ADMINISTRATIVE ACTION
DRAFT ENVIRONMENTAL IMPACT STATEMENT

U.S. Department of Transportation, Federal Highway Administration
North Carolina Department of Transportation

NC 109 Improvements Study
From Old Greensboro Road (SR 1798) to I-40/US 311
Davidson and Forsyth Counties

Federal Aid No.: STP-109(1)
NCDOT Project No.: 8.1772401
T.I.P. I.D. No.: R-2568C

Submitted Pursuant to 42 USC 4332(2)(c) and 49 USC 303

Cooperating Agencies:
U.S. Army Corps of Engineers

8/26/10
Date

Eric Midkiff
FOR Gregory J. Thorpe, PhD
Environmental Management Director
Project Development & Environmental Analysis Branch
North Carolina Department of Transportation

9/7/10
Date

Clarence W. Coleman Jr.
for John F. Sullivan, III, P.E.
Division Administrator
Federal Highway Administration

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The proposed project consists of improvements to the NC 109 corridor in Davidson and Forsyth Counties, south of the city of Winston-Salem. This statement documents the need for improvements to the existing corridor and evaluates alternatives with respect to costs and social, economic, and environmental impacts. A Preferred Alternative will be selected based on the findings of this study, an evaluation of comments received on this document, and comments received at the Public Hearing.

Comments on the Draft EIS are due by _____ and should be sent to Mr. Thorpe at the above address.

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PROJECT COMMITMENTS

NC 109 Improvements Study
Davidson and Forsyth Counties
State Project No. 8.1172401
TIP No.: R-2568C

NCDOT Hydraulics Unit

The Hydraulics Unit will coordinate with the NC Floodplain Mapping Program (FMP), to determine status of project with regard to applicability of NCDOT'S Memorandum of Agreement, or approval of a Conditional Letter of Map Revision (CLOMR) and subsequent final Letter of Map Revision (LOMR).

NCDOT Division 9

This project involves construction activities on or adjacent to FEMA-regulated stream(s). Therefore, the Division shall submit sealed as-built construction plans to the Hydraulics Unit upon completion of project construction, certifying that the drainage structure(s) and roadway embankment that are located within the 100-year floodplain were built as shown in the construction plans, both horizontally and vertically.

SUMMARY

S.1 FEDERAL HIGHWAY ADMINISTRATION

(X) Draft ( ) Final ( ) Draft Section 4(f) Evaluation attached

S.2 CONTACTS

The following individuals may be contacted for additional information concerning this Draft Environmental Impact Statement (DEIS):

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S.3 DESCRIPTION OF PROPOSED ACTION

This study evaluates transportation improvements proposed for the NC 109 corridor between Old Greensboro Road (SR 1798) in northeastern Davidson County and southeastern Forsyth County. This transportation improvement project is identified in the North Carolina Department of Transportation (NCDOT) 2009-2015 State Transportation Improvement Program (STIP) as Project R-2568C. Right-of-way acquisition and construction are scheduled to begin after 2015.

The primary purpose of the proposed project is to improve traffic flow and levels of service on NC 109 within the project study area. The secondary purpose is to improve safety on NC 109 within the project study area.

S.4 OTHER MAJOR ACTIONS IN THE PROJECT VICINITY

There are fifteen other projects located in or near the study area; nine NCDOT STIP projects, and six proposed local projects. These are listed below:

NCDOT STIP Projects
The following projects are currently listed in the 2009-2015 STIP:

- R-4750. Upgrade existing US 52 from I-85 in Davidson County to I-40 in Forsyth County to interstate standards. Construction is scheduled to begin in 2010.
- U-4909. Widen Union Cross Road (SR 2643) from Wallburg Road (SR 2691) to Sedge Garden Road (SR 2632) in Forsyth County. Construction is scheduled to begin in 2010.
- U-2923. Widen Clemmonsville Road (SR 2747) from Old Salisbury Road (SR 3011) to South Main Street in Winston-Salem. Construction is scheduled to begin in 2011.
- U-2579. Winston-Salem Northern Beltway Eastern Section Extension - new location multi-lane freeway. Construction of segment from US 311 to I-40 has not yet been programmed for funding.
- B-4742. Replace Bridge No. 134 over a creek on SR 1755 in Davidson County. The project is currently under construction.
- B-4101. Replace Bridge No. 142 over Abbotts Creek on SR 1741 in Davidson County. The project is currently under construction.

S.5 ALTERNATIVES CONSIDERED

A screening evaluation was conducted to identify the alternatives that could fulfill the purpose and need for the proposed project. Five broad-ranged alternatives were established for consideration on this project. These alternatives include:

- No-Build Alternative
- Transportation System Management Alternative
- Mass Transit Alternative
- Upgrade Existing Facility Alternative/Build Alternative involving the construction of a roadway on new location

The preliminary alternatives that could not fulfill the purpose of and need for the project, had excessive undesirable impacts, or were considered unreasonable were eliminated from further consideration. The potential for adverse environmental impacts on residential communities and businesses, historic resources, streams, wetlands, and natural areas was also considered. The evaluations of the preliminary alternatives are included in Section 2 of this DEIS.

Based on this first screening evaluation, only the Build Alternative was determined to meet the purpose and need of the proposed project. The Build Alternative includes several alternatives for the proposed project, referred to as the NC 109 Improvements project. For purposes of comparison of project impacts, the No-Build Alternative is being carried forward through detailed study.

Land suitability maps of the project study area were created highlighting man-made and natural features that make one particular area unsuitable or less desirable than another for roadway construction. Such features included places of worship, cemeteries, schools, residential communities, parks, known historic architectural sites, community facilities, streams, and wetlands.

Based on input from local officials, the public, and agency representatives, numerous preliminary corridors over existing roads and on new location were considered for the project. More than 35 preliminary location concepts were identified. Similarities among preliminary location concepts, including location and overall concept purpose, were identified and combined to develop preliminary study corridors. The preliminary study corridors were evaluated for potential impacts to natural and human resources, design and construction feasibility, and ability to meet the purpose and need for the project. After this evaluation, thirteen corridors remained for further study. Based on discussions with various NCDOT departments and NCDOT Division 9, eight corridors were eliminated due to major environmental impacts, prohibitive projected cost, and/or design constraints. Five preliminary study corridors then remained for detailed study: Alternatives 1, 3, 4, 5, and 6 (Alternative 2 was eliminated during screening). This evaluation and screening process is described in greater detail in Section 2.4.3.

An impact matrix table was developed for the five preliminary study corridors to estimate the potential impacts of each corridor. Based on the results of this second screening evaluation, and consideration of comments received through public involvement and agency coordination programs, all five of the preliminary study corridors were subject to further consideration. Alternative 1 would upgrade existing NC 109, mainly on existing alignment, and the other four alternatives would be mainly on new location. Alternatives designed within each of these five corridors are evaluated in detail in this DEIS.

S.6 SUMMARY OF ENVIRONMENTAL IMPACTS

The following is a narrative summary of the primary environmental consequences associated with each of the alternatives under consideration. Table S-1 found at the end of this section provides this information in table form.

Land Use and Transportation Planning

The proposed project would be consistent with the state and local transportation plans for the area.

Relocations

Alternative 1 would result in the most relocations of the five alternatives, requiring 204 residential and business locations. Alternative 5 would require the least, with 74 residential and business locations.

Environmental Justice

The analysis contained in this DEIS would be consistent with that outlined in the Executive Order 12898 and the Department of Transportation Environmental Justice Order. Analysis and field observations do not indicate that the proposed NC 109 Improvements would adversely or disproportionately affect any minority or low-income populations.

Community Cohesion

Most of the neighborhoods in the project area would not experience residential displacements or community cohesion impacts as a result of the project alternatives, with a few key exceptions. Alternatives 3 and 6 would result in displacements along the western edge of the Meadowlands community. Alternatives 4 and 5 would impact three neighborhoods along Gumtree Road west of Friendship-Ledford Road, Cedar Estates, Holly Acres, and Briers Creek. In all cases, these impacts would be limited to the edges of these neighborhoods, minimizing the community cohesion effects of the project. Alternative 1 would require displacements along NC 109 but would have minimal impacts on community cohesion as it follows mainly the road's existing alignment and would not introduce a new disruption.

While no major cross streets connecting to any of the residential areas would be closed as part of the proposed project, there may be individual and community property access impacts due to relocation of driveways and local roads. NCDOT provides new access wherever possible to properties isolated by a project. All property access changes and proposed solutions developed for the preferred alternative would be presented to affected property owners.

Community Facilities and Services

Schools, libraries, and parks and recreation areas in the study area would not be impacted by any of the project alternatives. Alternative 1 would displace three places of worship, Alternatives 3 and 6 would displace two places of worship, and Alternatives 4 and 5 would not displace any places of worship.

Utilities and Infrastructure

Alternatives 3 and 6 would cross Duke Power transmission line easements in two locations. All five alternatives likely would directly impact power transmission line towers: Alternative 1 would impact three towers, Alternatives 3 and 6 may each impact one tower depending on final project design, and Alternatives 4 and 5 would each impact three towers.

None of the alternatives would impact major water facilities, such as treatment plants or pump stations. Alternatives 1, 3 and 6 would cross the Transcontinental natural gas pipe line, near the Meadowlands neighborhood, but would not require the pipe line to be relocated.

Alternatives 4 and 5 cross the Winston-Salem Southbound Railway tracks near US 52. These two alternatives follow a common alignment at this location and would include a bridge over the tracks. Bridging should not impact railroad facilities or operations.

Historic Architectural Resources

There are three properties within the Area of Potential Effects (APE) which are either listed on the National Register of Historic Places or have been determined to be eligible for listing on the National Register: the George W. Wall House, the D. Austin Parker House and the Mark Parker House. Alternative 1 was determined to have No Adverse Effect on the George W. Wall House and No Effect on the other properties. Alternatives 3 and 6 would have No Effect on the George W. Wall House and No Adverse Effect on the D. Austin Parker House and Mark Parker House. Alternatives 4 and 5 would have No Effect on any of the properties.

Archaeological Resources

Based on prior archaeological reviews of the project study area, it was determined that all alternatives under consideration would have equal likelihood of impacting prehistoric and historic archaeological sites. Therefore, NCDOT, in coordination with the State Historic Preservation Office (HPO), has determined that no further detailed studies of the corridors will be completed until a preferred alternative is selected. Once the preferred alternative is selected, NCDOT and HPO will determine a survey protocol for evaluating archaeological resources within the corridor. Should items be located, NCDOT will coordinate with the Office of State Archaeology as needed to determine what further action should be taken.

Section 4(f)/6(f) Resources

None of the detailed study corridors would impact potential Section 6(f) resources. The three historic properties within the project's APE are potential Section 4(f) resources. Alternatives 4 and 5 would not involve use any of these properties. Alternatives 1, 3 and 6 may each have minor visual and/or noise impacts on historic properties; however, these impacts would not constitute substantial impairment of these properties and therefore would not constitute constructive use of the properties. Section 4(f) would therefore not apply to any sites within the project area.

Visual Impacts

All of the project alternatives would introduce a visual intrusion into the largely rural landscape, although this impact would be smaller for Alternative 1 because most of this alternative follows the existing NC 109 alignment. The other four alternatives would have similar impacts on the

visual character of the project area, introducing a new roadway facility. The overall visual character of the project area would be impacted by the introduction of a new roadway facility.

The historic properties within the project area are considered visually sensitive resources. Alternative 1 may have a slight negative impact on the visual quality of the George W. Wall House. Alternatives 3 and 6 would have a moderate impact on the visual quality of the D. Austin Parker House as they could create a moderate intrusion into the agricultural landscape. Alternatives 3 and 6 would also have a low impact on the visual quality of the Mark Parker House, which is adjacent to the D. Austin Parker House.

Air Quality

In comparing the projected carbon monoxide (CO) concentration levels with the National Ambient Air Quality Standards, no violations of the 1-hour standard (35 ppm) or 8-hour standard (9 ppm) are expected. The 1-hour and 8-hour CO concentrations are not expected to exceed 3.7 and 2.8 ppm (including background contributions), respectively, at any of the sites for any of the three years investigated.

Noise

Alternative 1 would result in the highest number of total impacted receptors (97) without mitigation. Alternative 5 would result in the lowest number (31). A more detailed traffic noise analysis, including consideration of noise abatement measures, will be performed once a Least Environmentally Damaging Practicable Alternative (LEDPA) is selected.

Hazardous Material and Waste Sites

Twenty-seven facilities with the possibility for underground storage tanks (USTs), three automotive salvage yards, three automotive repair sites, one dry cleaner and one industrial site were identified in the project study area. Alternative 1 could potentially affect the greatest number of sites (25), while Alternatives 4 and 6 could potentially affect the fewest (3). Based on current knowledge, it is not expected that conditions at any of these sites would preclude construction of any of the alternatives

Soils

Review of available information for the project area indicates that there are no soils or geological features that would preclude or alter the corridors of the alternatives under consideration. Detailed geotechnical investigations will be undertaken as part of the design phase if one of the build alternatives is selected as the preferred alternative.

Prime and Important Farmland

In accordance with the Farmland Protection Policy Act of 1981 (7 CFR Part 658) and State Executive Order Number 96, an assessment was undertaken of the potential impacts of land

acquisition and construction activities in prime, unique, and local or statewide important farmland soils, as defined by the US Natural Resource Conservation Service (NRCS).

As required by the FPPA, coordination with the NRCS for this project was initiated by submittal of Form AD-1006, Farmland Conversion Impact Rating. Sites receiving a total score of less than 160 should be given a minimal level of protection, and sites receiving a total score of 160 or more are given increasingly higher levels of consideration for protection (7 CFR Section 658.4). None of the proposed alternatives resulted in a total site assessment score greater than 160 points. Therefore, in accordance with the Farmland Protection Policy Act, no mitigation for farmland loss is required for the project.

No Voluntary Agricultural District (VAD) would be impacted by any project alternative.

Surface Waters

As shown in Table S-1, the number of stream crossings for the project alternatives ranges from 20 for Alternative 1 to 34 for Alternatives 4 and 5; stream impacts range between 4,432 linear feet for Alternative 1 and 10,729 linear feet for Alternative 5.

Streams crossed by the proposed alignment within any of the alternatives may be temporarily and locally impacted by road construction. Potential short-term water quality impacts include temporarily increased sedimentation and turbidity levels. An increase in impervious road surface area will result in increased runoff with the potential for carrying higher pollutant loads. Adherence to the NCDOT's *Best Management Practices for the Protection of Surface Waters* during design and construction of the proposed project are expected to minimize impacts.

Floodplains and Floodways

All five alternatives would cross the 100-year floodplains associated with Abbotts Creek and Brushy Fork. Alternatives 1, 3 and 6 would also cross the 100-year floodplains associated with South Fork Muddy Creek and Fiddlers Creek. Alternatives 4 and 5 would cross the 100-year floodplain associated with Soakas Creek. Alternative 5 would have the greatest area of floodplain impacts (10.46 acres) while Alternative 6 would have the smallest area (5.35 acres). Corridor location and conceptual design have taken into consideration all factors to minimize impact to floodplains.

Major drainage structures proposed for the project would cross the floodplain at or near perpendicular angles, minimizing the length of floodplain traversed. All hydraulic structures would be designed such that the proposed structures would not significantly increase upstream flooding and would not increase the flood hazard potential of the existing floodplain.

Terrestrial Plant Communities

The maintained-disturbed community type accounts for the majority of the vegetative cover in all of the alternate corridors. The dry-mesic oak hickory forest is the next most abundant community type within the study area. Piedmont/low mountain alluvial forest communities are represented least within the study area.

Terrestrial Wildlife

Most of the project area is rural in character with scattered residential and small commercial developments. Large forested areas are still present near the project study area, but are limited primarily to lands immediately adjacent to the larger streams. Clearing and conversion of land for highways, railroads, agricultural, timberland, commercial, and residential uses has eliminated cover and protection for many species of wildlife, but has increased habitat for others that are able to utilize these anthropogenic habitats. There is little habitat for interior species, but woodland strips bordering small tributaries often serve as travel corridors between habitat types. Agricultural fields and residential areas not only provide food for wildlife, but also create edge habitat favored by many species.

Any of the project alternatives would impact area wildlife. Due to the existing amount of urban development in the project area, wildlife habitat is fragmented. The new location alternatives and the portion of Alternative 1 on new location would add further fragmentation to the area. Wildlife expected to occur in the project area are generally acclimated to fragmented landscapes in this area. However, fragmentation and loss of forested habitat may impact other wildlife in the area by reducing potential nesting and foraging areas, as well as displacing animal populations.

Aquatic Communities

Aquatic habitats within the project study area range from ephemeral waters to intermittent streams, to permanent riverine habitat. The diversity of streams within the project study area provide habitat for a variety of aquatic species.

Resident aquatic species may be temporarily displaced during construction. Water resource impacts may also result from the physical disturbance of the forested stream buffers that adjoin most of the streams within the study area. Removing streamside vegetation can cause elevated water temperatures, cause an increase in sedimentation and turbidity, and ultimately lower the species diversity in the stream. Measures to maximize sediment and erosion control during construction would protect water quality for aquatic organisms.

Jurisdictional Issues

Section 404 of the Clean Water Act (CWA) requires regulation of discharges into “Waters of the United States.” Although the principal administrative agency of the CWA is the US

Environmental Protection Agency (EPA), the US Army Corps of Engineers (USACE) has major responsibility for implementation, permitting, and enforcement provisions of the Act.

Table S-1 provides information regarding the area wetlands, jurisdictional ponds, and streams impacted by the proposed preliminary engineering designs within each alternative. Total direct wetland impacts range from 0.14 acre for Alternative 6 to 0.58 acre for Alternative 1.

Protected Species

There are four federally-protected species with habitat ranges that extend into the study area: the bog turtle (*Clemmys muhelbergii*), red-cockaded woodpecker (*Picoides borealis*), small-anthered bittercress (*Cardamine micranthera*), and Schweinitz's sunflower (*Helianthus schweinitzii*). Habitat for the bald eagle (*Haliaeetus leucocephalus*) is also found within the study area.

The proposed project is expected to have No Effect on any of these species.

Indirect and Cumulative Impacts

The construction of the NC 109 Improvements project will improve overall mobility in northeastern Davidson County and southeastern Winston-Salem area by providing either additional capacity on existing NC 109 or an additional transportation corridor. The project will also improve accessibility for adjacent properties gaining new roadway frontage.

While the project will have a moderate impact on improving area wide mobility and accessibility to the area road network, several other factors will influence the magnitude of the project's indirect effects. The anticipated growth rate in the project area is approximately one percent per year, a modest rate that should moderate the demand for new residential and commercial development and limit rapid land use change in the area. In addition, the abundant supply of developable land will limit the development pressures on most parcels. The lack of existing or planned water and sewer service through much of the area will also limit the magnitude of induced land use change in the area.

Specific areas closer to the project alternatives are more likely to experience development influenced by the project. Parcels along new location alternatives and near new intersections will likely become attractive for development of large-lot rural residential subdivisions. Again, the modest annual growth rate predicted for the project area will moderate the pace of this development. The project alone is not likely to have a major effect on land use changes in areas more than a few miles from the project alternatives.

The construction of the NC 109 Improvements and any resultant induced development and complementary land development coupled with the construction of the other transportation projects listed in the STIP and other private development projects could constitute a cumulative impact on the study area. However, it is anticipated that NPDES Phase I and II stormwater rules, enforcement of local zoning and subdivision regulations and adherence to local land use plans

will support appropriate land development and in turn minimize any development-related impacts.

S.7 UNRESOLVED ISSUES OR AREAS OF CONTROVERSY

No major unresolved issues remain to be addressed prior to publication of the FEIS.

S.8 OTHER FEDERAL OR STATE ACTIONS REQUIRED

The proposed NC 109 Improvements (STIP Project R-2568C) would require environmental regulatory permits and actions as discussed in the following sections.

S.8.1 Permits

United States Army Corps of Engineers

Section 404 Permit. A permit from the US Army Corps of Engineers (USACE) is required for any activity in water or wetlands that would discharge dredged or fill materials into Waters of the United States and adjacent wetlands. To obtain permit approval, impacts to wetlands must be mitigated through avoidance, minimization, and compensation measures in accordance with the *Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines* (February 1991). Additional policy and guidance has been established through *An Interagency Agreement Integrating Section 404/NEPA* (May 1997) which is usually referred to as the NEPA/404 Merger Agreement.

Authority. Federal Pollution Control Act Amendments of 1972 and Section 404 of the Clean Water Act of 1977. Regulations promulgated in 33 CFR Part 323.

North Carolina Department of Environment and Natural Resources – Division of Water Quality

Section 401 Water Quality Certification. Any activity which may result in discharge to Waters of the United States requires a certification that the discharge will be in compliance with applicable state water quality standards. An application for a US Army Corps of Engineers Section 404 permit is considered an application for a water quality certification.

Authority. North Carolina General Statute 143, Article 21, Part 1. Regulations promulgated in 15A NCAC 2H and 2B.

National Pollutant Discharge Elimination System (NPDES) Permit. A permit is required for projects involving sewer systems, treatment works, disposal systems, and certain stormwater runoff that could result in a discharge to surface waters. The State has the authority to administer the national NPDES program for projects in North Carolina.

Authority. North Carolina General Statute 143, Article 21, Part 1. Regulations promulgated in 15A NCAC 2H.0100.

