berms, and temporary ground cover during construction.
- Strict enforcement of sedimentation and erosion control BMPs for the protection of surface waters and wetlands.
- Minimizing clearing and grubbing activity in and adjacent to water bodies.
- Re-establishing vegetation on exposed areas with judicious pesticide and herbicide management.
- Bridge lengthening in environmentally sensitive areas.
- Minimizing in-stream activities.

The DSAs incorporate measures to avoid and minimize impacts to Waters of the US. The horizontal alignment of the functional engineering designs was adjusted where possible to minimize or avoid impacts to streams, wetlands, and ponds. The presence of wetlands and streams, and the minimization or avoidance of impacts to these resources, were factors in considering interchange configurations.

The major drainage structures and crossings were reviewed by the environmental regulatory and resource agencies at the Turnpike Environmental Agency Coordination Meeting on October 7, 2008 and at a bridging location field review on October 21, 2008. As a result of these meetings, the agencies agreed with several recommended bridge and culvert locations, and NCTA agreed to include bridges at several locations previously recommended for culverts in order to avoid or minimize stream and wetland impacts. The bridge locations recommended for the avoidance or minimization of stream and wetland impacts are listed in **Section 4.7.3** (Major Drainage Structures and Floodway/Floodplain Impacts) and are shown in **Figure 2-10a-cc**.

6.4.5.3 Compensatory Mitigation

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization have been incorporated. It is the decision of USACE and NCDENR-DWQ whether to require mitigation for impacts associated with construction.

Because this project would be permitted under an Individual 404 Permit, mitigation for impacts to surface waters will be required by USACE and NCDENR-DWQ. Furthermore, in accordance with its regulations (33 CFR Part 332), USACE requires compensatory mitigation when necessary to ensure that adverse effects to the aquatic environment are minimal. It is anticipated that stream impacts will be greater than USACE and NCDENR-DWQ regulatory thresholds and will require compensatory mitigation.

Compensatory actions often include restoration, creation, and enhancement of Waters of the US. Such actions should be undertaken in areas adjacent to or contiguous to the discharge site (i.e., compensatory on-site mitigation). There are many possible streams within the project study area whose restoration may qualify as on-site mitigation for stream impacts. On-site restoration can include removal of existing fill materials at old bridge end bents, stabilization of degraded streams, and restoration of floodplains surrounding new bridges.

An off-site mitigation program based upon in-lieu fee payments made to the NCDENR Ecosystem Enhancement Program (EEP) was established by the *Memorandum of Agreement Among the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the US Army Corps of Engineers, Wilmington District* (January 22, 2003). Coordination with the regulatory agencies determined that payment of an in-lieu fee would be considered an available option for off-site mitigation.

6.5 PROTECTED SPECIES

This section summarizes the protected species assessments prepared for the project. Details are documented in the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008). For the purposes of this section, the term "protected species" includes those species listed by USFWS under the Endangered Species Act.

6.5.1 FEDERAL REGULATIONS

Endangered Species Act. Some populations of plants and animals are declining either as a result of natural forces or because of their difficulty competing with humans for resources. Plants and animals with a federal classification of Endangered (E), Threatened (T), Proposed Endangered (PE), and Proposed Threatened (PT) are protected under provisions of Sections 7 and 9 of the *Endangered Species Act of 1973* (ESA), as amended.

Endangered Species and Threatened Species

"Endangered species" are those plants and animals in danger of extinction throughout all or a significant portion of their range. "Threatened species" are those plants and animals likely to become endangered in the foreseeable future (USFWS Web site: www.fws.gov/endangered/glossary.html).

The ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, including the destruction or adverse modification of critical habitat. Critical habitat is a term used in the ESA to describe a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and which may require special management and protection.

The USFWS determines whether a species should be federally listed as being threatened or endangered. A listed species is protected under the ESA until its population has recovered to the point that it can be removed from the list. Any activity permitted, funded or conducted by a federal agency determined to affect a listed species or designated critical habitat requires a consultation with USFWS. The consultation may be informal or formal in nature. If formal consultation is needed, the result of the consultation is a written Biological Opinion by USFWS concerning whether the proposed action is likely to result in jeopardy to a listed species and/or adverse modification of designated critical habitat.