S.8.2 Other Regulatory Actions

United States Fish and Wildlife Service

Section 404 Permit Review. The US Fish and Wildlife Service's (USFWS) responsibilities include review of Section 404 permits. The USFWS recommendations to the USACE on how impacts to fish and wildlife resources and habitats can be minimized.

Authority. Endangered Species Act of 1973, Section 7.

North Carolina Department of Environment and Natural Resources – Division of Land Quality

Soil and Erosion Control Plan. Persons conducting land-disturbing activity shall take all reasonable measures to protect all public and private property from damage caused by such activities. Pursuant to GS 112A-57(4) and 113A-54(d)(4), an erosion and sedimentation control plan must be both filed and approved by the agency having jurisdiction.

Authority. North Carolina Administrative Code, Title 15A. Department of Environment and Natural Resources Chapter 4. 15A NCAC 04B.0101.

North Carolina Department of Environment and Natural Resources – Division of Air Quality

Burn Permit. Any burning done during the construction of the proposed project will be done in accordance with applicable local laws and ordinances and regulations of the North Carolina State Implementation Plan for air quality in accordance with 15 NCAC 2D.0520.

S.8.2 Subsequent Actions

The approval of this DEIS does not complete the project implementation process. The following is a summary of actions, events, and studies to be completed prior to project construction. Coordination with resource agencies will be maintained throughout the entire process. The DEIS will be circulated to environmental agencies and the public for review. Then, the following

studies and actions will be completed to advance the project though the NEPA/Section 404 Merger Process:

- A Corridor Public Hearing will be held to present the alternative corridors and solicit public comments.

- The comments received through the DEIS review and public hearing processes will be thoroughly considered in the selection of the preferred alternative by the North Carolina Department of Transportation and FHWA.

- NEPA/Section 404 Merger Concurrence Point 3 – Least Environmentally Damaging Practicable Alternative (LEDPA) will be selected.

- The preliminary designs for the preferred alternative will be refined and will include efforts to further minimize impacts to the human and natural environments, specifically to streams and wetlands. These minimizations will be approved at the NEPA/Section 404 Merger Concurrence Point 4A meeting.

- A copy of the preferred alternative engineering designs will be forwarded to the State Historic Preservation Office (HPO). The NCDOT, in coordination with the HPO, will determine a survey protocol for evaluating archaeological resources along the preferred alternative.

- A mitigation plan for unavoidable impacts to streams and wetlands will be developed in consultation with the USACE.

The Final Environmental Impact Statement (FEIS) will be prepared based on the results of the items listed above. The FEIS will be circulated for public and agency review. After approval of the FEIS and Record of Decision (ROD), a Design Public Hearing will be held to receive public comments on the refined preliminary design for the selected alternative.

The final roadway design plans will be prepared, taking into consideration all public and agency comments received on the preliminary designs and FEIS.

Other actions which must be completed prior to the start of project construction include but are not limited to the following:

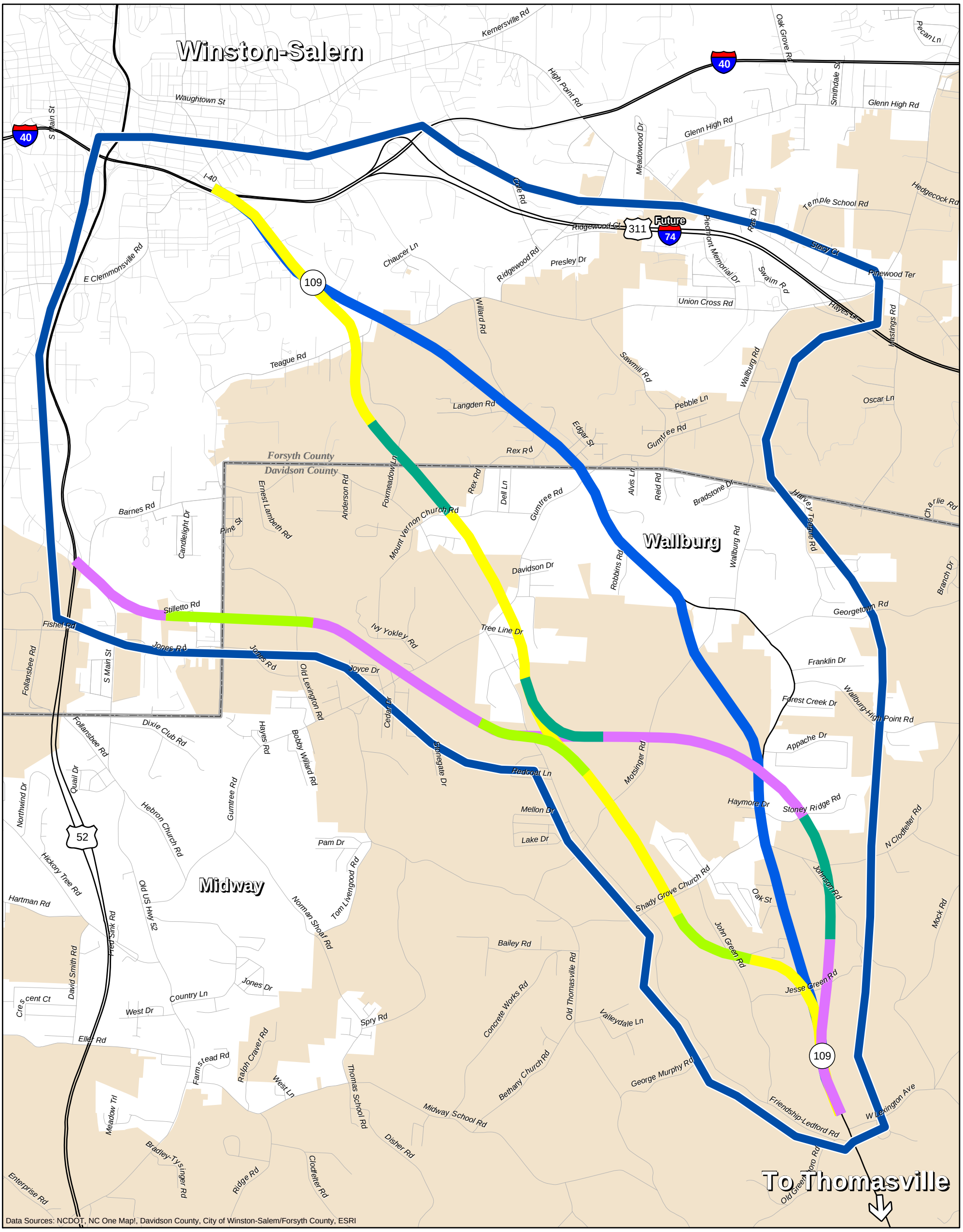
- Preparation of an erosion control plan incorporating the NCDOT *Best Management Practices for protection of Surface Waters.*
- Coordination with municipalities and utilities for relocation and reconfiguration of utility systems.
- Implementation of the Relocation Assistance Program.
- Approval of all required permits and certifications.

S.9 SUMMARY OF ENVIRONMENTAL IMPACTS

Table S-1 contains a summary of environmental impacts associated with the build alternatives selected for detailed study. The alternatives are shown on Figure S-1.

TABLE S-1: SUMMARY OF ENVIRONMENTAL IMPACTS

		Build Alternative				
		Alternative 1	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Length of Corridor (Miles)	Length on Existing	7.74	1.80	0.81	1.29	1.33
	Length on New Location	1.80	7.61	8.39	7.21	8.72
	Total Length	9.54	9.41	9.20	8.50	10.05
Relocations	Residential	165	87	75	70	97
	Business	39	5	3	4	5
	Total	204	92	78	74	102
Minority Populations Impacted		0	0	0	0	0
Schools		0	0	0	0	0
Parks		0	0	0	0	0
Churches		3	2	1	1	2
Cemeteries		0	0	0	0	0
Number of New Directional Crossover Intersections		13	6	8	8	6
New Indirect Left Turns (No Directional Crossover)		9	2	2	0	3
Railroad Crossings		0	0	1 (Grade Sep.)	1 (Grade Sep.)	0
Major Utility Conflicts		3	4	3	3	4
Historic Sites with Adverse Effects		0	0	0	0	0
Section 4(f) Sites		0	0	0	0	0
Federally Protected Species		0	0	0	0	0
Prime Farmland (acres)		230.13	124.81	137.41	139.13	124.98
Hazardous Materials Sites		25	9	3	4	3
Noise Impacted Receptors		97	61	33	31	61
100-Year Floodplain (acres)		10.44	9.94	5.87	10.46	5.35
Wetlands (acres)		0.58	0.15	0.21	0.16	0.14
Streams	Stream Crossings	20	24	34	34	24
	Stream Impacts (linear feet)	4,432	7,757	9,259	10,729	6,500
Cost	Construction	$70,000,000	$78,500,000	$85,600,000	$78,400,000	$81,500,000
	Right-of-Way	$69,975,000	$49,425,000	$34,975,000	$39,950,000	$46,710,000
	R/W Utility	$4,758,169	$628,221	$657,572	$657,572	$618,841
	Total	$144,733,169	$128,553,221	$121,232,572	$119,007,572	$128,828,841



Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary

N W E S

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure S-1 **Build Alternates for Detailed Study**

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APPENDICES

SECTION 1
PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

This section summarizes the proposed action studied in this Draft Environmental Impact Statement (DEIS) and provides a summary of the need and purposes for improvements to the NC 109 corridor in northeastern Davidson County and southeastern Forsyth County, in the vicinity of the City of Winston-Salem.

This document has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, and the North Carolina Environmental Policy Act (NCEPA). This document conforms to the Council on Environmental Quality (CEQ) guidelines regarding implementation of the procedural provisions of NEPA, and the Federal Highway Administration's (FHWA) *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (Technical Advisory T6640.8A, 1987).

1.2 DESCRIPTION OF PROPOSED ACTION

This study evaluates transportation improvements proposed between Old Greensboro Road (SR 1798) in northeastern Davidson County and southeastern Forsyth County. The general location of this project is shown in Figure 1-1. This transportation improvement project is identified in the North Carolina Department of Transportation (NCDOT) 2009-2015 State Transportation Improvement Program (STIP) as Project R-2568C.

1.3 SUMMARY OF NEED FOR PROPOSED ACTION

The need for improvements to the NC 109 corridor between Old Greensboro Road (SR 1798) in northeastern Davidson County and southeastern Forsyth County is demonstrated by the following summary of existing and projected conditions. Detailed discussions of the existing and projected conditions and the needs for the proposed action are presented in Sections 1.6 through 1.10.

- ***Existing and Projected Unacceptable Levels of Service***
  Existing level of service[1] (LOS) on some two-lane segments along NC 109 were an unacceptable LOS E or F in 2008. From 2008 to 2035, traffic volumes along NC 109 are expected to increase by approximately 90 percent. In 2035, under no-build conditions, all

[1] Level of service (LOS) is a qualitative measure describing operational conditions within a traffic stream and how motorists and/or passengers perceive these conditions. A LOS definition generally describes these conditions in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Six levels of service, with letter designations from A (best) to F (worst), represent operations for each type of facility for which analysis procedures are available.

segments of NC 109 are predicted to operate over capacity at unacceptable LOS E or LOS F.

By 2035, all four of the signalized intersections along NC 109 within the project area and all but three of the forty-one unsignalized intersections are projected to be over capacity.

- ***Above-Average Crash Rates***
  Between February 2006 and January 2009, a total of 219 crashes were recorded along this section of roadway. Of this total, 110 crashes caused injuries. The total crash rate for NC 109 within the project area for the three-year period from February 2006 through January 2009 (228.69 crashes per 100 million vehicle miles traveled [MVM]), is approximately 36 percent higher than similar routes in North Carolina (167.65 crashes/MVM), and exceeds the statewide critical crash rate (189.94 crashes/MVM) by approximately 20 percent.

1.4 PURPOSE OF PROPOSED ACTION

Projects can serve both primary and secondary purposes. FHWA considers a primary purpose to be a "driver" of the project; it "reflects the fundamental reason why the project is being pursued" (AASHTO, 2007). A secondary purpose is an additional desirable purpose, but not the core purpose of the project.

The primary purpose of the proposed action is to improve traffic flow and levels of service along the NC 109 corridor in the project study area. The secondary purpose is to improve safety along the NC 109 corridor in the project study area. By meeting these, the project will address existing and projected deficiencies in levels of service and above average crash rates along the NC 109 corridor.

The performance measures considered when developing and evaluating alternatives in terms of their ability to meet the purpose and need were as follows:

- The ability to provide a transportation facility between Old Greensboro Road and the Winston-Salem area that consistently operates at an acceptable LOS on its mainline (LOS D or better) in 2035.
- Reduction in travel times between Old Greensboro Road and the Winston-Salem area relative to the no-build scenario.
- Reduce the rate of rear end crashes along the NC 109 corridor, the most common type of accident along the corridor.

1.5 PROJECT DESCRIPTION

1.5.1 Project Setting

The project study area is located within the Piedmont Region of North Carolina near the southeastern edge of the City of Winston-Salem. Most of the study area lies in northern Davidson County; the northern portion of the study area is in southeastern Forsyth County (Figure 1-1).

The City of Thomasville, in Davidson County, lies south of the project area; the portion of NC 109 examined in this study serves commuting traffic between employment centers in Thomasville and Winston-Salem. Greensboro and High Point, the two other major cities which along with Winston-Salem make up the Piedmont Triad economic region, lie to the east of the project area. The cities of Lexington and Salisbury lie to the southwest.

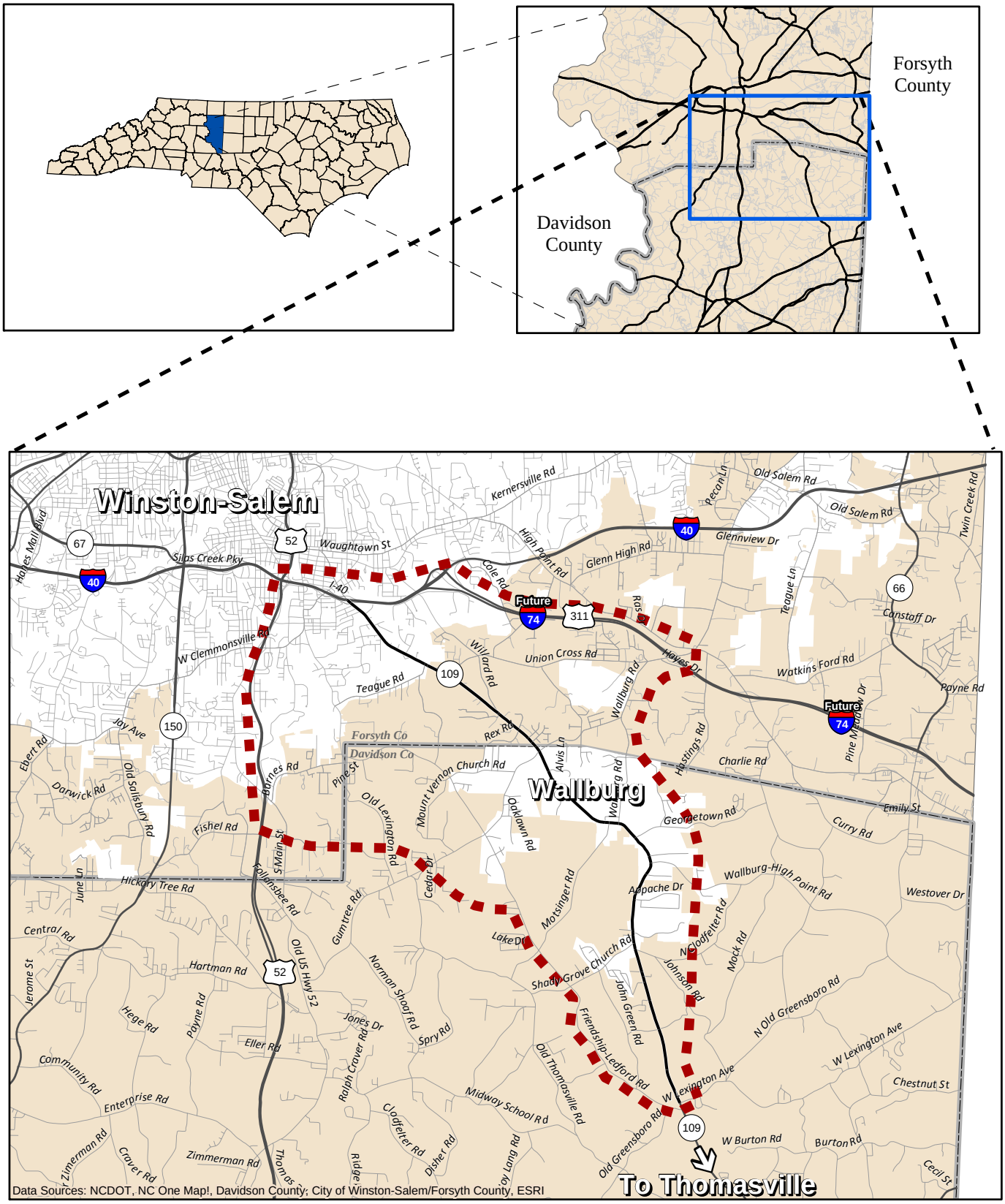
As shown in Figure 1-2, the northern boundary of study area is defined by I-40/US 311 in southeastern Forsyth County, the western boundary is defined by US 52, and the southern boundary is defined by Old Greensboro Road (SR 1798). Portions of the study area are within the City of Winston-Salem and the Town of Wallburg, as well as unincorporated areas of Davidson and Forsyth Counties.

The once rural study area is becoming more suburban. Residential development is becoming denser along NC 109. New neighborhoods such as the Meadowlands residential and golf community, which is just west of NC 109 near Wallburg, are under development. Rural residential and agricultural uses are found throughout much of the study area; more urban development patterns are concentrated at the northwestern corner of the study area. Commercial areas are scattered along NC 109, but dense in the northwestern portion of the study area within Winston-Salem. There are several business parks located along the northern edge of the study area.

1.5.2 Project History

In the 1984 Davidson County Thoroughfare Plan, improvements to existing NC 109 were listed as the second highest priority project for the county. In 1990, a Feasibility Study for improvements to NC 109 from I-85 Business in Davidson County to US 311 in Forsyth County was completed by NCDOT.

In 1993, NCDOT began a planning study for improvements to NC 109 from I-85 Business in Davidson County to I-40/US 311 in Forsyth County. In June 1995, the project was broken into two sections. The southern section (STIP Project Number R-2568 Sections A and B) includes improvements to NC 109 from Business I-85 to just north of SR 1798 (Old Greensboro Road). The northern section (STIP Project Number R-2568 Section C) includes improvements to NC 109 from just north of SR 1798 to I 40/US 311. NCDOT designated the southern section as the priority section to be constructed first (NCDOT, NC 109 Update Newsletter, June 1995). An



Legend

Project Study Area

N W E S

0 0.5 1 2 Miles

North Carolina Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 1-1 **Project Vicinity**

Legend

Project Study Area

N
W E
S

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 1-2 Project Study Area

Environmental Assessment (EA) for the southern section (STIP Project Number R-2568 A and B) was signed in 1996. The Finding of No Significant Impact (FONSI) was signed in 1997. STIP Project R-2568A included improvements to the I-85 Business Interchange, which were completed in 2004. STIP Project R-2568B included NC 109 from just north of the I-85 Business interchange to just north of Old Greensboro Road (SR 1798); it was completed in 2007.

The initial agency scoping meeting for R-2568C was held in January 2004. The first round of Citizens Informational Workshops was held in April 2004 and the second round was held in November 2005. Between 2004 and the present, environmental screening, alternatives development, and detailed studies based on preliminary level designs were completed in accordance with NCDOT policies and procedures. Table 1-1 contains a brief summary of the project's history.

TABLE 1-1: PROJECT HISTORY

Date	Event
1984	Project appears on Davidson County Thoroughfare Plan
1990	NCDOT completes feasibility study for NC 109 from I-85 Business to US 311
1993	NCDOT begins planning study for NC 109 from I-85 Business to US 311
1995	Project separated into two sections
1997	FONSI signed for southern section of NC 109 (R-2568A and B)
2004	Agency scoping meeting held
2004	First Citizens Informational Workshops held
2004	Merger Team achieves Concurrence Point 1: Purpose and Need
2004	Construction of R-2568A completed
2005	Second Citizens Informational Workshops held
2006	Merger Team selects alternatives for detailed study (Concurrence Point 2)
2007	Construction of R-2568B completed
2009	Merger Team achieves Concurrence Point 2A: Bridging Locations

1.6 SYSTEM LINKAGE

1.6.1 Existing Road Network

NC 109 is the only direct route between Thomasville and Winston-Salem and functions as a north-south connector between I-85, I-85 Business and I-40/US 311. Locally, NC 109 provides an important route for daily commuter traffic between these areas. South of the project study area in Davidson County, NC 109 intersects with US 64, NC 47, and I-85. NC 109 runs between Troy, North Carolina and Winston-Salem.

In the vicinity of the project, I-85 connects Davidson County with Greensboro and Durham to the northeast and Charlotte to the southwest. I-85 extends from Montgomery, Alabama through Atlanta, Georgia to Richmond, Virginia and runs southwest-northeast through Davidson County. I-40, which connects Forsyth County with Greensboro to the east and Hickory to the southwest, is an east-west interstate route that traverses Forsyth County.

US 52 (future I-285) is a major north-south route at the western edge of the project area, connecting Winston-Salem to Lexington and points south. US 311 crosses east-west through the northeastern corner of the project area, connecting the project area to High Point to the east; it connects to I-40 in southeastern Winston-Salem. Business I-85/US 29/70 extends east-west approximately three miles south of the project area.