Bald and Golden Eagle Protection Act. The bald eagle was adopted as a national symbol in 1782. During the next century and a half, the bald eagle was heavily hunted. This led the US Congress to pass the Bald Eagle Protection Act in 1940 to prevent the species from becoming extinct. The Bald Eagle Protection Act prohibits the "take, possession, sale, or purchase" of the bald eagle as well as the "offer to sell, purchase, export or import" the bald eagle "at any time or in any manner (16 USC 668-668d)." In 1962, Congress adopted the Bald and Golden Eagle Protection Act (BGEPA) to protect golden eagles, which also strengthened protection of bald eagles since they were often killed by people mistaking them for golden eagles (USFWS Web site: http://www.fws.gov/permits/mbpermits/ActSummaries.html).

Bald Eagle. Photo Credit: NCTC Image Library, USFWS

Since the bald eagle was declared recovered and removed from the Federal List of Threatened and Endangered Species in July 2007, the Bald and Golden Eagle Protection Act becomes the primary law protecting bald eagles.

6.5.2 STATE REGULATIONS

North Carolina Endangered Species Act. The NC Endangered Species Act (NCGS Chapter 113, Article 25), enacted in 1987, authorizes the NC Wildlife Resources Commission (NCWRC) to monitor and protect rare animal species in the state as well as develop and implement management plans for listed species. The NC Endangered Species Act prohibits the taking of state-listed species. Organisms that are listed as State Endangered (E), Threatened (T), or Special Concern (SC) on the NC Natural Heritage Program List of Rare Plant and Animal Species are afforded state protection under the State Endangered Species Act and the NC Plant Protection and Conservation Act of 1979. However, the level of protection given to state-listed species does not apply to NCDOT/NCTA activities

North Carolina Plant Protection and Conservation Act of 1979. The NC Plant Protection and Conservation Act of 1979 (NCGS Chapter 106, Article 19B) authorizes the NC Department of

Agriculture to monitor and protect rare plant species in the state. The law is aimed primarily at protecting rare plants from the actions of illegal traffickers and minimizing the impacts of state development projects on rare plant populations. The NC Natural Heritage Program (NCNHP) currently maintains a database that tracks rare plant populations.

6.5.3 PROTECTED SPECIES IMPACTS

6.5.3.1 Federally-Protected Species

The USFWS lists three species under federal protection that are considered to have ranges extending into Union County, and four species under federal protection that are considered to have ranges extending into Mecklenburg County (USFWS Web site: www.fws.gov/nc-es/es/countyfr.html). These species are listed in **Table 6-5,** along with the bald eagle, which has been delisted but is still federally protected by the Bald and Golden Eagle Protection Act. A brief description of each species' habitat requirements follows the table. Habitat requirements for each species are based upon the current best available information, as referenced in USFWS literature and correspondence.

TABLE 6-5: Federally-Protected Species Listed for Union and Mecklenburg Counties

Common Name	Scientific Name	County	Federal Status
Vertebrates			
Bald eagle	*Haliaeetus leucocephalus*	Union & Mecklenburg	Delisted (BGPA)
Invertebrates			
Carolina heelsplitter	*Lasmigona decorata*	Union & Mecklenburg	E
Vascular Plants			
Michaux's sumac	*Rhus michauxii*	Union & Mecklenburg	E
Schweinitz's sunflower	*Helianthus schweinitzii*	Union & Mecklenburg	E
Smooth coneflower	*Echinacea laevigata*	Mecklenburg	E

Notes: BGPA Bald and Golden Eagle Protection Act
E Endangered-A species that is threatened with extinction throughout all or a significant portion of its range.

Source: USFWS Web site: www.fws.gov/nc-es/es/countyfr.html, Updated 1/31/08

Bald Eagle (*Haliaeetus leucocephalus*). The bald eagle is a large raptor with a wingspan reaching seven feet. The bald eagle is primarily associated with coasts, rivers, and lakes, usually nesting near large bodies of water where it feeds. It preys primarily on fish, but will feed on birds, mammals, turtles, and carrion when fish are unavailable.

Bald eagles were first listed as Endangered in 1967 due to population decline caused by the use of the pesticide DDT and other factors. Since that listing the population of eagles in the lower 48 states has increased from 487 breeding pairs to an estimated 9,789 breeding pairs in 2007. Due to this recovery and the additional protection provided by the Bald and Golden Eagle Protection

Act (BGEPA) and the Migratory Bird Treaty Act (MBTA), the Bald eagle was removed from the list of endangered species in 2007.

Carolina heelsplitter (*Lasmigona decorata*). The Carolina heelsplitter was listed as endangered in 1993. The Carolina heelsplitter is a greenish brown to dark brown mussel, often with faint greenish brown to black rays visible on young specimens.

The species exists in very low abundances, usually within 6 feet of shorelines, throughout its known range. The general habitat requirements for the Carolina heelsplitter are shaded areas in large rivers to small streams, often burrowed into clay banks between the root systems of trees, or in runs along steep banks with moderate current. More recently, the Carolina heelsplitter has been commonly found in sections of streams containing bedrock with perpendicular crevices filled with sand and gravel, and in streams that have wide riparian buffers.

The Carolina heelsplitter was historically known to have existed in several locations within the Catawba and Pee Dee River systems in North Carolina and the Pee Dee and Savannah River systems, and possibly the Saluda River system in South Carolina. In North Carolina, the species is now known to exist in only a handful of streams in the Rocky and Catawba River systems.

The Goose Creek basin, located at its closest point, approximately one mile to the north of the DSAs in northwestern Union County, supports one of six known remaining populations of the Carolina heelsplitter and is designated as critical habitat for this species (**Appendix A-3**, scoping letter from USFWS dated February 13, 2007).

Michaux's sumac (*Rhus michauxii*). Michaux's sumac, or false poison sumac, is a densely hairy shrub with erect stems, which are 1 to 3 feet in height. Flowers are greenish-yellow to white. The plant flowers from April to June; and its dull red fruit is produced during October and November. Michaux's sumac grows in sandy or rocky open woods in association with basic soils. Most of the plant's remaining populations are on highway rights of way, roadsides, or on the edges of artificially maintained clearings. 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, and/or periodic fire) maintains its open habitat.

Michaux's sumac. Photo Credit: USFWS

Schweinitz's sunflower (*Helianthus schwienitzii*). Schweinitz's sunflower is endemic to the Piedmont of North and South Carolina. The few sites where this rhizomatous perennial herb occurs in relatively natural vegetation are found in xeric hardpan forests. The species is also found along roadside rights of way, maintained power lines and other utility rights of way, edges of thickets and old pastures; clearings and edges of upland oak-pine-hickory woods and Piedmont longleaf pine forests, and other sunny or semi-sunny habitats

Schweinitz's sunflower. Photo Credit: ESI

where disturbances (e.g., mowing, clearing, grazing, blow-downs, storms, and/or frequent fire) help create open or partially open areas for sunlight. The species is intolerant of full shade and excessive competition from other vegetation. It is generally found growing on shallow sandy soils with high gravel content; shallow, clayey hardpans; or shallow rocky soils, especially those derived from mafic rocks.

Smooth coneflower. Photo Credit: USFWS

Smooth coneflower (*Echinacea laevigata*). 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 soil associated with gabbro and diabase parent material, and typically occurs in Iredell, Misenheimer, and Picture soil series. The species grows best where there is abundant sunlight, little competition in the herbaceous layer, and periodic disturbances (*e.g.*, regular fire regime, well-timed mowing, and/or careful clearing) that prevents encroachment of shade-producing woody shrubs and trees.

6.5.3.2 Federal Species of Concern and Candidate Species

Federal Species of Concern (FSC) and Candidate (C) species are not legally protected under the ESA and are not subject to any of its provisions, including Section 7, until they are formally proposed or listed as "Threatened" or "Endangered." **Table 6-6** includes Candidate and FSC species listed for Union and Mecklenburg Counties. There are nine Federal Species of Concern and one Candidate species listed for Mecklenburg and Union Counties. Of these, the NCNHP has records of the Carolina darter, savannah lilliput, Piedmont aster, and Georgia aster occurring within the project study area shown in **Figure 2-1 (Appendix A-3,** scoping letter from the NCNHP dated January 23, 2007).