Other important east-west roads in the vicinity of the project include Union Cross Road (SR 1730) in the northern portion of the study area, Gumtree Road (SR 1711) and Wallburg-High Point Road (SR 1741) in the central portion, and Old Greensboro Road at the southern end. Other important north-south roads include Wallburg Road (SR 1730) along the eastern side of the project area, Motsinger Road (SR 1723) and Friendship-Ledford Road (SR 1700) in the central area, and Old Lexington Road (SR 2743) and South Main Street (SR 4205) at the western side.

1.6.2 Modal Interrelationships

Bus

Commuter bus service is provided by the Winston-Salem Transit Authority to a small portion of the northern section of the project study area. Two bus routes, the Martin Luther King, Jr. Boulevard/ Peachtree/ Old Lexington Road Bus Route and the Main/ Konoak/ Cassell Stoney Glen Bus Routes, are located within the project study area.

Within Davidson County, there is no available commuter bus service. However, the Davidson County Transportation System provides transportation for the human service agencies, the elderly, the disabled, and the general public of Davidson County. The service uses standard vans, small buses, and small buses with wheelchair lifts to assist persons with specialized transportation needs.

The Piedmont Authority for Regional Transportation (PART) provides bus service between Winston-Salem, Greensboro, and Highpoint. Buses run from the Winston-Salem Transportation Center to the PART regional hub at the Piedmont Triad International Airport every half hour from 6:00 a.m. to 6:30 p.m. weekdays. From the regional hub, passengers can travel to High Point or Greensboro. Regional buses also run along US 52, at the western edge of the project area, connecting Lexington and Winston-Salem.

Rail

Within the project study area, the Winston-Salem Southbound Railway (WSSB) runs parallel to US 52. The WSSB is owned jointly by CSX and Norfolk Southern Railway. The WSSB track is used by two to four freight trains per day. No passenger trains operate over the WSSB rail line.

The nearest commuter rail service terminals are located in Greensboro and High Point.

Air

The Piedmont Triad International Airport (PTI) is located in Guilford County, approximately sixteen miles northeast of the project study area. PTI provides the Triad with direct and connecting commercial air passenger and airfreight service to national and international destinations.

The majority of private air traffic in Winston-Salem and Forsyth County originates at the Smith Reynolds Airport. This airport, owned by the Airport Commission of Forsyth County, is a general aviation airport with limited commuter flights. The airport is located approximately six miles north of the project study area.

By improving traffic flow and levels of service and reducing travel times along the NC 109 corridor in the project study area, the project would also increase access to area rail and airport facilities.

1.6.3 Commuting Patterns

NC 109 is one of the major travel routes used by residents commuting to and from Thomasville and Winston-Salem. In 2000, 11,062 residents commuted from Davidson County to Forsyth County, while 4,136 residents commuted from Forsyth County to Davidson County. Net out-commuting is greater than in-commuting for Davidson County; a fairly high percentage of Davidson residents who commute to jobs outside the county. Net in-commuting is greater than out-commuting in Forsyth County. Mean commuting travel times in the area are slightly lower than the State average.

1.7 SOCIAL AND ECONOMIC CONDITIONS

1.7.1 Demographics

The project study area has experienced moderate population growth in recent years; this growth has been somewhat slower than in North Carolina as a whole, although it has outpaced nationwide population growth. Between 1990 and 2000, the population in the project study area grew by approximately 17 percent (see Section 3.1).

Growth trends have varied considerably across the project area. The northeastern part of the project area, in southeastern Forsyth County near Kernersville, has grown much faster than the project area as a whole as suburban development spreads into this once rural area. Likewise, areas just south of the project area near Thomasville have grown more rapidly as suburban growth spreads north from Thomasville. Other parts of the project area have experienced modest population growth. Moderate growth overall is expected to continue in the future in the project study area.

1.7.2 Economic Data

1.7.2.1. Employment

According to the Employment Security Commission, the manufacturing sector comprises a large but declining share of total employment in the area (see Table 1-2). It is the largest employment sector in Davidson County, claiming 27 percent of the County's total employment, and is the second largest sector in Forsyth County, claiming 13 percent of its total employment in 2007. Significant manufacturing sub-sectors within the area include furniture, tobacco products, textiles, and apparel. While manufacturing remains an important employment sector in the region, it has faced a significant loss of manufacturing jobs as major employers have eliminated jobs and closed plants in the area. Since 2000, two of the area's largest manufacturers, R.J. Reynolds Tobacco and Thomasville Furniture, have eliminated over 3,000 jobs combined. Nationwide trends, including offshoring of factories, suggest that the manufacturing sector will continue to decline.

The total number of jobs in Davidson County declined by 10.3 percent between 1997 and 2007, largely due to loss of manufacturing jobs. Overall job growth in Forsyth County and other surrounding areas has helped to offset Davidson's job loss. Health care, one of the fastest growing job sectors in Forsyth County, employs the largest number of workers in Forsyth. The management sector is Forsyth's fastest growing sector (129.7 percent job growth between 1997 and 2007), although it still claims a fairly small share of the county's total employment (2.6 percent). The retail and educational services sectors are also significant employers in Forsyth and growth in the educational services has been brisk. Retail, educational services and health care are also significant employment sectors in Davidson County, together claiming nearly one-third of the county's total employment.

TABLE 1-2: EMPLOYMENT BY SECTOR

Sector	Davidson County Employment			Forsyth County Employment		
	1997	2007	% Change 1997-2007	1997	2007	% Change 1997-2007
Public Administration	1,954	2,071	+5.9%	7,233	6,980	-3.5%
Agriculture, Forestry, Fishing & Hunting	50	44	-12.0%	114	72	-36.8%
Mining	*	63	N/A	38	55	+44.7%
Utilities	167	131	-21.6%	372	201	-46.0%
Construction	2,120	2,738	+22.6%	7,955	8,326	+4.7%
Manufacturing	20,050	12,030	-40.0%	31,859	23,693	-25.6%
Wholesale Trade	1,437	1,977	+37.6%	5,592	5,886	+5.3%
Retail Trade	5,233	4,610	-13.5%	20,145	20,895	+3.7%
Transportation & Warehousing	1,524	1,341	-12.0%	10,040	7,892	-21.4%
Information	383	306	-20.1%	2,616	1,886	-32.3%
Finance and Insurance	664	726	+9.3%	10,768	10,321	-4.1%
Real Estate & Rental and Leasing	318	297	-6.6%	2,261	2,145	-5.1%
Professional and Technical Services	678	754	+11.2%	5,983	7,607	+27.1%
Management of Companies and Enterprises	1,629	718	-55.9%	1,953	4,487	+129.7%
Administrative & Waste Services	1,026	2,321	+126.2%	12,795	13,054	+2.0%
Educational Services	3,834	4,637	+20.9%	14,111	18,895	+33.9%
Health Care & Social Assistance	3,803	4,486	+18.0%	19,958	32,251	+61.6%
Arts, Entertainment & Recreation	322	498	+54.7%	2,131	2,085	-2.2%
Accommodation & Food Services	2,919	3,361	+15.1%	12,007	14,680	+22.2%
Other Services	961	891	-7.3%	4,607	4,780	+3.7%
Total	49,072	44,000	-10.3%	172,538	186,191	+7.9%

Source: Employment Security Commission, Labor Market Information, 1997-2007
*Indicates disclosure suppression; data not available

1.7.2.2. Major Employers

Table 1-3 lists the largest employers in Davidson and Forsyth counties. Davidson County Schools are that county's largest employer. Other educational and health facilities including Davidson County Community College, Lexington Memorial Hospital, and Lexington and Thomasville city schools are significant employers. Despite the ongoing loss of manufacturing jobs, several manufacturers including furniture manufacturers Leggett and Platt and Thomasville Furniture and window manufacturers Atrium Companies, PPG Industries and Jeld-Wen remain major employers in the area. Reflecting the importance of the health care sector to Forsyth County's economy, North Carolina Baptist Hospitals, Forsyth Memorial Hospital, and Wake Forest University School of Medicine are among its major employers. Educational services are

also well-represented by Winston Salem-Forsyth County Schools, the largest employer in Forsyth County, and Wake Forest University. Two of the manufacturers that have long been mainstays of this region, R.J. Reynolds Tobacco and Hanesbrands (apparel manufacturing), are also major employers in the area. Wachovia Bank is headquartered in Winston-Salem and is another of Forsyth's major employers.

TABLE 1-3: PROJECT AREA MAJOR EMPLOYERS

DAVIDSON COUNTY		
Employer	**Industry**	**Employment Range**
Davidson County Schools	Education and Health Services	1,000+
County of Davidson	Public Administration	500-999
Atrium Companies Inc	Manufacturing	500-999
Bradley Personnel Inc	Professional and Business Services	500-999
Wal-Mart Associates Inc	Trade, Transportation, and Utilities	500-999
Davidson County Community College	Education and Health Services	500-999
Lexington Memorial Hospital	Education and Health Services	500-999
Lexington City Schools	Education and Health Services	500-999
PPG Industries Fiberglass Products	Manufacturing	500-999
Jeld-Wen	Manufacturing	500-999
Thomasville City Schools	Education and Health Services	500-999
Leggett & Platt Incorporated	Manufacturing	250-499
Thomasville Furniture Inc	Manufacturing	250-499
FORSYTH COUNTY		
Winston Salem Forsyth Co Schools	Education and Health Services	1,000+
North Carolina Baptist Hospitals	Education and Health Services	1,000+
Forsyth Memorial Hospital Inc	Education and Health Services	1,000+
Wake Forest University School of Medicine	Education and Health Services	1,000+
RJ Reynolds Tobacco Company	Manufacturing	1,000+
Hanesbrands, Inc.	Manufacturing	1,000+
Wachovia Bank	Financial Activities	1,000+
City of Winston-Salem	Public Administration	1,000+
State of North Carolina	Public Administration	1,000+
US Air Inc	Trade, Transportation, and Utilities	1,000+
Wal-Mart Associates Inc	Trade, Transportation, and Utilities	1,000+
Wake Forest University	Education and Health Services	1,000+

Source: Employment Security Commission, Labor Market Information, December 2007.

1.8 TRANSPORTATION PLANNING

1.8.1 North Carolina Transportation Improvement Program

The North Carolina STIP is a multi-year plan for all state transportation projects. The STIP contains funding information and schedules for proposed transportation projects throughout the state and is updated every two years to reflect changing priorities and funding availability. The proposed NC 109 Improvements project is included as Project No. R-2568C in the 2009-2015 NCDOT STIP.

The following projects are currently listed in the 2009-2015 STIP for the project area (Figure 1-3):

- R-4750. Upgrade existing US 52 from I-85 in Davidson County to I-40 in Forsyth County to interstate standards. Construction is scheduled to begin in 2010.
- U-4909. Widen Union Cross Road (SR 2643) from Wallburg Road (SR 2691) to Sedge Garden Road (SR 2632) in Forsyth County. Construction is scheduled to begin in 2010.
- U-2923. Widen Clemmonsville Road (SR 2747) from Old Salisbury Road (SR 3011) to South Main Street in Winston-Salem. Construction is scheduled to begin in 2011.
- U-2579. Winston-Salem Northern Beltway Eastern Section Extension - new location multi-lane freeway. Construction of segment from US 311 to I-40 has not yet been programmed for funding.
- B-4742. Replace Bridge No. 134 over a creek on SR 1755 in Davidson County. The project is currently under construction.
- B-4101. Replace Bridge No. 142 over Abbotts Creek on SR 1741 in Davidson County. The project is currently under construction.

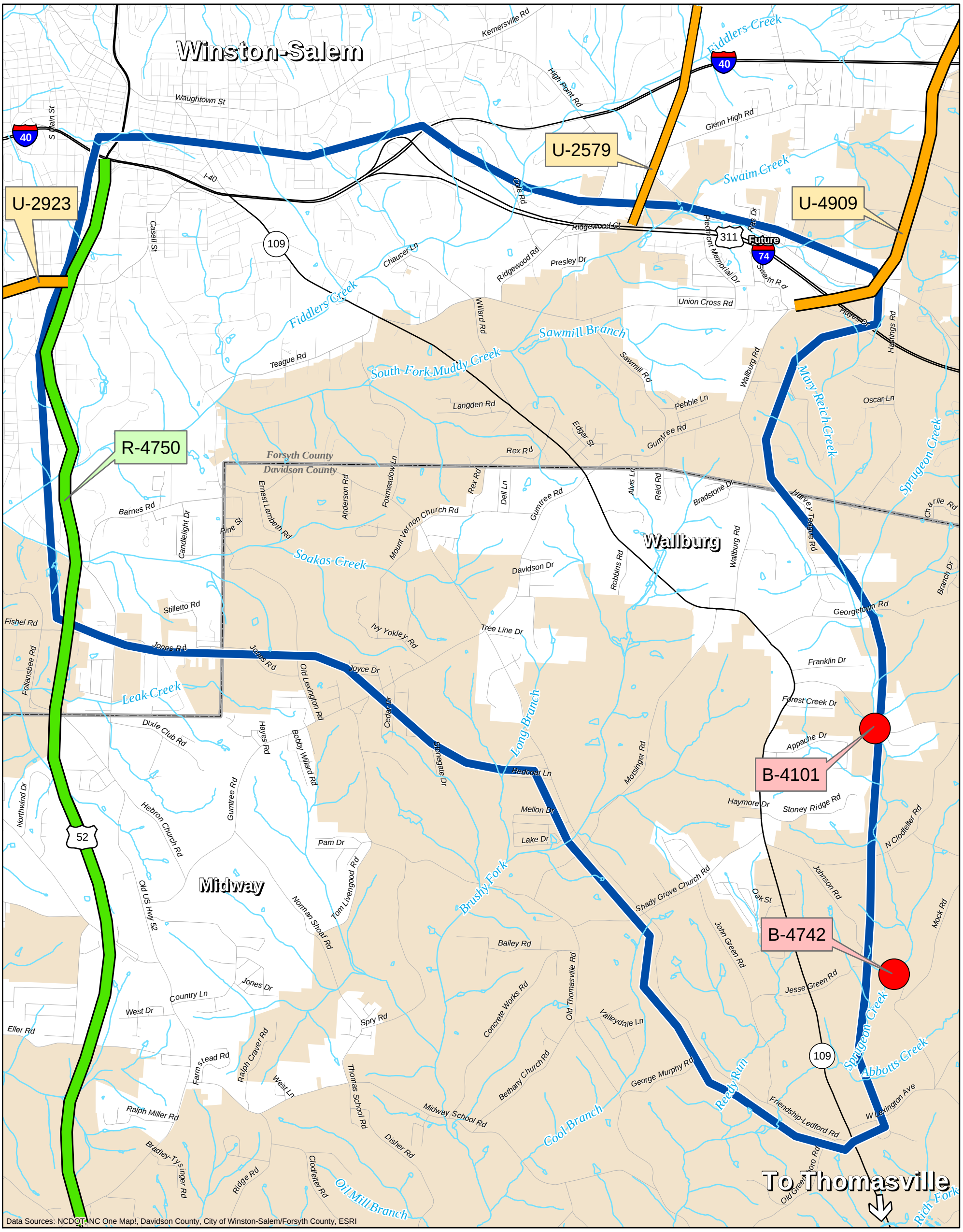
1.8.2 Local Thoroughfare Plans

The High Point Metropolitan Planning Organization (HPMPO) maintains jurisdiction over an area that includes most of the project area within Davidson County, including the Town of Wallburg. The current *High Point Urban Area Thoroughfare Plan*, last updated in 2006 recommends that NC 109 should be widened to a four-lane divided roadway. The Metropolitan Planning Organization (MPO) for the Winston-Salem/Forsyth County Urban Area adopted its 2035 *Long Range Transportation Plan* in 2009. This plan also recommends that NC 109 should be improved to a four-lane divided roadway. The *Davidson County Thoroughfare Plan*, last updated in 1984, recommended that NC 109 from Thomasville to Forsyth County be improved to a four-lane divided facility. These Thoroughfare Plans and Comprehensive Transportation Plan comprise the tools that public officials will use to assure the development of a street system that will accomplish the goals established in local comprehensive and land use plans while also meeting existing and future multi-modal travel desires within the area.

1.9 TRAFFIC OPERATIONS ANALYSES

1.9.1 Existing Roadway Characteristics

Existing NC 109 within the project area is a two-lane undivided rural highway with no control of access. This existing cross-section of NC 109 consists primarily of two ten-foot lanes with unpaved shoulders varying from three to six feet in width. NC 109 in the vicinity of the interchange of I-40/US 311 has been widened to a five lane, sixty-four-foot curb and gutter cross section. Speed limits on NC 109 are 45 mph except within the Town of Wallburg, where the speed limit is 35 mph.



Legend

- Study Area Boundary
- Urban Project
- Rural Project
- Bridge Replacement Project

N W E S

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 1-3 **TIP Projects Near the Study Area**

Rural residential and agricultural uses typify much of the land use along NC 109, with development becoming denser and more intense toward the northern end of the project area. There are few residential subdivisions near NC 109, with most of these subdivisions including fewer than 20 lots. The only major residential subdivision is the Meadowlands development, a golf-course oriented subdivision near central Wallburg. Commercial development is concentrated in a few areas: the intersection of Gumtree Road and NC 109 contains two retail shopping centers, fast food restaurants, and service stations; and central Wallburg contains a small number of retail stores, offices, restaurants and other commercial establishments. Other commercial uses, including restaurants, auto-related businesses and small offices, are lightly scattered along NC 109.

1.9.2 Existing No-Build Traffic Conditions (2008)

For this project, the Highway Capacity Manual 2000 and its accompanying software (HCS 2000) were used to determine the current (2008) and future (2035) levels of service (LOS).

Traffic flow and LOS on rural arterial two-way highways, such as the NC 109 corridor, are influenced by the geometric characteristics of the facility (curvature, grade, lane width, shoulder width and sight distance), adjacent land use, traffic density, truck percentage, turning movements, and the effect of traffic signals. As shown in Table 1-4, NC 109 within the project limits is currently carrying traffic volumes at or beyond its design capacity, with all segments operating at LOS D or worse. This is primarily due to a lack of north-south linkages with sufficient capacity to service the future travel demand between Thomasville and Winston-Salem. Average operating speed on NC 109 within the project limits was 38 mph in 2008.

TABLE 1-4: YEAR 2008 TRAFFIC VOLUMES ALONG NC 109*

NC 109 Segment	Current ADT*	LOS
I-40 to Teague Rd.	14,316	D
Teague Rd. to Union Cross Rd.	14,988	E
Union Cross Rd. to Gumtree Rd.	11,964	D
Gumtree Rd to Motsinger Rd.	9,860	D
Motsinger Rd. to Wallburg Rd.	10,296	D
Wallburg Rd. to Georgetown Rd.	10,532	D
Georgetown Rd. to Wallburg High Point Rd.	10,420	D
Wallburg High Point Rd. to Shady Grove Church Rd.	9,748	D
Shady Grove Church Rd. to Johnson Rd.	9,972	D
Johnson Rd. to Jesse Green Rd	8,976	D
Jesse Green Rd. to Old Greensboro Rd.	9,312	D

* Extrapolated from 2003 and 2005 data

As suggested by the varied land uses along NC 109, travelers on this road are a combination of commuters traveling from areas south of the project area and local travelers accessing retail uses, public uses and other services along NC 109. The conflict between these groups and their travel characteristics adds to driver frustration, particularly since NC 109 currently only has one lane of traffic in each direction for most of its length. Along NC 109, the number and spacing of unsignalized and signalized intersections with associated delays dictates the capacity and LOS as much as the number of lanes or traffic demand. Seven of nine existing unsignalized intersections along NC 109 for which 2008 data were available have undesirable LOS E or F on at least one of the critical turn movements during either the morning or evening peak (see *Traffic Analysis for Bypass Alternatives for NC 109 Improvements Study*, Lochner 2009a). Table 1-5 summarizes LOS at signalized intersections along NC109 during 2008. As shown, the intersections have on average LOS C and D during peak periods of travel. Some of the movements currently have LOS E and F.

TABLE 1-5: CURRENT LEVELS OF SERVICE AT SIGNALIZED INTERSECTIONS ALONG NC 109 WITH EXISTING LANE CONFIGURATION (2008)

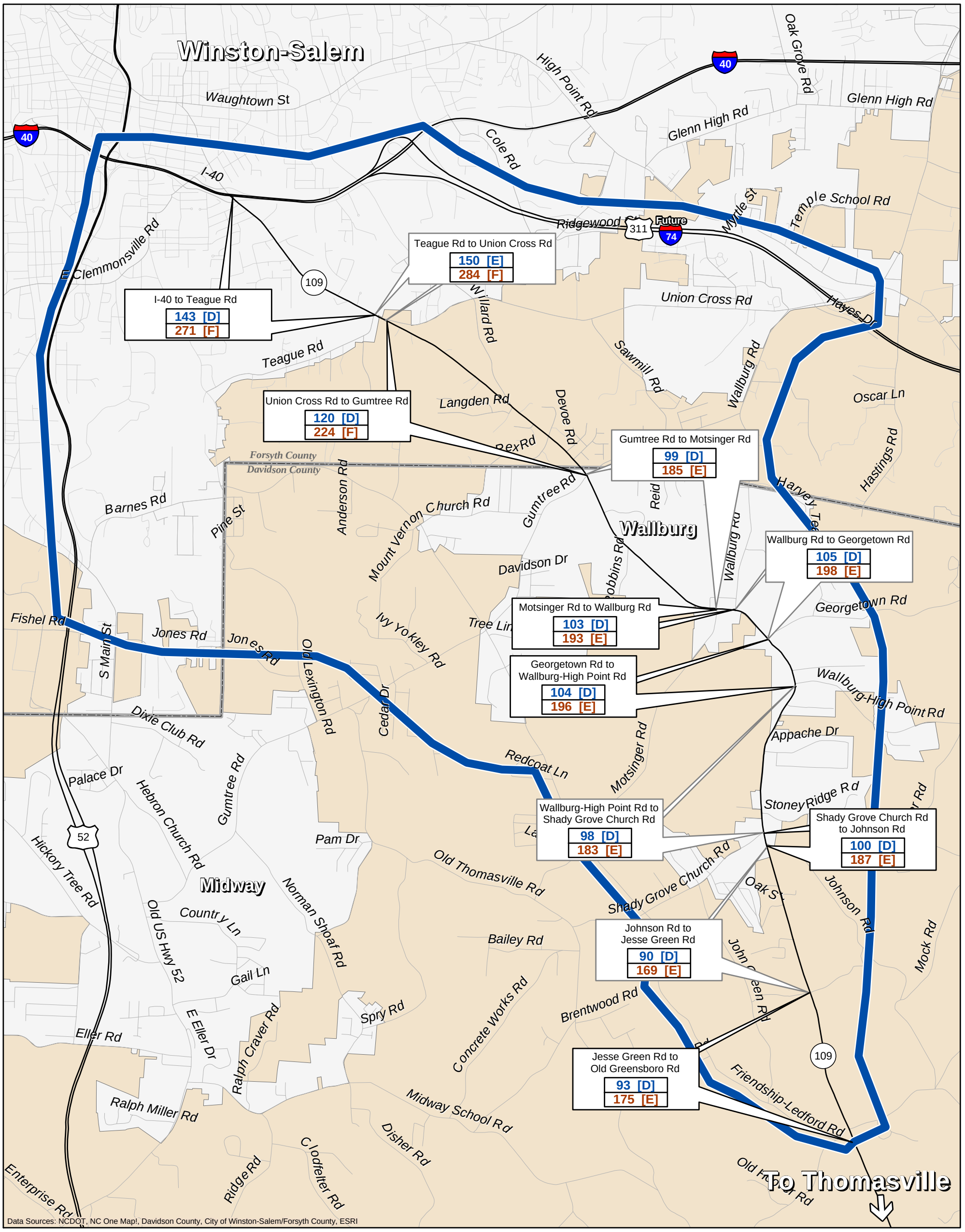
Location	Critical Movements	AM LOS	LOS (DELAY)	PM LOS	LOS (DELAY)
NC 109 & Gumtree Road	SEL	C	C (26.9 sec)	D	D (49.4 sec)
	SET	C		E	
	NWL	C		D	
	NWT	C		E	
	NEL	C		F	
	NET	C		B	
	SWT	C		B	
NC109 & Old Greensboro Road	EBL	C	C (33.9 sec)	C	C (31.3 sec)
	EBT	D		C	
	WBL	D		C	
	WBT	C		C	
	NBL	C		C	
	NBT	C		C	
	NBR	C		D	
	SBL	C		D	
	SBT	C		C	
	SBR	C		C	

1.9.3 Year 2035 No-Build Traffic Protections and Capacity Analysis

To estimate the impact of future growth on the existing transportation network, NCDOT prepared a travel demand model to project 2035 traffic volumes for the "no-build" condition. No-build is defined as no improvements being made to NC 109 or any minor side roads and no bypass constructed.

The 2035 year traffic indicates that NC 109 will carry up to 28,380 vehicles per day (VPD) between Old Greensboro Road and the I-40 interchange with NC 109 (Figure 1-4). The conflict between types of travelers on NC 109 will increase through 2035, adding to driver frustration on an at- or over-capacity facility. Examples include travelers wishing to travel directly and quickly between home and their destinations but slowed by school traffic, 35 mph zones, and usually slower local commuters making frequent stops with slower 90 degree turns along NC 109. Because of the rural nature of the existing facility, there are few places where the horizontal and vertical geometry allow vehicular passes to be made safely. Additionally, passing is difficult because of such high opposing traffic volumes.

The population of the project area is expected to increase by approximately 50 percent by 2035. As a result of continued growth in the area, the travel demand in the NC 109 corridor is projected to increase by nearly 90 percent. Traffic volumes forecast on segments of NC 109 in 2035 are shown in Table 1-6. The southernmost section, between Old Greensboro Road and Jesse Green Road, currently carries 9,312 VPD and is forecast to have a demand of approximately 17,520 VPD in 2035. The northernmost section, between Teague Road and I-40, currently carries 14,316 VPD and is forecast to have a demand of 28,380 in 2035. As a result, the average delay experienced by commuters between Old Greensboro Road and I-40 will increase from 15 minutes to 45 minutes between 2008 and 2035 under the no-build scenario, a tripling of the wait time.



Legend

- Study Area Boundary
- Municipal Boundary
- # # # [X] 2008 Estimated AADT In Hundreds (No Build) [LOS]
- # # # [X] 2035 Estimated AADT In Hundreds (No Build) [LOS]

N W E S

0 0.5 1 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 1-4 **Traffic Volume Comparison**

TABLE 1-6: YEAR 2035 TRAFFIC VOLUMES ALONG NC 109 (NO-BUILD)		
NC 109 Segment	**Forecast ADT**	**Forecast LOS**
I-40 to Teague Rd.	27,060	F
Teague Rd. to Union Cross Rd.	28,380	F
Union Cross Rd. to Gumtree Rd.	22,440	F
Gumtree Rd to Motsinger Rd.	18,500	F
Motsinger Rd. to Wallburg Rd.	19,260	F
Wallburg Rd. to Georgetown Rd.	19,820	F
Georgetown Rd. to Wallburg High Point Rd.	19,600	F
Wallburg High Point Rd. to Shady Grove Church Rd.	18,280	F
Shady Grove Church Rd. to Johnson Rd.	18,720	F
Johnson Rd. to Jesse Green Rd	16,860	F
Jesse Green Rd. to Old Greensboro Rd.	17,520	F

Building all other planned STIP projects is not likely to be sufficient to meet regional capacity needs. The delays for segments in 2035 indicate failing levels of service for most of the corridor network. Another measure of congestion, the average network speed[2], also shows declining driving conditions under the 2035 no build scenario. Average network speed, currently estimated to be 38 mph, would decrease approximately 68 percent to 12 mph by 2035. The total time it takes to travel the length of the NC 109 corridor within the project limits (currently 15 to 18 minutes) is forecast to increase by as much as 278 percent by 2035. Without improvements beyond those listed in the 2009-2015 STIP, service will remain at LOS F with increasing congestion, longer delays, declining average speeds and longer travel times. Projected wait times at five of the unsignalized intersections are between 5 and 10 minutes (see *Traffic Analysis for Bypass Alternatives for NC 109 Improvements Study*, Lochner 2009a). Eleven of the intersections are expected to have wait times for critical turn movements between 10 and 30 minutes. Two intersections show wait times of over one hour.

Table 1-7 summarizes the level of service at the signalized intersections along NC 109 in the year 2035. As shown, the vast majority of turn movements have an undesirable LOS E or F during both the morning and evening peak periods. Gumtree Road will have a significant delay of over 15 minutes.

[2] Average Network Speed is measured in miles per hour and shows directly the ability of the street and arterial network to move vehicles throughout the system. It represents the average speed along the major arterials in the study area on an average day.

TABLE 1-7: LEVELS OF SERVICE AT SIGNALIZED INTERSECTIONS ALONG NC 109 WITH EXISTING LANE CONFIGURATION (YEAR 2035)					
Location	**Critical Movements**	**AM LOS**	**LOS (DELAY)**	**PM LOS**	**LOS (DELAY)**
NC 109 & Gumtree Road (Existing Signal)	SEL	F	15 min 42 sec	F	34 min 30 sec
	SET	F		F	
	NWL	F		F	
	NWT	F		F	
	NEL	F		E	
	NET	F		F	
	SWT	F		F	
NC 109 and Old Greensboro Road (Existing Signal)	EBL	F	3 min 11 sec	F	3 min 9 sec
	EBT	F		F	
	WBL	F		F	
	WBT	F		F	
	NBL	F		F	
	NBT	E		D	
	NBR	D		D	
	SBL	F		F	
	SBT	F		F	

1.10 CRASH ANALYSIS

The crash rate data obtained is for the 10.2 mile section of NC 109 between SR 1755 (Old Greensboro Road) in Davidson County to I-40 in Forsyth County. The data in Table 1-8 show that the NC 109 corridor exceeds the statewide crash rates in all categories except the fatal category and exceeds the critical crash rate in the total and non-fatal injury categories. Two hundred and nineteen (219) crashes occurred on NC 109 in the project area, representing a crash rate of 228.69 crashes per 100 MVM. That is 36.4 percent higher than the statewide rate at 167.65 crashes per 100 MVM.

TABLE 1-8: EXISTING NC 109 AND AVERAGE STATEWIDE CRASH RATES			
Crash Type	**Existing NC 109 Crash Rate per 100 MVM***	**Statewide Average Crash Rate per 100 MVM^**	**Critical Crash Rate per 100 MVM#**
Total Accident Rate	228.69	167.65	189.94
Fatal Accident Rate	0	1.98	4.87
Non-Fatal Injury Accident Rate	114.87	63.02	76.89
Night Accident Rate	67.88	56.33	69.47
Wet Accident Rate	31.33	25.46	34.36

* Accident rates are expressed in crashes per 100 million vehicle miles (MVM) of travel. This study uses accident data for the period 2/1/2006-1/31/2009 for the project area.
^ 2005-2007 statewide crash rate for US routes.
# Based on the statwide crash rate (95% level of confidence).

As shown in Table 1-9, the most common type of accident (25.6 percent) in the corridor was rear end crashes, which are common in congested, stop-and-go conditions. Approximately 17 percent of crashes were angle type crashes and nearly 12 percent were left-turn same roadway type of accident. These types of crashes typically occur when a driver fails to respond to changes to constantly changing traffic conditions characteristic of congested areas.

TABLE 1-9: 2006-2009 CRASH DATA		
Accident Type	**Number**	**Percent of Total**
Angle	38	17.35
Collision – Animal	20	9.13
Backing up	2	0.91
Collision – Fixed Object	24	10.96
Head On	1	0.46
Left Turn – Different Roadways	14	6.39
Left Turn – Same Roadway	27	12.33
Other Collision with Vehicle	3	1.37
Other Non-collision	1	0.46
Overturn / Rollover	7	3.20
Pedestrian	1	0.46
Ran Off Road – Left	1	0.46
Ran Off Road – Right	10	4.57
Ran Off Road – Straight	1	0.46
Rear End – Slow or Stop	56	25.57
Rear End – Turning	5	2.28
Right Turn – Different Roadway	1	0.46
Right Turn – Same Roadway	3	1.37
Sideswipe – Opposite Direction	2	0.91
Sideswipe – Same Direction	2	0.91
Total	**219**	**100**

SECTION 2
ALTERNATIVES CONSIDERED

Four broad-ranged alternatives were established for consideration on this project. These alternatives include: a No-Build Alternative, a Transportation System Management Alternative, a Mass Transit Alternative, and a Build Alternative. Each broad-ranged alternative may be comprised of several components or sub-alternatives. This chapter presents the range of alternatives considered for the project, a discussion of the alternatives eliminated from further consideration, and the alternatives selected for detailed study. Each alternative is assessed with respect to its ability to meet the project's purpose and need.

As noted in Section 1, planning studies and alternatives development for this project began in 1993. The following section describes all alternatives considered for detailed study, the reasons for eliminating some of these alternatives, and the alternatives retained for detailed study.

2.1 NO-BUILD ALTERNATIVE

The No-Build Alternative would not make any substantial improvements to the NC 109 corridor through the year 2035, with the exception of regular maintenance such as patching and resurfacing, regrading shoulders, and maintaining ditches. The No-Build Alternative would incur neither right-of-way nor substantial construction costs. There would be no long-term disruptions during construction. There would be no impacts to streams, wetlands, or other natural and cultural resources, nor would there by any residential or business relocations.

All other planned STIP and local projects would be constructed (see Section 1.8). Currently there are two capacity projects proposed in the STIP in the project area. The first includes upgrading US 52 from I-85 in Davidson County to I-40 in Forsyth County to interstate standards (STIP No. U-4750). The second includes widening Union Cross Road (SR 2643) from Wallburg Road (SR 2691) to Sedge Garden Road (SR 2632) in Forsyth County (STIP No. U-4909).

As explained in Section 1.9, many of the intersections along NC 109 currently operate at or over capacity (LOS E or F). With no improvements along existing NC 109 and no new routes for future traffic, all segments along NC 109 and nearly all of the existing unsignalized and signalized intersections along the roadway will be over capacity by the year 2035.

As discussed in Chapter 1 and above, the No-Build Alternative would not meet the project's purpose and need; however, in accordance with NEPA (40 CFR 1502.14(d)) and FHWA guidelines (FHWA Technical Advisory T 6640.8A: p.15), the No-Build Alternative will be given full consideration to provide a baseline for comparison with the Build Alternative.

2.2 TRANSPORTATION SYSTEMS MANAGEMENT ALTERNATIVE

The Transportation Systems Management (TSM) Alternative includes limited construction activities designed to maximize the traffic flow and efficiency of the present transportation system. There are two main types of TSM roadway improvements: operational and physical. Examples of these improvements include:

Operational Improvements

- Traffic law enforcement
- Turn prohibitions
- Access control
- Speed Restrictions
- Signal coordination
- Signal phasing or timing changes

Physical Improvements

- Addition of turn lanes
- Intersection realignment
- Improved warning and information signs
- New signals or stop signs
- Intersection geometric and signalization improvements
- High-occupancy vehicle (HOV) lanes

The TSM roadway improvements typically are effective in solving site-specific capacity and safety deficiencies in urban areas. However, these enhancements would not improve the level of service at the intersections or along the existing roadway network enough to make a substantial difference. Forecast capacity problems at many of the existing intersections are due to through volumes that exceed the theoretical capacities of the roadways. In order to provide any improvement in the forecast traffic congestion on the NC 109 corridor, additional through lanes are needed. High-occupancy vehicle (HOV) lanes are typically utilized for urbanized areas with a population over 200,000. Since the project area's population lies below this threshold, HOV lanes and the other TSM measures would not adequately address the needs of the project and have been eliminated from further consideration.

2.3 MASS TRANSIT ALTERNATIVE

The Mass Transit Alternative includes options such as expanding the existing bus service, implementing a light rail or fixed guideway system, or a regional rail service so that the number of vehicles and subsequent congestion on local roads would be decreased. Commuter bus service is provided by the Winston-Salem Transit Authority to a small portion of the northern section of the project study area. Two bus routes, the Martin Luther King, Jr. Boulevard/ Peachtree/ Old Lexington Road Bus Route and the Main/ Konoak/ Cassell Stoney Glen Bus Routes, are located within the project study area.

Within Davidson County, there is no available commuter bus service. However, the Davidson County Transportation System provides transportation for the human service agencies, the elderly, the disabled, and the general public of Davidson County. The service uses standard vans, small buses, and small buses with wheelchair lifts to assist persons with specialized transportation needs.

The Piedmont Authority for Regional Transportation (PART) provides bus service between Winston-Salem, Greensboro, and High Point. Buses run from the Winston-Salem Transportation Center to the PART regional hub at the Piedmont Triad International Airport every half hour from 6:00 a.m. to 6:30 p.m. weekdays. From the regional hub, passengers can travel to High Point or Greensboro.

Mass transit operations are compared to other forms of travel by evaluating the number of times people use mass transit for traveling to work, shopping, schools, etc. rather than using private automobiles. Because of the minimal transit service available through most of the project area, transit likely serves an extremely small number of existing trips in the area. Even with expanded bus services to the project area, this alternative would not address adequately the purpose and need for the project.

The FHWA considers urbanized areas with populations greater than 200,000 as areas where Mass Transit Alternatives should be considered (FHWA Technical Advisory T 6640.8A: p.15). The project area is located on the less densely populated fringe of the Winston-Salem area and the population near the project area is less than 200,000 people. According to the US Census, approximately 56,000 people resided within the project study area in 2000. For this and the reasons noted above, the Mass Transit Alternative was eliminated from further consideration.

2.4 BUILD ALTERNATIVES AND UPGRADE EXISTING FACILITY ALTERNATIVE

The NC 109 Corridor Improvements Build Alternative includes constructing a new facility between Old Greensboro Road (SR 1798) in northeastern Davidson County and southeastern Forsyth County. The Upgrade Existing Facility Alternative includes making roadway improvements along NC 109 between Old Greensboro Road (SR 1798) and southeastern Forsyth County. The new facility is proposed as a four-lane median divided facility with partial control of access, a design speed of 60 miles per hour, and a posted speed limit of 55 miles per hour. Directional crossovers with offset left turns will be used at major intersections (see Section 2.4.6). No signalized intersections are proposed. Driveway accesses along NC 109 will be right in, right out only. Several build alternatives and one upgrade existing facility alternative have been considered for the project, all of which would meet the purpose and need of the project, improving safety, traffic flow and levels of service along the NC 109 corridor.

2.4.1 Logical Termini

FHWA regulations (23 CFR 771.111(f)) outline three general principles to determine project limits. The regulations state:

"In order to ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated, the action evaluated in each EIS or finding of no significant impact (FONSI) shall:

- Connect logical termini and be of sufficient length to address environmental matters on a broad scope;
- Have independent utility or independent significance, i.e.: be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and
- Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements."

The proposed project has logical termini. It would connect segments of NC 109 south of this project from I-85 Business to Old Greensboro Road (SR 1798), which have recently been improved, to either I-40 to the north or US 52 to the west, two chief travel routes in the Winston-Salem area. The project termini adequately encompass the area required to address the project scope. In addition, the project is of sufficient length (between 8.5 miles and 10.0 miles) to address environmental matters on a broad scope. Because the proposed project would improve mobility in the project area and improve levels of service along the NC 109 corridor, it would have independent utility; it would be a reasonable expenditure of capital even if additional transportation improvements in the area were not made. The proposed project would not restrict consideration of other reasonably foreseeable transportation improvements contained in the NCDOT STIP or local long range plans within the project study area.

2.4.2 Design Features

2.4.2.1. Design Criteria

Design criteria are established standards and procedures that guide the establishment of roadway layouts, alignments, geometry, and dimensions. Detailed design criteria for the Build Alternatives are listed in Table 2.1. They were developed in accordance with the American Association of State Highway and Transportation Officials' (AASHTO) *A Policy on Geometric Design of Highways and Streets* (2004) and the *NCDOT Roadway Design Manual*. The design criteria are influenced by the type of roadway required to fulfill the purpose and need of the project.

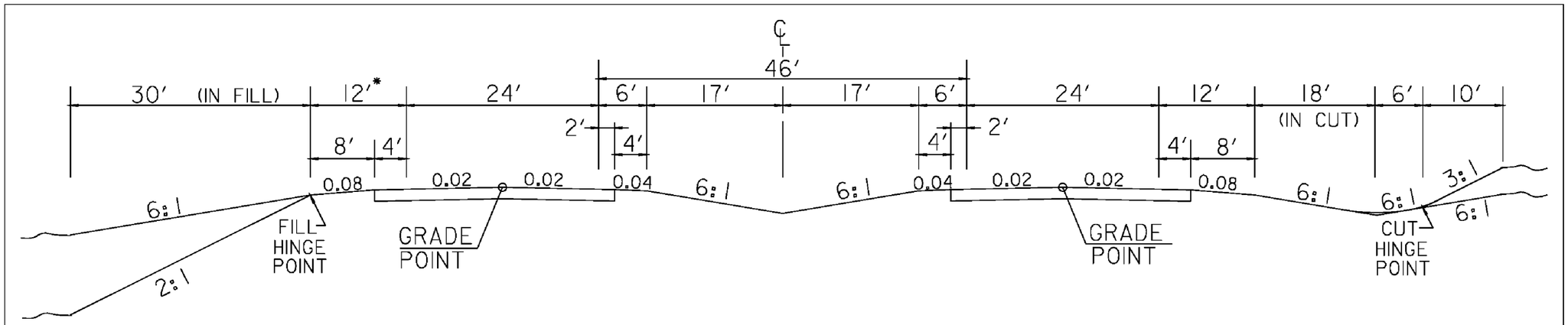
2.4.2.2. Typical Sections

Typical sections are drawings or descriptions of a roadway that define cross-sectional features such as roadway and shoulder widths. Like design criteria, typical roadway cross-sections are influenced by the type of roadway required to fulfill the purpose and need of the project. Design criteria and typical sections were established for the proposed highway facility based on existing (2006) and projected travel demand (2035) along the facility. To maintain at least a LOS D with 2035 design year traffic forecasts, the proposed facility requires at least four travel lanes (two in each direction). There are three distinct typical sections proposed for different portions of the Build Alternatives. The New Location Alternatives would include full control of access, a 46-foot median, a design speed of 60 mph, and a posted speed of 55 mph. Portions of Build Alternatives on existing NC 109 would include partial control of access. South of Teague Road along the Upgrade Existing Alternative, the typical section would include a 46-foot median, a

design speed of 60 mph, and a posted speed of 55 mph. North of Teague Road as the area becomes more urban, the Upgrade Existing Alternative and portions of the New Location Alternatives tying into existing NC 109 would transition to an urban typical section with a 23-foot raised median, curb and gutter, a design speed of 50 mph, and a posted speed of 45 mph. The proposed typical sections are presented in Figure 2-1.