TABLE 6-6: Candidate and Federal Species of Concern

Common Name	Scientific Name	NC Status	Federal Status	Counties of Occurrence
Vertebrates				
Carolina darter	*Etheostoma collis collis*	SC	FSC	Union & Mecklenburg
Invertebrate				
Atlantic pigtoe	*Fusconaia masoni*	E	FSC	Union
Septima's clubtail	*Gomphus septima*	SR	FSC	Union
Savannah lilliput	*Toxoplasma pullus*	E	FSC	Union
Carolina creekshell	*Villosa vaughaniana*	E	FSC	Union & Mecklenburg
Vascular Plant				
Carolina birdfoot-trefoil	*Acmispon helleri*	SR-T	FSC	Union & Mecklenburg
Tall larkspur	*Delphinium exaltatum*	E-SC	FSC	Mecklenburg
Piedmont aster	*Eurybia mirabilis*	SR-T	FSC	Union & Mecklenburg
Virginia quillwort	*Isoetes virginica*	SR-L	FSC	Union
Georgia aster	*Symphotrichum georgianum*	T	C	Union & Mecklenburg

Source: NC Natural Heritage Program Web site: http://149.168.1.196/nhp/find.php , lists updated 1/9/09.

Notes:
- C Candidate
- FSC Federal Species of Concern
- E Endangered
- T Threatened
- SC Special Concern
- SR Significantly Rare
- L Range limited to NC and adjacent states
- T Rare throughout range

6.5.3.3 State Listed Species

Organisms that are listed as State Endangered (E), Threatened (T), or Special Concern (SC) on the NCNHP List of Rare Plant and Animal Species are afforded state protection under the State Endangered Species Act and the NC Plant Protection and Conservation Act of 1979. The state protection regulates the taking, collection, or sale of state-listed species, but does not apply to the management of lands for agriculture, forestry, or development (including transportation projects).

Table 6-7 lists the state-listed species with known occurrences within the project study area shown in **Figure 2-1** (**Appendix A-3,** scoping letter from the NCNHP dated January 23, 2007).

TABLE 6-7: State Listed Species in Union and Mecklenburg Counties With Known Occurrences in the Project Study Area

Common Name	Scientific Name	NC Status	Federal Status	Counties of Occurrence
Vertebrates				
Loggerhead shrike	*Lanius ludovicianus*	SC	None	Union & Mecklenburg
Invertebrate				
Notched rainbow	*Villosa constricta*	SC	None	Union
Eastern creekshell	*Villosa delumbis*	SR	None	Union & Mecklenburg
Vascular Plant				
Thin-pod white wild indigo	*Baptisia albescens*	SR-P	None	Union & Mecklenburg
Indian physic	*Gillenia stipulata*	SR-P	None	Union
Smooth sunflower	*Helianthus laevigatus*	SR-P	None	Union
Non Vascular Plant				
Small wood-bark moss	*Orthotrichum exiguum*	SR-O	None	Union

Notes: SC Special Concern
SR Significantly Rare
P Peripheral – The species is at the periphery of its range in North Carolina
O Other – The range of the species is sporadic
Source: NCNHP Web site: http://149.168.1.196/nhp/find.php , lists updated 1/9/09.

6.5.4 SURVEY FINDINGS AND IMPACTS TO PROTECTED SPECIES

Carolina Heelsplitter (*Lasmigona decorata*)

Biological Conclusion: Unresolved

Goose Creek basin, at its closest point located approximately one mile to the north of the corridor study area, is designated as critical habitat for the Carolina heelsplitter, with Goose Creek supporting one of six known remaining populations of this species.

The larger streams within the project study area may provide potentially suitable habitat for this species. All DSAs have similar stream crossings. NCTA will work with USFWS to develop a survey protocol for the Carolina heelsplitter. The results of the survey will determine the next

steps in the consultation process with the USFWS. The outcome of the consultation process will be reported in the Final EIS.

Critical Habitat of the Carolina Heelsplitter (*Lasmigona decorata*)

Biological Conclusion: Unresolved

Within Union County, the USFWS has designated portions of Goose, Duck, and Waxhaw Creeks as Critical Habitat areas for the Carolina heelsplitter (Federal Register Vol. 67, No. 127, Page 44502, www.fws.gov/southeast/news/2002/heelsplitter/heelsplitter.pdf). The Goose and Duck Creeks are outside of the project study area but within the project's Future Land Use Study Area (FLUSA) as defined in the *Indirect and Cumulative Effects Assessment* (HNTB, January 2009) and also discussed in **Section 7**. Waxhaw Creek is outside of the project study area as well as the FLUSA and was not considered in this study.