TABLE 2-1: BUILD ALTERNATIVE DESIGN CRITERIA

Factor	New Location (Alternatives 3, 4, 5 and 6)	Upgrade Existing NC 109, South of Teague Road (Alternative 1)	Upgrade Existing/New Location NC 109, North of Teague Road (Urban Area; Alternative 1)
Functional Classification	Arterial	Arterial	Arterial
Terrain	Rolling	Rolling	Rolling
Control of Access	Full	Partial	Partial
Design Speed	60 MPH	60 MPH	50 MPH
Right of Way Width	250 feet minimum	250 feet minimum	Variable – 10 feet past construction limits
Maximum Horizontal Curvature	R_{min} = 1200 feet	R_{min} = 1200 feet	R_{min} = 926 feet
Maximum Grade	4% maximum	4% maximum	5% maximum
Number of Lanes	4 Lanes	4 Lanes	4 Lanes
Lane Width	12 feet	12 feet	12 feet
Shoulder Width	Median – 6 feet Outside (w/o guardrail) – 12 feet Outside (w/guardrail) – 15 feet	Median – 6 feet Outside (w/o guardrail) – 12 feet Outside (w/guardrail) – 15 feet	No shoulder will be provided (see Figure 2-1c)
Median Width	46 feet depressed median	46 feet depressed median	23 feet raised median
Maximum Superelevation	0.08 ft./ft.	0.08 ft./ft.	0.04 ft./ft.
Stopping Sight Distance	Current AASHTO Standards	Current AASHTO Standards	Current AASHTO Standards
Length of Vertical Curve	Current AASHTO Standards	Current AASHTO Standards	Current AASHTO Standards
Cross Slopes (Normal Sect.)	1/4”/foot (2%)	1/4”/foot (2%)	1/4”/foot (2%)



* USE 15′ IN GUARDRAIL LOCATIONS

FUNCTIONAL CLASS. = ARTERIAL
DESIGN SPEED = 60 MPH
MAX SUPERELEV. = 8%

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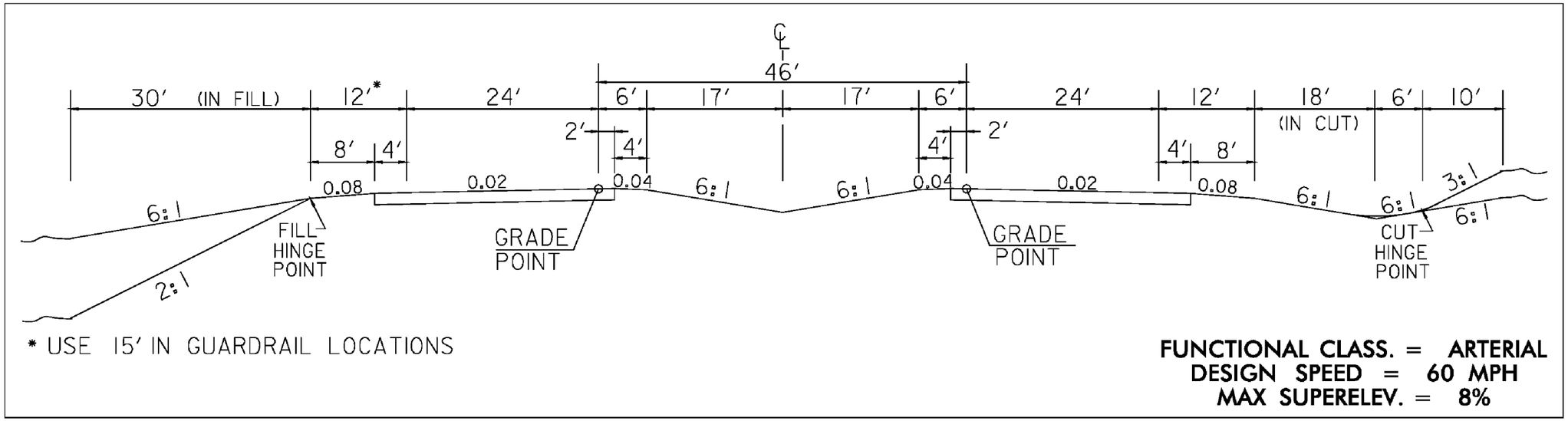
Figure 2-1A **Build Alternative Typical Section**
Existing NC 109, South of Teague Rd.



* USE 15′ IN GUARDRAIL LOCATIONS

FUNCTIONAL CLASS. = ARTERIAL
DESIGN SPEED = 60 MPH
MAX SUPERELEV. = 8%

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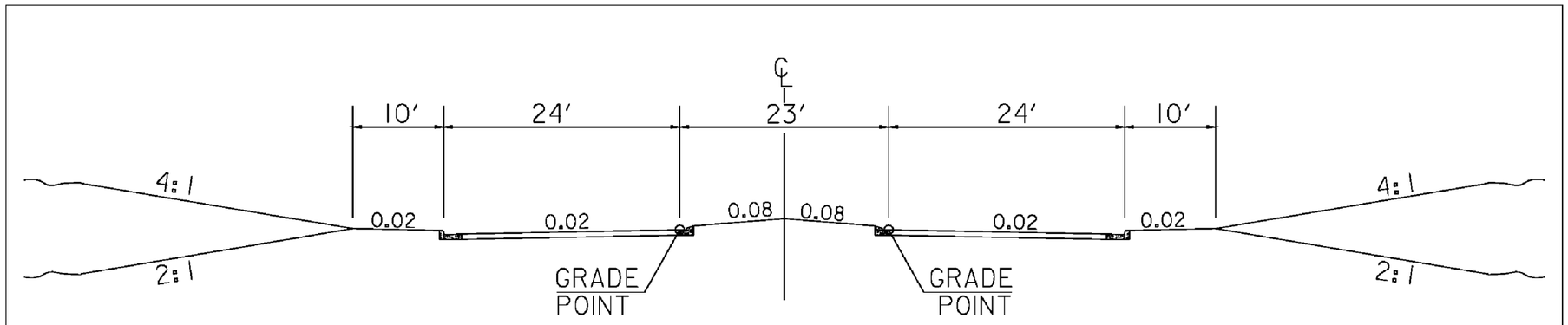
Figure 2-1B Build Alternative Typical Section
New Location



FUNCTIONAL CLASS. = ARTERIAL
DESIGN SPEED = 50 MPH
MAX SUPERELEV. = 6%

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Figure 2-1C **Build Alternative Typical Section**
Existing NC 109, North of Teague Rd.
(Urban Area)

2.4.3 Evaluation of Preliminary Corridors

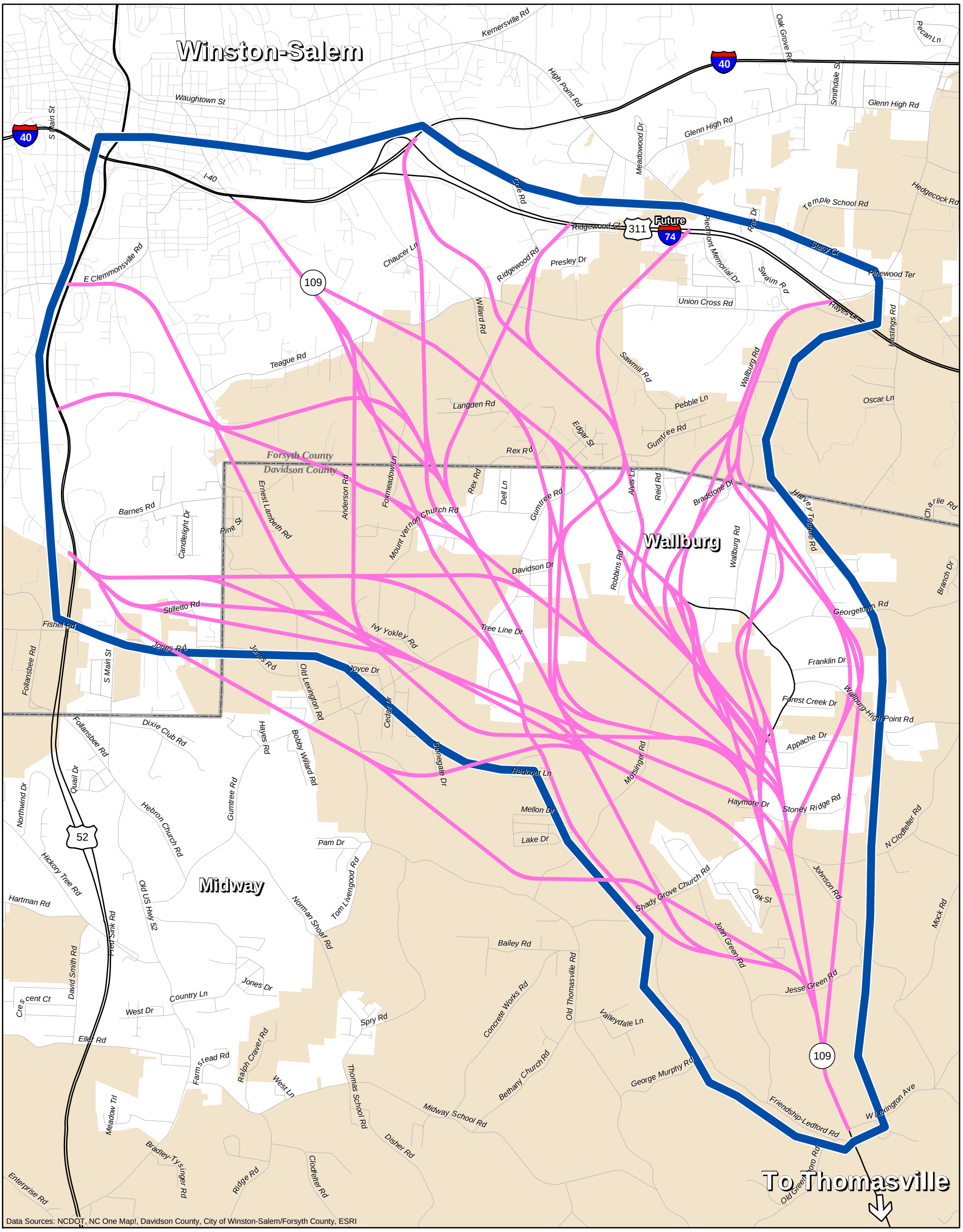
Numerous corridors over existing roads and on new location were considered for the project to determine the best location for a new facility. The preliminary location concepts were developed based on comments received from the public and local officials and by reviewing natural and cultural resources in the project area. More than 35 preliminary location concepts were identified (see Figure 2-2); all had the same southern terminus along NC 109 at Old Greensboro Road (SR 1798), with northern termini considered along US 52, I-40, and US 311 at existing or proposed interchanges. Similarities among preliminary location concepts, including location and overall concept purpose, were identified and combined to develop preliminary study corridors.

To begin the selection of alternatives for detailed study, the preliminary study corridors were evaluated for potential impacts to natural and human resources, design and construction feasibility, and ability to meet the purpose and need for the project. In considering preliminary impacts, planning and design objectives included avoiding residential housing, businesses, and public meeting places such as places of worship; avoiding properties on or eligible for the National Register of Historic Places, where feasible; and avoiding and minimizing impacts to wetlands, streams, and other natural resources. Corridors were eliminated based on at least one of the following impacts:

- Conflicts with the topography of existing land,
- Severity of impacts in densely developed areas,
- Inappropriate crossings of secondary roads,
- Natural resources impacts,
- Failure to meet project purpose and need,
- Limited locations for feasible connections to US 311, US 52, and I-40, and
- Potential impacts to historic properties.

Several corridors with obvious "fatal flaws," including substantial impacts to wetlands, streams, and communities, were eliminated early in the alternatives development process. Those without obvious fatal flaws were presented to local officials and planners. Based on their input, the following concepts were eliminated:

- Corridors with a northern terminus at the US 311/Ridgewood Road (SR 2698) were eliminated due to substantial impacts on the Proposed Friedland Lower Tier Historic District (see Section 3.4.1).
- Corridors with a northern terminus at the US 52/West Clemmonsville Road were eliminated due to topography, proximity to an adjacent landfill, and poor crossings with existing roads.
- Corridors bisecting the Meadowlands residential and golf community were eliminated due to residential and environmental impacts, cost, and poor location with respect to electrical transmission lines.



Legend

- Conceptual Corridors
- Study Area Boundary

N
W E
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0 0.5 1 2 Miles

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Figure 2-2 Conceptual Corridors

Thirteen corridors remained for further study after this evaluation. These are described in the following section. A more detailed discussion of alternatives development, evaluation, and screening is in the *Preliminary Alternatives Report* (Lochner, 2006) prepared for this project.

2.4.3.1. Description of Preliminary Corridors

The thirteen corridors remaining for further study after evaluating the preliminary location concepts were made up of different combinations of segments. These corridors are shown in Figure 2-3; they are described by colored segments and grouped by northern terminus location as followed:

US 311/proposed Winston-Salem Northern Bypass Interchange

- Blue-light green-light purple-orange-light blue
- Blue-yellow-green-orange-light blue

US 311/Union Cross Road (SR 1730) Interchange

- Blue-light green
- Blue-red-light green
- Blue-light green-light purple-dark purple-blue-red-light green

I-40/NC 109 Interchange

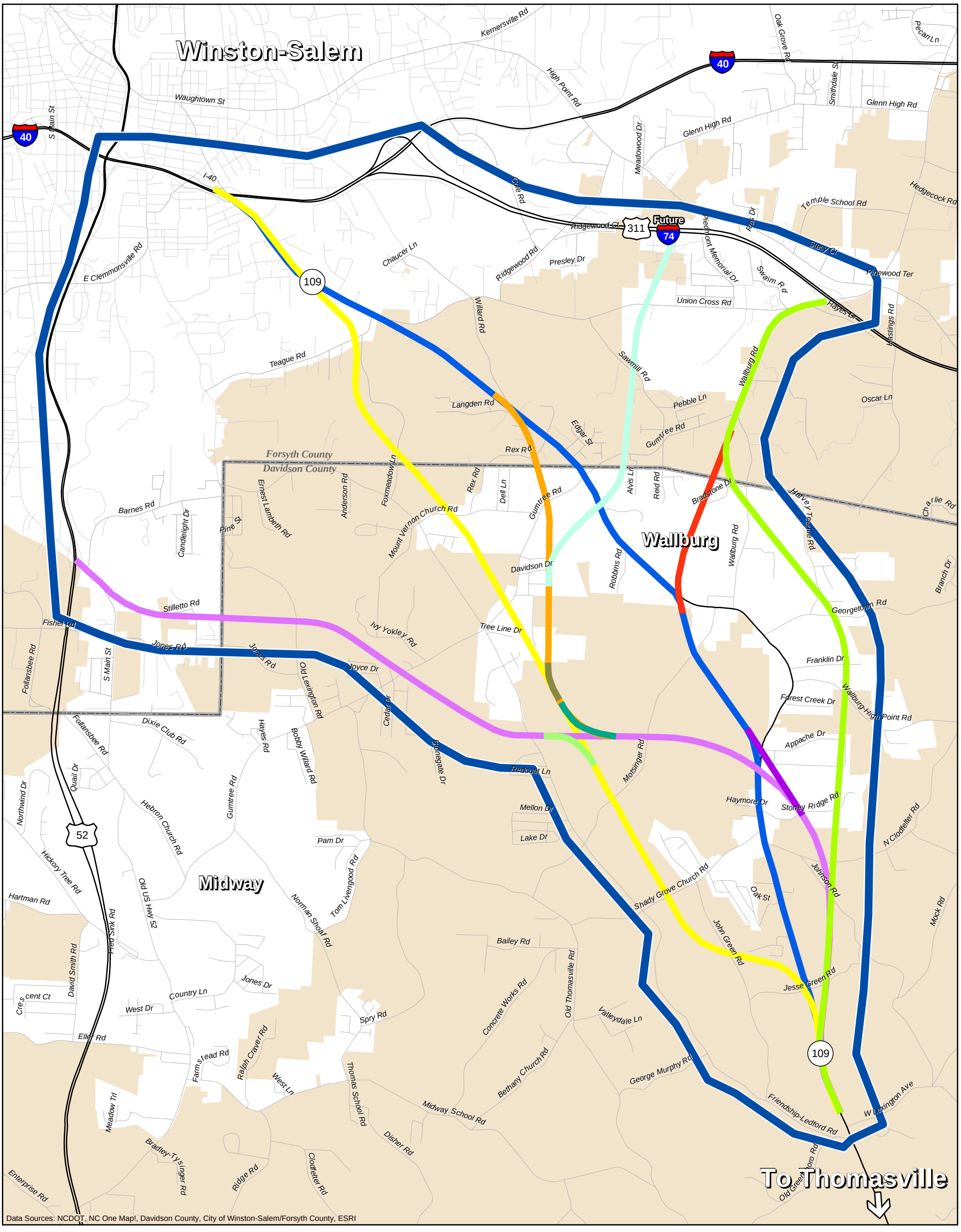
- Blue (Upgrade Existing NC 109 Alternative)
- Blue-yellow-blue
- Blue-light green-light purple-orange-blue
- Blue-light green-light purple-dark purple-blue
- Blue-yellow-green-orange-blue
- Blue-light purple-green-yellow

US 52/South Main Street (SR 4205) Interchange

- Blue-light purple
- Blue-yellow-light green-light purple

These thirteen corridors were discussed during a series of meetings in 2005 between representatives of various NCDOT departments and NCDOT Division 9. Over the course of many months of discussion and analysis, eight corridors were eliminated from further study, as discussed below.

The two corridors proposed to tie into the interchange of US 311 and the proposed Winston-Salem Northern Beltway were determined to be infeasible due to impacts to Spurgeon Creek and to two public golf courses, as well as prohibitive cost. These corridors were therefore eliminated from further consideration.



Legend

Study Area Boundary

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Figure 2-3 **Preliminary Study Corridors (January 2004)**

Three corridors tied to an existing interchange at US 311 and Union Cross Road (SR 2643). A comparison of these three alternatives revealed that one (blue-light green-light purple-blue-red-light green) had far greater impacts to natural and human resources, as well as design concerns with poor skews at Johnson Road (SR 1755) and Clodfelter Road (SR 1726). This corridor was eliminated from further study.

Six corridors, including the Upgrade Existing NC 109 Alternative, made use of the existing interchange of NC 109 and I-40/US 311. Of these corridors, two (blue-light green-light purple-orange-blue and blue-yellow-green-orange-blue) had substantially higher impacts to residential developments along Rex Road (SR 1709), Langden Road (SR 2702), NC 109, and to the Meadowlands Residential and Golf Community than other corridors with the same termini. In addition, the orange segment common to these corridors had design concerns with poor skews at Gumtree Road (SR 1711) and Willard Road (SR 1968). These two corridors were eliminated from further study, leaving four corridors terminating at I-40.

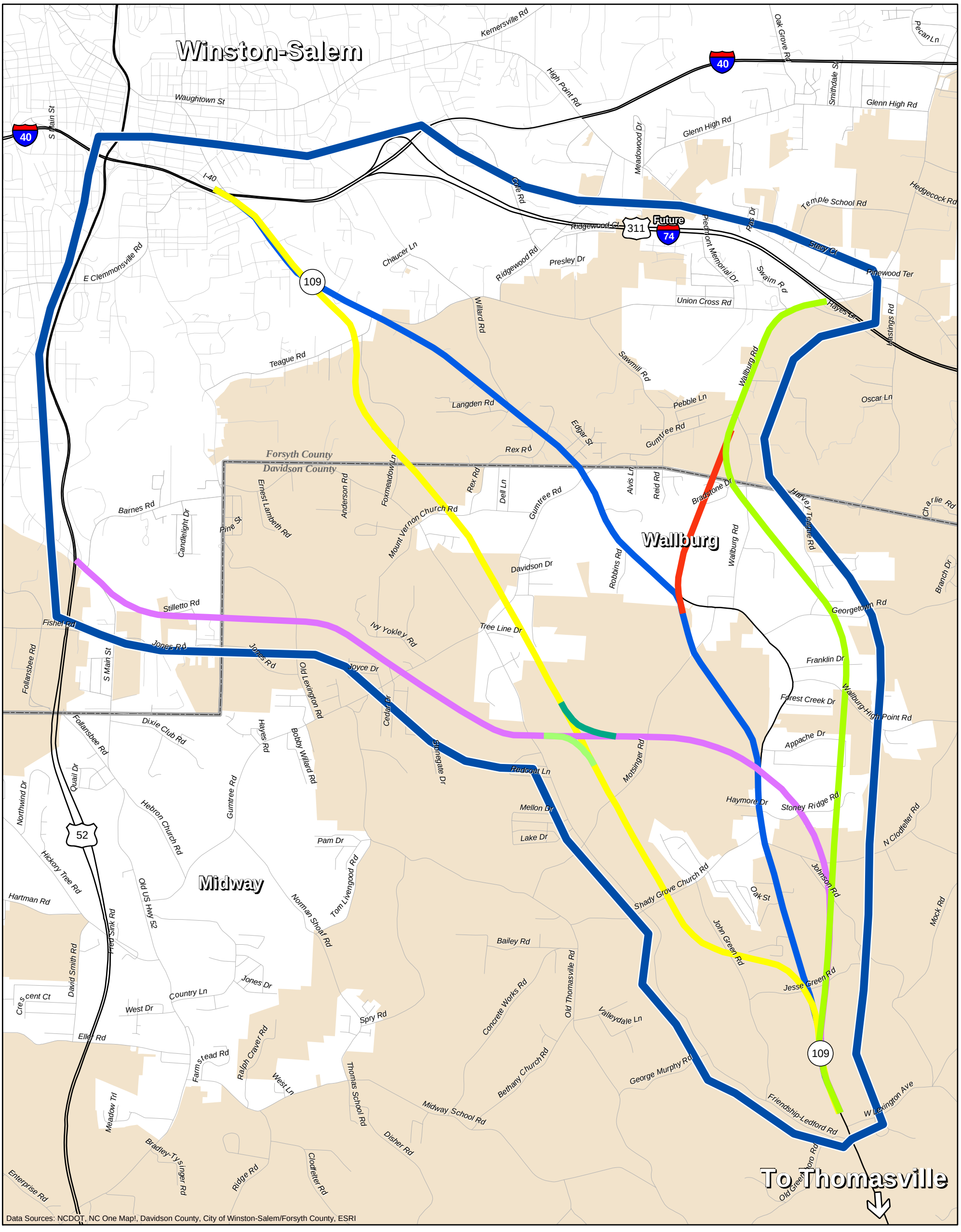
Of the four remaining corridors terminating at I-40, one was found to have substantially higher relocation impacts than the other three corridors. The blue-light green-light purple-dark purple-blue corridor also had design concerns with poor skews at NC 109 and Clodfelter Road (SR 1726). This corridor was therefore eliminated leaving three corridors terminating at I-40. These corridors include the blue (Upgrade Existing Alternative), blue-yellow, and blue-light purple-green-yellow corridors.

Seven corridors remained for further examination and comparison (see Figure 2-4): two terminating at US 311/Union Cross Road; three terminating at I-40/NC 109; and two terminating at US 52/South Main Street. Preliminary traffic projections were obtained for each of these corridors. These projections revealed that the corridors tying to I-40 and US 52 would remove substantially more traffic from the NC 109 corridor (at least 73 percent and 43 percent respectively) than the corridors tying to US 311. Because the two corridors tying to US 311 did not reduce traffic by a significant percentage along the NC 109 corridor they were determined not to meet the full purpose and need for the project and were eliminated from further study. Five corridors then remained for analysis and comparison. These corridors are shown in Figure 2.-5.

2.4.3.2. Alternatives Carried Forward for Detailed Study

The five preliminary corridors were then assessed in greater detail for impacts to human, environmental, and cultural resources using conceptual construction limits (plus an additional 25 feet for potential clearing impacts) to begin the selection of alternatives for detailed studies. Preliminary impacts were assessed for the following resources (summarized in Table 2-2):

- Number of relocations (residential and commercial),
- Number of stream crossings and linear feet of stream impacts,
- Number of floodplain crossings,
- Acreage of wetland impacts,



Legend

Study Area Boundary

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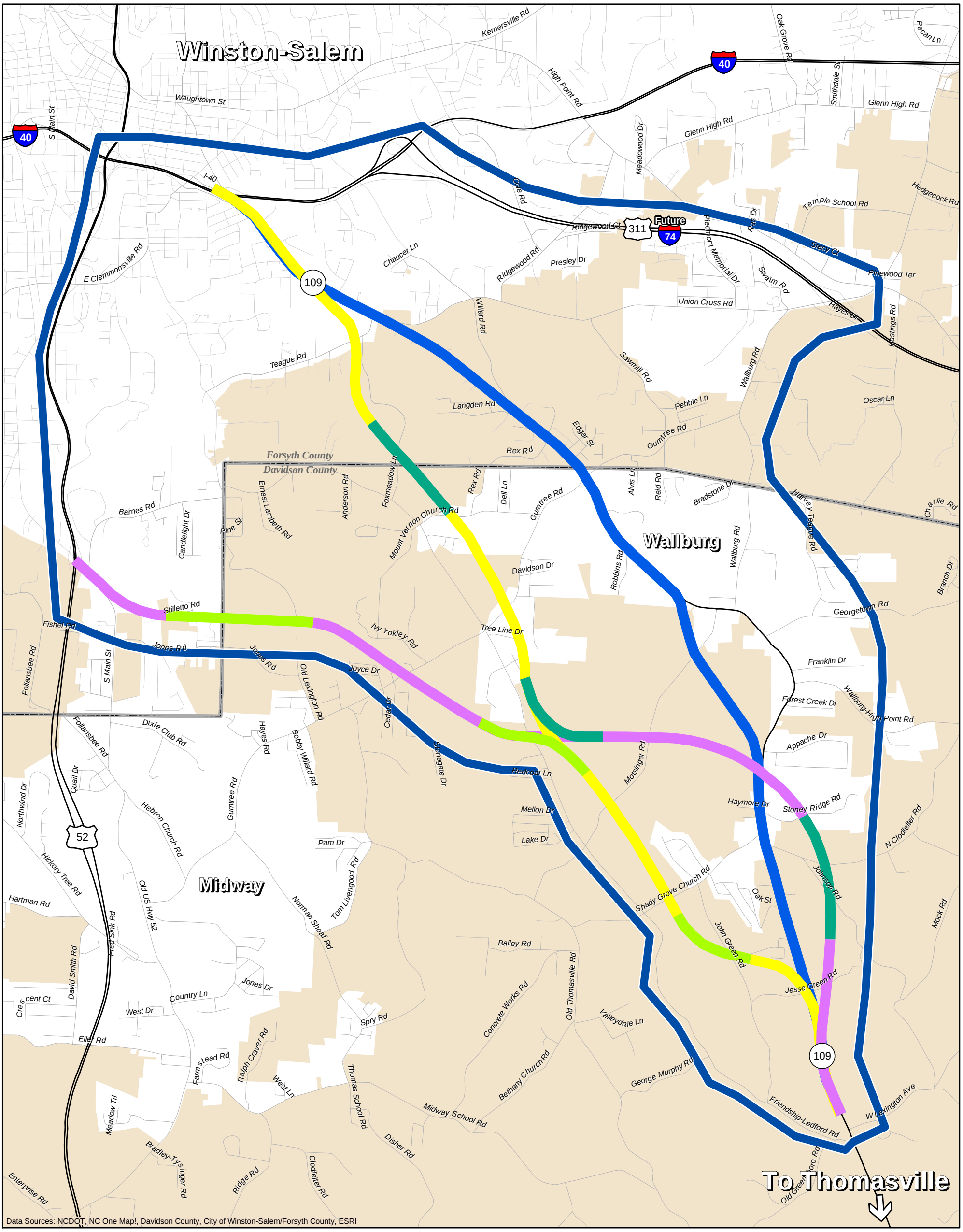
Figure 2-4 **Preliminary Study Corridors (March 2005)**



Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary

N W E S

0 0.5 1 2 Miles

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Figure 2-5 **Build Alternates for Detailed Study**

- Major utility and railroad crossings,
- Length of corridor on new location,
- Historic resource impacts, and
- Number of new directional crossover intersections.

The five preliminary corridors and information about the potential impacts of each were presented to the public at workshops held in November 2005. Representatives of federal, state, and local agencies met in August 2006 as part of the NEPA/404 Merger Process for this project to consider the potential impacts of each alternative, along with public comments, and to select alternatives to carry through for detailed studies. The Merger Team retained all five alternatives for detailed study. The build alternatives for detailed study are shown in Figure 2-5 and described below.

2.4.4 Description of Detailed Study Alternatives

2.4.4.1. Upgrade Existing Alternative (Alternative 1)

The Upgrade Existing Alternative (Alternative 1) includes making roadway improvements along NC 109 that would better serve traffic in the design year 2035. Existing NC 109 within the project study area is a two-lane undivided rural highway with no control of access. This existing cross-section of NC 109 consists primarily of two ten-foot lanes with unpaved shoulders varying from three to six feet in width. In the vicinity of the I-40/US 311 interchange, NC 109 has a five lane, 64-foot curb and gutter cross section. Speed limits on NC 109 range from 45 to 55 mph except within Wallburg, where the speed limit is 35 mph.

This alternative follows NC 109 from Old Greensboro Road (SR 1798) for three miles where it turns to the northwest to bypass the Town of Wallburg, crossing Motsinger Road (SR 1723) 0.4 miles southwest of its existing intersection with NC 109. Corridor 1 ties back to NC 109 0.4 miles west of the existing intersection of NC 109 and Motsinger Road and follows NC 109 to the existing interchange at I-40.

Alternative 1 is 9.5 miles long with 1.6 miles on new location. Alternative 1 includes thirteen directional crossover intersections, including four with traffic signals: at Jesse Green Road (SR 1753), Motsinger Road (SR 1723), Gumtree Road (SR 1711) and Rex Road (SR 1709)/Devoe Road (SR 2839). At all other intersecting roads, only right turns would be permitted. Drivers will be forced to turn right onto NC 109 and then make a u-turn at median openings to travel in the opposite direction.

2.4.4.2. Alternative 3

Alternative 3 follows NC 109 from Old Greensboro Road (SR 1798) one mile and then turns northwest, crossing John Green Road (SR 1752), Shady Grove Church Road (SR 1751), Motsinger Road (SR 1723), Gumtree Road (SR 1711), Mount Vernon Church Road (SR 1708), Fox Meadow Lane (SR 1921), and Teague Road (SR 1705). Alternative 3 parallels Friendship-

Ledford Road (SR 1700) north to Fox Meadow Road, then continues north into Forsyth County, connecting back to NC 109 0.75 miles south of the interchange with I-40. Alternative 3 then follows NC 109 and connects to the existing interchange at I-40.

This alternative is 9.5 miles long with 7.75 miles on new location. Alternative 3 includes six directional crossover intersections: at NC 109, Jesse Green Road (SR 1753), Shady Grove Church Road (SR 1751), Motsinger Road (SR 1723), Gumtree Road (SR 1711), Fox Meadow Lane (SR 1921), and Teague Road (SR 2705). Alternative 3 connects to the existing interchange at NC 109 and I-40.

2.4.4.3. Alternative 4

Alternative 4 follows NC 109 from Old Greensboro Road (SR 1798) approximately 0.55 miles and then turns northeast crossing Jesse Green Road (SR 1753), Johnson Road (SR 1755), Jerry Clodfelter Road (SR 1747), and Stony Ridge Drive (SR 1749) east of existing NC 109. Alternative 4 then turns west and crosses NC 109, Motsinger Road (SR 1723), and Friendship-Ledford Road (SR 1700) and then turns northwest crossing Gumtree Road (SR 1711), Old Lexington Road (SR 1706), Beckerdite Road (SR 2759), and the Winston-Salem Southbound Railway railroad tracks. Alternative 4 connects with the existing interchange of US 52 and South Main Street (SR 4205).

This alternative is 9.3 miles long with 8.5 miles on new location. Alternative 4 includes seven directional crossover intersections: at Jerry Clodfelter Road (SR 1747), NC 109, Jesse Green Road (SR 1753), Motsinger Road (SR 1723), Friendship-Ledford Road (SR 1700), Gumtree Road (SR 1711), Old Lexington Road (SR 1706), and Beckerdite-Stewart Road (SR 2759).

2.4.4.4. Alternative 5

Alternative 5 follows Alternative 3 over existing NC 109 from Old Greensboro Road (SR 1798) 1 mile and then turns west at Jesse Green Road (SR 1753). It crosses John Green Road (SR 1752) and then Shady Grove Church Road (SR 1751) approximately 0.2 miles east of the intersection with Friendship-Ledford Road (SR 1700). Alternative 5 continues northwest paralleling Friendship-Ledford Road (SR 1700) and passing southwest of Meadowlands Residential and Golf Community. Alternative 5 then follows Alternative 4 for the remaining 3.6 miles to connect with the existing interchange of US 52 and South Main Street (SR 4205).

This alternative is 8.6 miles long with 7.4 miles on new location. Alternative 5 includes seven directional crossover intersections: at NC 109, Jesse Green Road (SR 1753), Shady Grove Church Road (SR 1751), Motsinger Road (SR 1723), Friendship-Ledford Road (SR 1700), Gumtree Road (SR 1711), Old Lexington Road (SR 1706), and Beckerdite-Stewart Road (SR 2759).

2.4.4.5. Alternative 6

Alternative 6 follows Alternative 4 for 4.5 miles before splitting off to the northwest to follow Alternative 3 for 4.4 miles all the way to the existing interchange of I-40 and NC 109.

This alternative is 10.1 miles long with 8.7 miles on new location. Alternative 6 includes five directional crossover intersections: at Jerry Clodfelter Road (SR 1747), NC 109, Jesse Green Road (SR 1753), Motsinger Road (SR 1723), Gumtree Road (SR 1711), and Teague Road (SR 2705).

2.4.5 Interchanges and Intersections

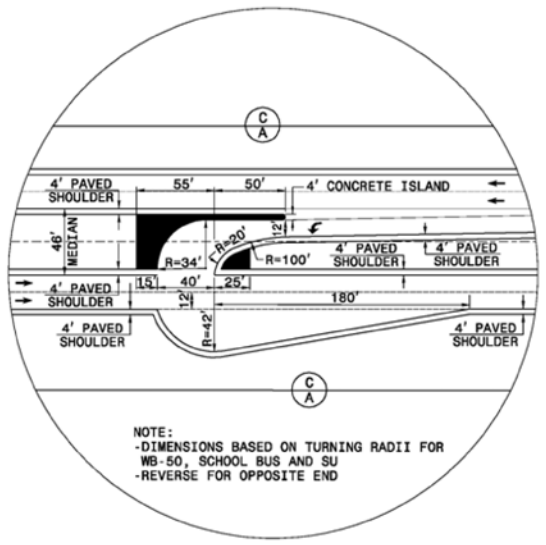
Each of the build alternatives under consideration would tie to an existing interchange at its northern terminus: Alternatives 1, 3, and 6 terminate at the I-40/NC 109 interchange, and Alternatives 4 and 5 tie to the US 52/South Main Street (SR 4205) interchange. The I-40/NC 109 interchange, along with the I-40/Clemmonsville Road interchange, makes up a spread diamond interchange. Ramps on this interchange serve as a collector-distributor system to move traffic between I-40 and the two diamond type interchanges. The interchange at US 52/South Main Street is a diamond interchange.

Along the alternatives, the use of directional crossovers with offset left turns is proposed for major intersections. Directional crossovers are generally used in the following situations, all of which can be applied to the project area:

- High speed rural median divided facilities
- Corridors with partial or limited control of access
- Intersections with a documented crash history
- In congested areas where it is desirable to minimize the use of traffic signals.

The directional crossover eliminates full movement median openings. Traffic on the primary highway is not affected as all movements are still permitted; however, traffic on the secondary highway must turn right onto the primary highway. Through and left turn movements from the secondary highway are then directed to a median u-turn crossover approximately 800 to 1,300 feet downstream of the intersection. Figure 2-6 illustrates the directional crossover intersection. Because these turning movements are separated, the need for signalization at intersections is reduced. Other intersections and driveways will have right-in, right-out capability only.

DIRECTIONAL CROSSOVER WITH MEDIAN U-TURNS



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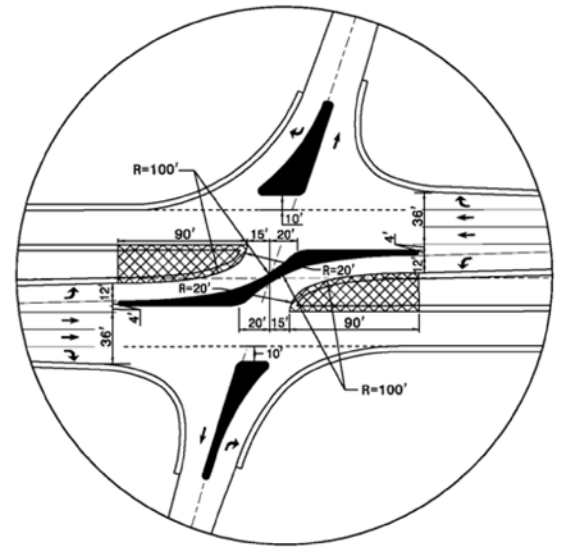

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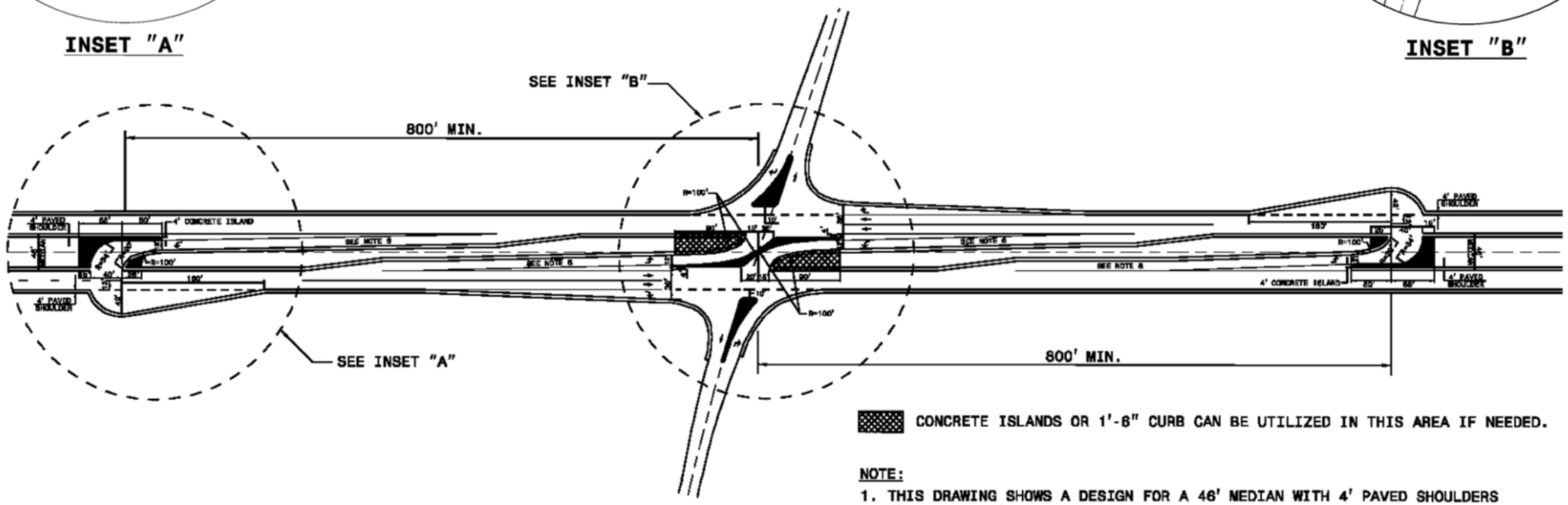


PLAN

CONCRETE ISLANDS OR 1'-6" CURB CAN BE UTILIZED IN THIS AREA IF NEEDED.

NOTE:

1. THIS DRAWING SHOWS A DESIGN FOR A 46' MEDIAN WITH 4' PAVED SHOULDERS (MEDIAN AND OUTSIDE) ASSUMING A 55 MPH POSTED SPEED. WHEN OTHER MEDIAN WIDTHS, PAVED SHOULDERS, AND POSTED SPEEDS ARE USED, ENGINEERING JUDGEMENT SHOULD BE USED TO ESTABLISH APPROPRIATE GEOMETRY.
2. AT -Y- LINES ONLY PASSENGER CAR U-TURNS ARE ACCOMMODATED.
3. DESIGN BULB OUTS TO ACCOMODATE WB-50. IN AREAS WHERE THERE ARE R/W OR ENVIRONMENTAL CONSTRAINTS, BULB OUT DIMENSIONS MAY BE REDUCED.
4. ALL DIMENSIONS ARE SUBJECT TO FIELD CONDITIONS.
5. FULL CONTROL OF ACCESS SHOULD BE OBTAINED THROUGHOUT LIMITS OF THE BULB OUT ON BOTH SIDES OF ROADWAY.
6. USE 575' MINIMUM LENGTH FOR ALL LEFT TURN LANES (INCLUDES TAPER AND FULL STORAGE LENGTH).

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 2-6 Directional Crossover

TABLE 2-2: PRELIMINARY ALTERNATIVE IMPACTS*

		Preliminary Corridor				
		Alternative 1 Upgrade Existing	Alternative 3 New Location	Alternative 4 New Location	Alternative 5 New Location	Alternative 6 New Location
Length of Corridor (Miles)	Length on Existing	7.9	1.75	0.8	1.2	1.4
	Length on New Location	1.6	7.75	8.5	7.4	8.7
	Total Length	9.5	9.5	9.3	8.6	10.1
Number of New Directional Crossovers with Indirect Left Turns		4	6	8	7	7
Railroad Crossings		0	0	1 (Grade Sep.)	1 (Grade Sep.)	0
Schools		0	0	0	0	0
Parks		0	0	0	0	0
Churches		3	0	0	0	0
Cemeteries		0	0	0	0	0
Major Utility Conflicts		7	7	5	4	8
Recorded Historic Sites		0	0	0	0	0
Number of Known Federally Listed Species Habitats		1	1	1	1	1
Number of 100-Year Floodplain Impacts		4	4	2	2	4
Relocations+		164	84	71	73	82
Hazardous Material Sites		0	0	0	0	0
NWI Wetland Impacts	Number of Crossings	2	0	3	2	1
	Acreage	0.136	0	1.688	0.558	1.130
Streams	Stream Crossings	4	8	2	3	7
	Stream Impacts (linear feet)	949.99	2858.62	484.75	856.99	2390.50
Riparian Buffers		No	No	No	No	No
Water Supply Critical Areas (CA)		No	Yes	Yes	Yes	Yes
Number of Greenway Crossings		0	0	0	0	0
Potential Section 4(f) Impacts		None	None	None	None	None
Low Income or Minority Populations		Yes	Yes	No	No	Yes

* Impacts as presented at the August 15, 2006 Concurrence Point 2 Meeting based on April 2006 functional designs (slope stakes plus ten feet).
+ Based on year 2006 aerial photographs.