Since the project study are does not extend into either the Goose Creek drainage basin or the Duck Creek drainage basin, it is not anticipated that there will be any direct impacts from the project to either of these drainage basins. The *Indirect and Cumulative Effects Assessment* (HNTB, January 2009) determined there would be a low potential for indirect impacts to the Goose Creek and Duck Creek basins, and therefore, to the critical habitat of the Carolina heelsplitter. Therefore, there is low potential for the project to cause effects to the critical habitat for the Carolina heelsplitter.

As part of the Section 7 of the Endangered Species Act consultation process, the FHWA and NCTA will coordinate and consult with the USFWS to reach a biological conclusion regarding the critical habitat for the Carolina heelsplitter. The outcome of the consultation process will be reported in the Final EIS.

Michaux's Sumac (*Rhus michauxii*)

Biological Conclusion: No Effect

Potential habitat for this species is present within the corridor study area along the roadside margins and utilities rights of way. Areas identified as potentially suitable habitat were systematically surveyed along overlapping transects by ESI biologists from September 25 to October 26, 2007 (*Natural Resources State Technical Report for the Monroe Connector/Bypass,* ESI, December 2008). No occurrences of Michaux's sumac were observed. A review of NCNHP records, updated August 27, 2008, indicated no documented occurrences of Michaux's sumac within one mile of the corridor study area.

Schweinitz's Sunflower (*Helianthus schweinitzii*)

Biological Conclusion: May Affect/Not Likely to Adversely Affect

Potential habitat for this species is present within the corridor study area along roadsides and utility rights of way. A review of NCNHP records, updated August 27, 2008, indicated three documented occurrences of Schweinitz's sunflower within one mile of the corridor study area. These recorded occurrences are located at: 1) along the side of Indian Trail–Fairview Road (SR 1520), 2) along US 601 three miles north of its junction with US 74 (extirpated 2005), and 3) along the southwest bank of Secrest Shortcut Road (SR 1501) in the 1618 block. The populations

located along US 601 and Indian Trail-Fairview Road (SR 1520) are located outside of the corridor study area The recorded population of Schweinitz's sunflower along Secrest Shortcut Road (SR 1501) was visited during the 2007 plant surveys conducted for the project (described below), but no specimens of Schweintz's sunflower were found in this location. However, a population of Schweinitz's sunflower was found across Secrest Shortcut Road (SR 1501) from the NCNHP-recorded location.

Areas identified as potentially suitable habitat were systematically surveyed along overlapping transects by ESI biologists from September 25 to October 26, 2007 (*Natural Resources State Technical Report for the Monroe Connector/Bypass,* ESI, December 2008). During the field investigation, two population sites were discovered and documented along Secrest Shortcut Road (SR 1501) within a power-line easement. Both populations are located just outside the boundaries of DSA Segments 22A and 30 where they join (all DSAs), but within the corridor study area. The functional designs in this area do not directly encroach on either population, and it is expected that no direct disturbance to the populations will occur from construction activities. Care should be taken to reduce the potential for indirect impacts. At a minimum, informal consultation with USFWS will be conducted for the Preferred Alternative.

Smooth Coneflower (*Echinacea laevigata*)

Biological Conclusion: No Effect

Potential habitat for this species is present within the corridor study area along the roadside margins and utility right of way. Areas identified as potentially suitable habitat were systematically surveyed along overlapping transects by ESI biologists from September 25 to October 26, 2007 (*Natural Resources State Technical Report for the Monroe Connector/Bypass,* ESI, December 2008). No occurrences of smooth coneflower were observed. A review of NCNHP records, updated August 27, 2008, indicated no documented occurrences of smooth coneflower within 1 mile of the corridor study area.

Bald Eagle (*Haliaeetus leucocephalus*)

Biological Conclusion: No Effect

The project study area is more than 1 mile from any potential habitat. During the field surveys for the project, conducted in March 2008, no individuals or nesting sites were observed within the corridor study area. A review of NCNHP records, updated August 27, 2008, indicated no documented occurrences of bald eagle nests within 1 mile of the project study area. The project will not disturb bald eagles.