2.5 TRAFFIC OPERATIONS ANALYSES

Traffic operations and levels of service were evaluated for the alternatives under detailed study for the design year 2035 (see *Traffic Analysis for Bypass Alternatives for NC 109 Improvements Study*, Lochner 2009a). The traffic volume projected for the project alternatives in the year 2035 is 34,400 average annual daily traffic (AADT). The main purpose of the build traffic analysis is to evaluate the performance measures identified for determining the ability of alternatives to meet the project purpose and need: operation at acceptable LOS in 2035 and reduction in travel times between Old Greensboro Road and the Winston-Salem area relative to the no-build scenario.

2.5.1 Year 2035 Build Traffic Projections

When compared to the 2035 No-Build alternative, all the build alternatives except Alternative 1 show an overall reduction in AADT on NC 109. Alternatives 3 and 6 would result in the greatest overall reductions in AADT on NC 109, reducing AADT by more than 40 percent on most segments of NC 109. Alternatives 4 and 5 would also result in reductions in AADT on NC 109, but these reductions would be more modest for most segments. Alternative 1 would increase AADT on most segments of existing NC 109 (the exceptions are the new location segments), but under Alternative 1 capacity on NC 109 would also increase as this alternative would upgrade existing NC 109. The segment of existing NC 109 forecast to experience the highest traffic volume in 2035 under the No-Build scenario, between Teague Road and Union Cross Road, would experience approximately 58 percent reductions in AADT with Alternatives 3 and 6, an approximately 39 percent reduction with Alternative 4, an approximately 35 percent reduction with Alternative 5, and an approximately 6 percent reduction with Alternative 1. Table 2-3 summarizes the comparative changes in 2035 AADT on NC 109 for all the alternatives relative to the No-Build scenario.

TABLE 2-3: 2035 TRAFFIC VOLUMES (NO-BUILD VS. BUILD)						
NC 109 Road Segment	No-Build	Build Alternative (AADT and percent change)				
	AADT	Alternative 1	Alternative 3	Alternative 4	Alternative 5	Alternative 6
I-40 to Teague Road	27,060	32,000 (18.3 %)	34,400 (27.1 %)	22,000 (-18.7 %)	23,000 (-15.0 %)	34,400 (27.1 %)
Teague Rd. to Union Cross Rd.	28,380	26,800 (-5.6 %)	12,000 (-57.7 %)	17,400 (-38.7 %)	18,400 (-35.2 %)	12,000 (-57.7 %)
Union Cross Rd. to Gumtree Rd.	22,440	26,600 (18.5 %)	11,800 (-47.4 %)	17,600 (-21.6 %)	18,600 (-17.1 %)	11,800 (-47.4 %)
Gumtree Rd. to Motsinger Rd.	18,500	27,000 (45.9 %)	11,000 (-40.5 %)	18,000 (-2.7 %)	19,000 (-2.7 %)	11,600 (-37.3 %)
Motsinger Rd. to Wallburg Rd.	19,260	10,200 (-47.0 %)	12,900 (-33.0 %)	19,600 (1.8 %)	20,600 (7.0 %)	13,500 (-29.9 %)
Wallburg Rd. to Georgetown Rd.	19,820	7,600 (-61.7 %)	10,300 (-48.0 %)	17,000 (-14.2 %)	18,000 (-9.2 %)	10,900 (-45.0 %)
Georgetown Rd. to Wallburg-High Point Rd.	19,600	12,800 (-34.6 %)	10,300 (-47.4 %)	17,000 (-13.3 %)	18,000 (-8.2 %)	10,900 (-44.4 %)
Wallburg-High Point Rd. to Shady Grove Church Rd.	18,280	24,600 (34.6 %)	8,600 (-53.0 %)	15,100 (-17.4 %)	16,100 (-11.9 %)	9,400 (-48.6 %)
Shady Grove Church Rd. to Johnson Rd.	18,720	26,800 (43.2 %)	10,300 (-45.0 %)	5,000 (-73.3 %)	18,100 (-3.3 %)	5,000 (-73.3 %)
Johnson Rd. to Jesse Green Dr.	16,860	21,500 (27.5 %)	5,400 (-68.0 %)	1,100 (-93.5 %)	13,200 (-21.7 %)	1,200 (-92.9 %)
Jesse Green Dr. to Old Greensboro Rd.	17,520	21,800 (24.4 %)	25,600 (46.1 %)	26,000 (48.4 %)	26,100 (49.0 %)	24,200 (38.1 %)

2.5.2 Year 2035 Build Capacity Analysis

Traffic operations analyses were conducted for multilane sections and intersections along the five build alternatives.

2.5.2.1. Roadway Segments

As shown in Table 2-4, all multilane segments along all five build alternatives are expected to operate at desirable levels of service (LOS C or better) under 2035 conditions.

TABLE 2-4: MULTILANE SEGMENT LEVEL OF SERVICE (2035)		
Multilane Segment	**LOS - NB**	**LOS - SB**
Alternative 1		
Union Cross Rd. to Willard Rd.	B	B
Willard Rd. to Gumtree Rd.	B	C
Gumtree Rd. to Existing NC 109	B	C
Motsinger Rd. to Existing NC 109	A	B
Existing NC 109 to Haymore Dr.	B	B
Jerry Clodfelter Rd. to Jesse Green Rd.	B	B
Jesse Green Rd. to Old Greensboro Rd.	B	B
Alternative 3		
Baden Rd. to Teague Rd.	A	A
Teague Rd. to Mt. Vernon Church Rd.	A	B
Mt. Vernon Church Rd. to Gumtree Rd.	A	B
Gumtree Rd. to Motsinger Rd.	B	B
Motsinger Rd. to Shady Grove Church Rd.	B	B
Shady Grove Church Rd. to Existing NC 109	B	A
Jesse Green Rd. to Old Greensboro Rd.	B	B
Alternative 4		
Main St. to Old Lexington Rd.	B	B
Old Lexington Rd. to Gumtree Rd.	B	B
Gumtree Rd. to Friendship-Ledford Rd.	B	B
Friendship-Ledford Rd. to Motsinger Rd.	A	B
Motsinger Rd. to Existing NC 109	A	B
Existing NC 109 to Jerry Clodfelter Rd.	B	B
Jerry Clodfelter Rd. to Existing NC 109	B	B
Existing NC 109 to Old Greensboro Rd.	B	B
Alternative 5		
Main St. to Old Lexington Rd.	B	B
Old Lexington Rd. to Gumtree Rd.	B	B
Gumtree Rd. to Friendship-Ledford Rd.	B	B
Friendship-Ledford Rd. to Motsinger Rd.	B	A
Motsinger Rd. to Shady Grove Church Rd.	B	A
Shady Grove Church Rd. to Existing NC 109	B	A
Jesse Green Rd. to Old Greensboro Rd.	B	B
Alternative 6		
Baden Rd. to Teague Rd.	A	A
Teague Rd. to Mt. Vernon Church Rd.	A	B
Mt. Vernon Church Rd. to Gumtree Rd.	A	B
Gumtree Rd. to Motsinger Rd.	A	B
Motsinger Rd. to Existing NC 109	A	A
Existing NC 109 to Jerry Clodfelter Rd.	B	B
Jerry Clodfelter Rd. to Existing NC 109	B	B
Existing NC 109 to Old Greensboro Rd.	B	B

2.5.2.2. Signalized and Unsignalized Intersections

The traffic operations analysis conducted for each build alternative is summarized below. Details can be found in the *Traffic Analysis for Bypass Alternatives for NC 109 Improvements Study* technical memorandum (Lochner 2009a).

Directional crossover intersections proposed along the NC 109 corridor were analyzed as unsignalized intersections. Unsignalized intersections forecast to not achieve a desirable LOS for the design year 2035 in both the AM and PM peak periods were upgraded to signalized intersections. In addition, unsignalized intersections forecast to achieve acceptable LOS but to experience long queues interfering with flow along upgraded NC 109 were also upgraded to signalized intersections. The majority of signalized intersections along the five build alternatives were forecast to experience acceptable LOS for all movements in 2035. The exceptions were the intersections at NC 109 and Old Greensboro Road (existing signal) and at Friendship-Ledford Old Greensboro Road for all five alternatives and the existing signalized intersection at NC 109 and Gumtree Road for Alternatives 3, 4, 5 and 6.

2.5.2.3. Year 2035 Travel Times

The travel time was approximated for each build alternative in 2035 and the 2035 no-build scenario between the southern project terminus at Old Greensboro Road and each alternative's northern terminus. Travel times were approximated using Synchro 7, incorporating delay forecasts from the intersection operations analysis at the following major intersections: Old Greensboro Road, Jesse Green Road, Johnson Road, Shady Grove Church Road, Wallburg-High Point Road, Georgetown Road, Wallburg Road, Motsinger Road, Gumtree Road, Union Cross Road, and Teague Road. Forecast travel times are shown in Table 2-5.

TABLE 2-5: FORECAST TRAVEL TIMES ALONG NC 109 CORRIDOR*

Alternative	Year	6:45 – 8:30 a.m.		4:45 – 6:30 p.m.		Average Travel Speed
		NB	SB	NB	SB	
Existing	2008	15 min	15 min	15 min	18 min	38.2 mph
No-Build	2035	45 min	55 min	30 min	68 min	12.1 mph
Alternative 1	2035	21 min	27 min	21 min	22 min	26.4 mph
Alternative 3	2035	17 min	19 min	21 min	19 min	31.6 mph
Alternative 4	2035	23 min	17 min	20 min	20 min	30.0 mph
Alternative 5	2035	17 min	19 min	21 min	19 min	31.6 mph
Alternative 6	2035	23 min	17 min	20 min	20 min	30.0 mph

* Calculated using Synchro 7, incorporating delay forecasts for major intersections.

All five build alternatives would substantially reduce the total time to travel the length of the NC 109 corridor within the project limits relative to the 2035 no-build scenario. Alternatives 3 and 5 would result in the greatest reduction in travel times, reducing the travel time by as much as 72 percent (for southbound traffic during the p.m. peak travel time). Alternatives 4 and 6 would result in reductions in travel times by as much as 71 percent (for southbound traffic during the p.m. peak travel time). Alternative 1 would result in the smallest reduction, but it would still reduce travel times in both directions during the a.m. and p.m. peak travel times.

2.6 TRAFFIC SAFETY

The proposed project will be designed to meet current design standards (as listed in Table 2-1). Average accident rates along a four-lane divided roadway with full or partial control of access, as is proposed for the project, are lower than those along a two-lane undivided facility with no access control, as is its existing condition.

A four-lane divided roadway with full or partial control of access would reduce congestion and provide increased capacity, which would be expected to reduce significantly the number of conflicts, and in particular, the rate of rear end crashes, occurring along existing NC 109.

2.7 COSTS

Preliminary cost estimates for each build alternative are presented in Table 2-6. These figures include estimates for construction, right-of-way, and utility costs and range from $119,007,572 (Alternative 5) to $144,733,169 (Alternative 1). These estimates are based on conceptual right of way limits from the preliminary designs for each alternate.

TABLE 2-6: COST ESTIMATES FOR BUILD ALTERNATIVES*

Alternative	Length (miles)	Construction Cost	Right-of-Way Cost	R/W Utility Cost	Total Cost
Alternative 1	9.54	$70,000,000	$69,975,000	$4,758,169	$144,733,169
Alternative 3	9.41	$78,500,000	$49,425,000	$628,221	$128,553,221
Alternative 4	9.20	$85,600,000	$34,975,000	$657,572	$121,232,572
Alternative 5	8.50	$78,400,000	$39,950,000	$657,572	$119,007,572
Alternative 6	10.05	$81,500,000	$46,710,000	$618,841	$128,828,841

* Construction and utility cost estimates prepared in March 2010; right-of-way estimates prepared in August 2009.

SECTION 3
AFFECTED ENVIRONMENT

This section describes the economic, social, and natural environments within the project study area. The descriptions are general in nature and address the entire project area rather than providing a separate description of the area as it relates to each bypass alternate. Data were collected from existing sources, such as local planning documents, databases, and other publications; through agency scoping comments and coordination; and from field surveys of the project area. This information will be used to evaluate the possible environmental impacts of each of the detailed study alternatives. The environmental consequences of the detailed study alternatives are discussed in Section 4.

3.1 HUMAN CHARACTERISTICS

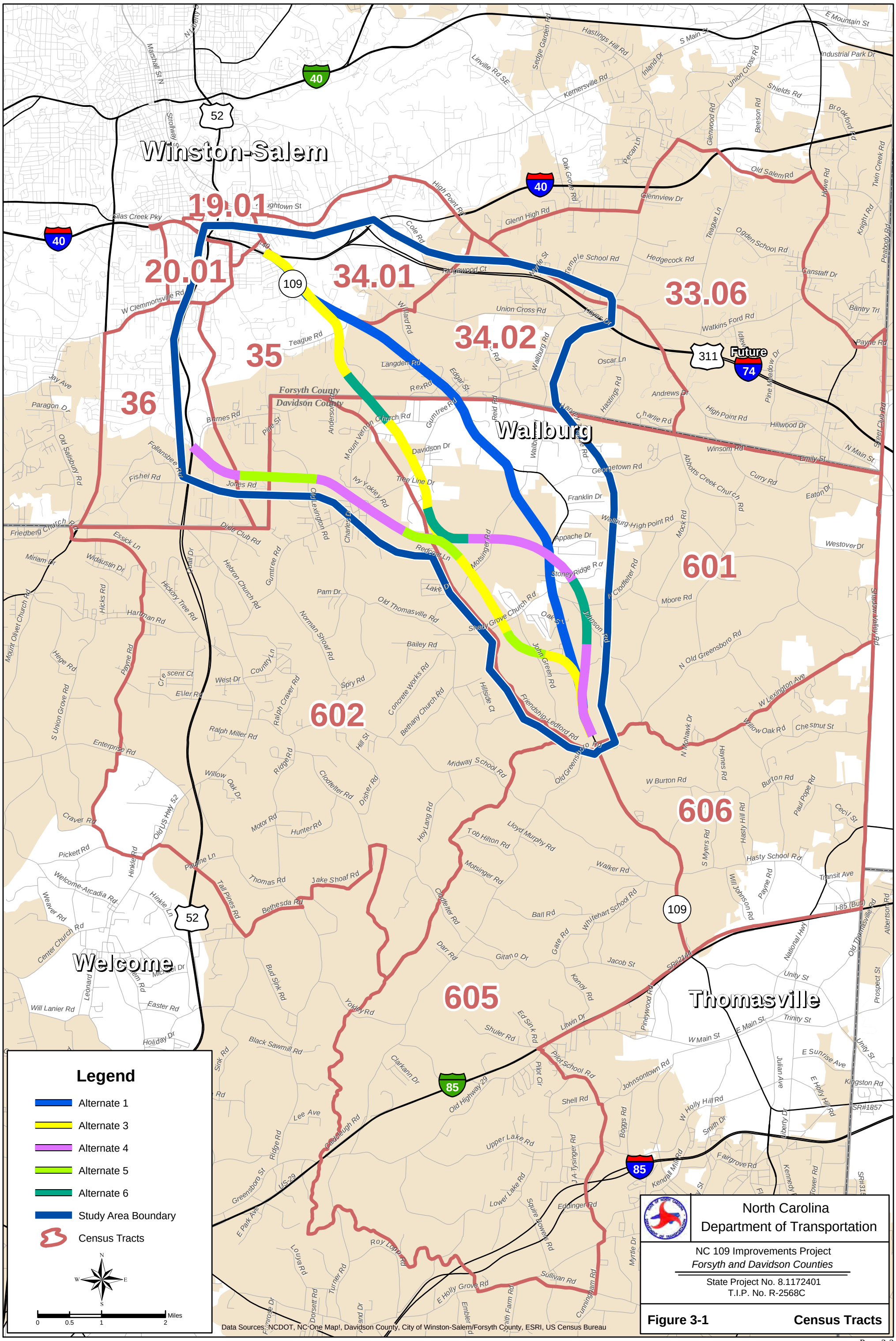
For purposes of discussing socioeconomic conditions, the study area is comprised of Census Tracts 601, 602, 605, and 606 in Davidson County and Census Tracts 19.01, 20.01, 33.06, 34.01, 34.02, 35 and 36 in Forsyth County based on the 2000 Census (see Figure 3-1). This study area includes the Town of Wallburg and a portion of Winston-Salem, as well as unincorporated areas of Davidson and Forsyth Counties.

3.1.1 Population Characteristics

3.1.1.1 Population and Demographics

The study area and surrounding areas have experienced moderate population growth from 1990 to 2000 (see Table 3-1). Although growth in these areas has been somewhat slower than in North Carolina as a whole, it has outpaced nationwide population growth of 13.2 percent. The population in the study area increased by 17.2 percent, similar to the growth rates in Davidson and Forsyth Counties. Winston-Salem's population grew by 29.5 percent, but much of this population growth is attributable to annexation, which has expanded the city's boundaries. According to the City-County Planning Board of Forsyth and Winston-Salem (2005), most of Forsyth County's growth is attributable to natural growth, rather than in-migration, while in-migration is responsible for more than half of Davidson County's growth.

The US Census Bureau 2008 American Community Survey estimates that Davidson County's population expanded by 7.4 percent from 2000 to 2008 and Forsyth County's population increased by 12.1 percent over that time period. The 2008 population estimates are not available at the Census Tract level and so cannot be determined for the study area. However, given that the study area's growth has closely followed the overall county population growth in the recent past, it is likely that the study area has experienced a similar rate of growth over this time period.


Winston-Salem
Wallburg
Thomasville
Welcome
Forsyth County
Davidson County
19.01
20.01
34.01
33.06
34.02
35
36
601
602
605
606
Legend
Alternate 1
Alternate 3
Alternate 4
Alternate 5
Alternate 6
Study Area Boundary
Census Tracts
Miles
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI, US Census Bureau
North Carolina
Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 3-1
Census Tracts

Growth trends varied considerably across the study area. In the northwestern corner of the study area, in an urban part of Winston-Salem, population actually declined from 1990 to 2000. Other areas, such as the southeastern and northeastern corners of the study area, near Thomasville and Kernersville, respectively, had growth rates of nearly 40 percent, much faster than the area as a whole.

TABLE 3-1: POPULATION GROWTH, 1990-2000

Area	Population		Growth	
	1990	2000	#	%
Study Area	47,540	55,722	8,182	17.2%
Davidson County	126,677	147,246	20,569	16.2%
Forsyth County	265,878	306,067	40,189	15.1%
Winston-Salem	143,485	185,776	42,291	29.5%
North Carolina	6,628,637	8,049,313	1,420,676	21.4%

Source: US Census 1990, 2000.

3.1.1.2 Ethnicity and Race

The racial composition of the project area and surrounding communities was examined in order to provide insight into the presence or absence of traditionally-underserved populations (see Table 3-2). According to the 2000 Census, minority residents make up approximately 20 percent of the study area population. This is somewhat lower than for North Carolina as a whole, although the study area has a slightly higher percentage of Hispanic residents (6.4 percent) than the State (4.7 percent). Davidson County's racial and ethnic makeup is somewhat more homogenous than the study area, with a higher percentage of white residents and smaller percentages of nonwhite and Hispanic residents. Forsyth County and Winston-Salem have more diverse populations than the study area, with smaller percentages of white residents and higher percentages of nonwhite and Hispanic residents. Within the study area, the highest percentages of nonwhite and Hispanic residents are found in its northwestern corner, near I-40/US 311 in Winston-Salem (Census Tracts 19.01 and 34.01).

TABLE 3-2: ETHNICITY AND RACE, 2000			
Area	White	Nonwhite	Hispanic
Census Tract 601	95.1%	4.9%	1.4%
Census Tract 602	93.2%	6.8%	1.0%
Census Tract 605	98.0%	2.0%	0.7%
Census Tract 606	95.8%	4.2%	2.4%
Census Tract 19.01	32.9%	67.1%	26.8%
Census Tract 20.01	50.1%	49.9%	5.6%
Census Tract 33.06	91.3%	8.7%	2.2%
Census Tract 34.01	38.7%	61.3%	22.1%
Census Tract 34.02	89.0%	11.0%	4.2%
Census Tract 35	49.8%	50.2%	14.6%
Census Tract 36	78.1%	21.9%	8.8%
Study Area	79.6%	20.4%	6.4%
Davidson County	78.1%	21.9%	3.2%
Forsyth County	68.5%	31.5%	6.4%
Winston-Salem	55.6%	44.4%	8.6%
NC	72.1%	27.9%	4.7%

Source: US Census 1990, 2000.

3.1.1.3 Age of Population

Age distribution provides insight into the available work force, which is an indicator of population trends and employee availability and provides information relative to service provision needs. In addition, the absence of individuals of working age can reflect the availability of jobs. Table 3-3 shows the relative ages of populations in the study area and surrounding communities. The age distribution within the study area is very similar to the distributions for Davidson County, Forsyth County, Winston-Salem and North Carolina as a whole.

TABLE 3-3: AGE DISTRIBUTION, 2000					
Area	Under 5	5-19	20-54	55+	Median Age
Study Area	6.8%	20.0%	51.4%	21.8%	36.0
Davidson County	6.5%	20.0%	50.7%	22.8%	37.1
Forsyth County	6.7%	20.0%	51.8%	21.5%	36.1
Winston-Salem	6.7%	19.9%	51.5%	21.9%	34.6
North Carolina	6.7%	20.5%	51.7%	21.1%	35.3

Source: US Census 1990, 2000.

3.1.1.4 Limited English Proficiency

According to Executive Order 13166, federal and state agencies are directed to "take reasonable steps to ensure 'meaningful' access to information and services". In some cases, this can be interpreted as meaning information should be presented in a language other than English and/or at a reading level reflective of their level of literacy. While there are few individuals classified by the Census as speaking English less than “very well” in most of the study area, the northwestern corner does contain areas with high concentrations of individuals with limited English proficiency

(LEP). The concentration of LEP individuals in these areas, which also feature higher concentrations of Hispanic individuals, ranges from approximately 28 percent to 7 percent of the total populations of the four Census Tracts in this area (Census Tracts 19.01, 34.01, 35 and 36). Most of the LEP individuals in these areas are Spanish speakers, with 32 percent to 9 percent of the total populations of those four Census Tracts speaking Spanish. Targeted public outreach has been provided for these communities over the course of the study (see Section 7.2.8). Spanish language newsletters will be distributed prior to the Corridor Public Hearing and Spanish translation services will be provided at the hearing.

3.1.2 Economic Characteristics

3.1.2.1 Employment

An important determinant of the overall economic well-being of an area is the unemployment rate. As shown in Table 3-4, unemployment rates in all project areas were equal to or lower than the State's unemployment rate in 2000 and had changed little since 1990. The 2000 unemployment rate was lowest within Winston-Salem (3.6 percent), while the rate was slightly higher within the study area (5.2 percent). Following State and national trends, unemployment rates in the area have risen since 2000. The 2008 unemployment rates for Davidson and Forsyth Counties were 7.3 percent and 5.8 percent, respectively, compared to a rate of 6.3 percent for North Carolina (Bureau of Labor Statistics, 2009). The 2008 unemployment rate is not available at the Census Tract level, so cannot be determined for the study area; however, based on past trends it is likely to be similar to the 2008 unemployment levels for Davidson and Forsyth.

TABLE 3-4: UNEMPLOYMENT RATE, 1990-2000

Area	Unemployment Rate		% Change 1990 to 2000
	1990	2000	
Study Area	4.6%	5.2%	+0.6%
Davidson County	3.7%	4.1%	+0.4%
Forsyth County	4.9%	4.6%	-0.3%
Winston-Salem	3.7%	3.6%	-0.1%
North Carolina	4.6%	5.3%	+0.7%

Source: US Census 1990, 2000.

3.1.2.2 Income

As shown in Table 3-5, the study area has had a somewhat higher median household income than the State as a whole. In 1999, the median household income in the study area was $42,119, compared to $39,184 for North Carolina. The figure for the study area was also somewhat higher than Davidson County's median household income ($38,640) and nearly identical to Forsyth County's ($42,097). Median household incomes in the demographic study area, the two counties and Winston-Salem grew more slowly between 1989 and 1999 than the State's median household income. The U.S. Census Bureau estimates that median household income grew by 13 percent and 11 percent in Davidson and Forsyth Counties, respectively, between 2000 and 2008. In 2008, median household income was estimated to be $43,663 in Davidson County and $46,561 in Forsyth County. Estimates for this timeframe are not available at the Census Tract level and so

cannot be determined for the study area. However, it is likely that median household income has grown similarly in the study area to the two counties.

TABLE 3-5: MEDIAN HOUSEHOLD INCOME, 1989 AND 1999

Area	Median Household Income		Change	
	1989	1999	$ Increase 1989 to 1999	% Increase 1989 to 1999
Study Area	$29,912	$42,119	$12,207	39.7%
Davidson County	$27,913	$38,640	$10,727	38.4%
Forsyth County	$30,449	$42,097	$11,648	38.3%
Winston-Salem	$26,488	$37,006	$10,518	39.7%
North Carolina	$26,647	$39,184	$12,537	47.0%

Source: US Census Bureau, 1990, 2000.

While the overall study area had a higher median household income than the State, the northwestern corner of the study area near I-40/US 311 in Winston-Salem (Census Tracts 19.01 and 34.01) had significantly lower median household incomes than the study area as a whole. In 2000, the median income in Census Tract 19.01 was $22,500 and in Census Tract 34.01 it was $29,747.

3.1.2.3 Poverty Status

Between 1990 and 2000, the study area, Davidson County and Forsyth County experienced slight increases in the percentage of individuals living below the poverty line. In contrast, North Carolina as a whole experienced a slight decrease in the percentage of individuals in poverty. However, year 2000 poverty levels were slightly lower in the study area and the two counties than the State. Winston-Salem had a higher percentage of residents in poverty than the study area. Poverty status is shown in Table 3-6. The U.S. Census Bureau estimates that in 2008 the percentages of residents in poverty in Davidson and Forsyth were 15.1 percent and 14.1 percent, respectively, compared to 14.3 percent for the State. Based on this estimate, poverty is expanding faster in Davidson County than in Forsyth County or the State. Estimates for 2008 are not available at the Census Tract level and thus the 2008 poverty level in the study area cannot be determined.

While poverty levels are fairly low in the study area, there are neighborhoods within the study area with substantial numbers of residents in poverty. Census Tract 19.01 in Winston-Salem, near I-40/US 311, had the highest percentage of residents in poverty (34.3 percent) within the study area. Other Census Tracts in the area near I-40/US 311 had higher percentages of residents in poverty than the study area as a whole.

TABLE 3-6: INDIVIDUALS BELOW POVERTY LEVEL, 1990-2000			
Area	Below Poverty Level		% Change 1990 to 2000
	1990	2000	
Study Area	8.7%	9.7%	+1.0%
Davidson County	9.8%	10.1%	+0.3%
Forsyth County	8.7%	9.7%	+1.2%
Winston-Salem	15.2%	15.2%	No change
North Carolina	12.5%	12.3%	-0.2%

Source: US Census Bureau 1990, 2000.

3.1.2.4 Housing

Similar to trends observed for population growth, the number of households in the study area and in Davidson and Forsyth Counties grew moderately between 1990 and 2000. This growth was slightly slower than the State's growth in the number of households. Winston-Salem's 27.7 percent growth in the number of households is attributable in part to annexation expanding the city's boundaries. While total population and the number of households grew in all areas under consideration, average household size decreased slightly in nearly all areas, reflecting a nationwide trend towards smaller household sizes. Average household size increased slightly in the study area from 2.53 in 1990 to 2.54 in 2000, when it surpassed average household size for the State overall. This small increase reflects increased suburban residential development in once rural parts of the study area. Table 3-7 shows change in households in the project area.

TABLE 3-7: HOUSEHOLDS, 1990-2000					
Area	Households			Household Size	
	1990	2000	% Change 1990-2000	1990	2000
Study Area	18,682	21,908	17.3%	2.53	2.54
Davidson County	48,886	58,156	19.0%	2.53	2.50
Forsyth County	107,459	123,851	15.3%	2.39	2.39
Winston-Salem	59,713	76,247	27.7%	2.30	2.32
North Carolina	2,517,098	3,133,282	24.4%	2.54	2.49

Source: US Census Bureau 1990, 2000

As shown in Table 3-8, approximately 43 percent of housing units in the study area were constructed prior to 1970. Housing stocks in the study area, Davidson and Forsyth Counties and Winston-Salem are older on average than in North Carolina as a whole, reflecting the modest growth experienced in this area in recent decades.

TABLE 3-8: HOUSING UNITS, 1990-2000

Area	Total Units	1990-2000		1980-1989		1970-1979		1969 or Earlier	
		Units Built	% of Total	Units Built	% of Total	Units Built	% of Total	Units Built	% of Total
Study Area	23,383	5,155	22.0%	4,250	18.2%	3,893	16.6%	10,085	43.1%
Davidson County	62,432	15,100	24.2%	10,980	17.6%	11,255	18.0%	25,097	40.2%
Forsyth County	133,093	25,707	19.3%	24,834	18.7%	24,525	19.2%	57,027	42.8%
Winston-Salem	82,640	11,623	14.1%	14,348	17.4%	14,288	17.3%	42,381	51.3%
North Carolina	3,523,944	949,985	26.9%	692,633	19.7%	641,117	18.2%	1,240,209	35.2%

Source: US Census Bureau 2000.

3.1.3 Community Facilities

Community facilities and services that serve the project vicinity include schools, recreational facilities, parks, places of worship, and emergency services.

3.1.3.1 Parks and Recreational Facilities

The City of Winston-Salem operates several parks in the project area. Belview Park, just north of I-40/US 311 in the northwestern corner of the project area is a 6-acre park featuring a soccer field, basketball court, fitness trail, playground and picnic shelter. Sprague Park, about 0.75 miles east of Belview Park is an 18-acre park featuring a public pool and a playground. Easton Park is located between NC 109 and Old Lexington Road in the northwestern corner of the project area; it is a 27-acre park with tennis courts, a basketball court, a softball field, a playground and a picnic shelter. Weston Park, located just east of US 52, is a 16-acre park featuring basketball and tennis courts, a softball field, a playground and a picnic shelter.

Within the project area, Forsyth County operates Union Cross Park, located at the intersection of Union Cross Road and Wallburg Road. It is a 15-acre park with extensive softball facilities, as well as tennis, basketball, sand volleyball courts, a walking path, picnic facilities and a playground.

The nonprofit Wallburg Booster Club operates the Wallburg Athletic Complex on Motsinger Road in Wallburg. The complex includes facilities for baseball/softball, soccer, basketball, and football. The Wallburg Booster Club operates numerous youth recreational sports leagues through the Athletic Complex.

There are three golf courses in the project vicinity. The Meadowlands Golf Club is located within the Meadowlands community in Wallburg. The Old Homeplace Golf Club and the Maple Leaf Golf Club are located at the northeastern corner of the project area, near the Davidson-Forsyth county line. All three of these golf courses are privately-owned but open to the public.

3.1.3.2 Schools

The project area is served by the Winston-Salem/Forsyth County School System and the Davidson County School System. Schools in the vicinity of the project are shown on Figure 3-2 and listed in Table 3-9.

TABLE 3-9: SCHOOLS IN VICINITY OF PROJECT AREA

School	Location
Easton Elementary School	East Clemmonsville Circle east of Old Lexington Road, Winston-Salem
Union Cross Elementary School	High Point Road east of US 311, Kernersville
Carter G. Woodson School of Challenge	Goldfloss Street west of US 52, Winston-Salem
Hill Magnet Middle School	Tryon Street and Waughtown Street, Winston-Salem
Forsyth Vocational High School	South Main Street south of I-40, Winston-Salem
Wallburg Elementary School	Motsinger Road south of NC 109, Wallburg
A.G. Cox Middle School	Motsinger Road south of NC 109, Wallburg
Friendship Elementary School	Friendship-Ledford Road west of NC 109
Ledford Middle School	East side of NC 109 south of Old Greensboro Road
Ledford Senior High School	Jesse Green Road and John Green Road, west of NC 109

3.1.3.3 Places of Worship

There are 22 places of worship located within the project study area (Table 3-10). Their locations are shown on Figure 3-2.

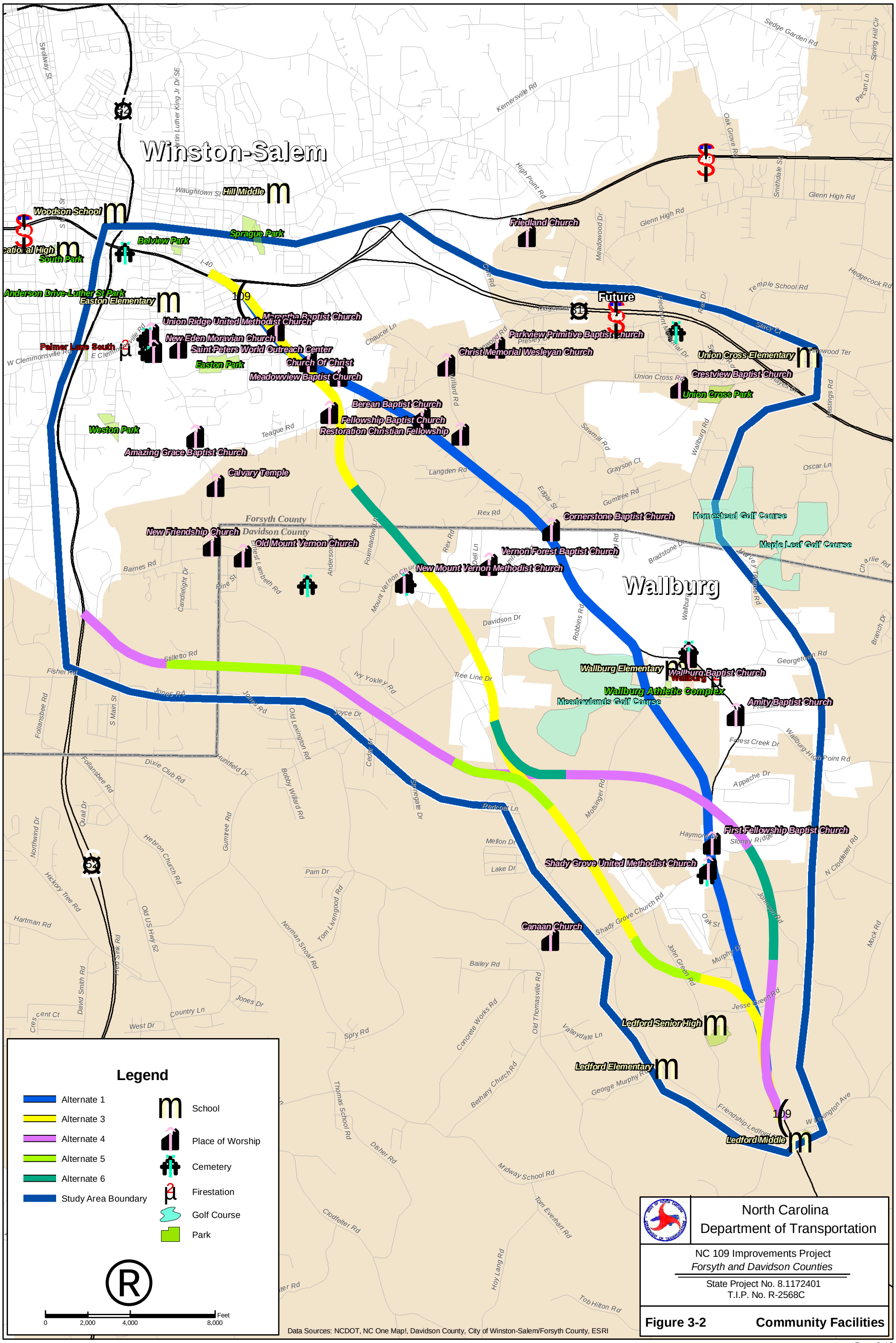

Winston-Salem
Waughtown St
Hill Middle
Woodson School
Belview Park
Sprague Park
South Park
Anderson Drive-Luther St Park
Easton Elementary
I-40
109
Union Ridge United Methodist Church
Maranatha Baptist Church
New Eden Moravian Church
Saint Peters World Outreach Center
Palmer Lane South
Easton Park
Church Of Christ
Meadowview Baptist Church
Weston Park
Amazing Grace Baptist Church
Calvary Temple
Berean Baptist Church
Fellowship Baptist Church
Restoration Christian Fellowship
Kernersville Rd
High Point Rd
Friedland Church
Glenn High Rd
Meadowood Dr
Smithdale St
Oak Grove Rd
Sedge Garden Rd
Spring Hill Cir
Pecan Ln
Hedgecock Rd
Temple School Rd
Cole Rd
Future
Parkview Primitive Baptist Church
Christ Memorial Wesleyan Church
Union Cross Elementary
Crestview Baptist Church
Union Cross Park
Union Cross Rd
Willard Rd
Chaucer Ln
Presley Dr
Ridgemont Dr
Fleetpoint Memorial Dr
Rae's Dr
Stacy Ct
Pinewood Ter
Hayes St
Hastings Rd
Wallburg Rd
Sawmill Rd
Grayson Ct
Oscar Ln
Langden Rd
Gumtree Rd
Edgar St
Rex Rd
Forsyth County
Davidson County
New Friendship Church
Old Mount Vernon Church
Barnes Rd
Candlelight Dr
Pine St
Forest Lambeth Rd
Anderson Rd
Foxmeadow Ln
Mount Vernon Church
Cornerstone Baptist Church
Vernon Forest Baptist Church
New Mount Vernon Methodist Church
Homestead Golf Course
Maple Leaf Golf Course
Harvey Teague Rd
Bradstone Dr
Charlie Rd
Robbins Rd
Davidson Dr
Wallburg
Wallburg Elementary
Wallburg Baptist Church
Wallburg Athletic Complex
Meadowlands Golf Course
Amity Baptist Church
Forest Creek Dr
Wallburg-High Point Rd
Appache Dr
Georgetown Rd
Branch Dr
Stilletto Rd
Fishel Rd
Jones Rd
Ivy Yokley Rd
Tree Line Dr
Joyce Dr
Follansbee Rd
S Main St
Old Lexington Rd
Cedar Dr
Huntfield Dr
Dixie Club Rd
Bobby Willard Rd
Stonegate Dr
Redcoat Ln
Motsinger Rd
Haymore Dr
Stoney Ridge
First Fellowship Baptist Church
Shady Grove United Methodist Church
Canaan Church
Shady Grove Church Rd
Oak St
Johnson Rd
Murphy Dr
John Green Rd
Jesse Green Rd
Mock Rd
N Clodfelter Rd
Ledford Senior High
Ledford Elementary
Ledford Middle
George Murphy Rd
Friendship-Ledford Rd
W Lexington Ave
Bailey Rd
Concrete Works Rd
Old Thomasville Rd
Valleydale Ln
Bethany Church Rd
Thomas School Rd
Disher Rd
Midway School Rd
Tom Everhart Rd
Clodfelter Rd
Hoy Lang Rd
Tob Hilton Rd
Mellon Dr
Lake Dr
Pam Dr
Norman Shoaf Rd
Tom Livengood Rd
Old US Hwy 52
Hickory Tree Rd
Hartman Rd
Fred Shik Rd
David Smith Rd
Country Ln
Jones Dr
West Dr
Cres cent Ct
Northwind Dr
Quail Dr
Hebron Church Rd
Gumtree Rd
Hebron Church Rd
Teague Rd
Rex Rd
Dell Ln
Rod Rd
Legend
Alternate 1
Alternate 3
Alternate 4
Alternate 5
Alternate 6
Study Area Boundary
School
Place of Worship
Cemetery
Firestation
Golf Course
Park
0
2,000
4,000
8,000
Feet
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 3-2
Community Facilities

TABLE 3-10: PLACES OF WORSHIP IN PROJECT AREA	
Church	**Location**
Shady Grove United Methodist Church	NC 109 south of Wallburg
First Fellowship Baptist Church	NC 109 south of Wallburg
Amity Baptist Church	NC 109, Wallburg
Wallburg Baptist Church	NC 109, Wallburg
Cornerstone Baptist Church	NC 109, Wallburg
Vernon Forest Baptist Church	Mt. Vernon Church Road (SR 1708)
New Mount Vernon Methodist Church	Mt. Vernon Church Road (SR 1708)
Old Mount Vernon Church	Friendship-Ledford Road (SR 1700)
New Friendship Baptist Church	Old Lexington Road (SR 2743)
Calvary Temple	Old Lexington Road (SR 2743)
Amazing Grace Baptist Church	Old Lexington Road (SR 2743)
Union Ridge United Methodist Church	Old Lexington Road (SR 2743)
Immanuel New Eden Moravian Church	Old Lexington Road (SR 2743)
Saint Peter's World Outreach Center	Old Lexington Road (SR 2743)
Marantha Baptist Church	NC 109, Winston-Salem
Meadowview Baptist Church	Nathan Avenue
Church of Christ	NC 109, Winston-Salem
Fellowship Baptist Church	Teague Road (SR 2705)
Berean Baptist Church	NC 109, Winston-Salem
Restoration Christian Fellowship	NC 109, Winston-Salem
Christ Wesleyan Church	Union Cross Road (SR 2643)
Parkview Primitive Baptist Church	Ridgewood Road (SR 2698)
Crestview Baptist Church	Union Cross Road (SR 2643)

3.1.3.4 Emergency Services

Davidson County has a central 911 Communications Center which serves as the public safety answering point for all agencies in the County. All portions of the County are served by Davidson County EMS, which provides Advanced Life Support (ALS) services. The Wallburg Fire Department, located on NC 109 in central Wallburg, is a volunteer agency providing fire protection services to northeastern Davidson County. The Davidson County Sheriff's Office provides service throughout Davidson County. In Forsyth County, emergency first response is provided by the Winston-Salem Fire Department within the city limits and in surrounding areas. The Palmer Lane South Fire Station, part of the Winston-Salem Fire Department, is located off East Clemmonsville Road in the northwestern corner of the study area. The Union Cross Volunteer Fire Department, located at 4401 High Point Road northeast of the study area, provides emergency first response to this part of unincorporated Forsyth County. The Forsyth County Sheriff's Department provides service throughout Forsyth County and residents of incorporated Winston-Salem are also served by the Winston-Salem Police Department.

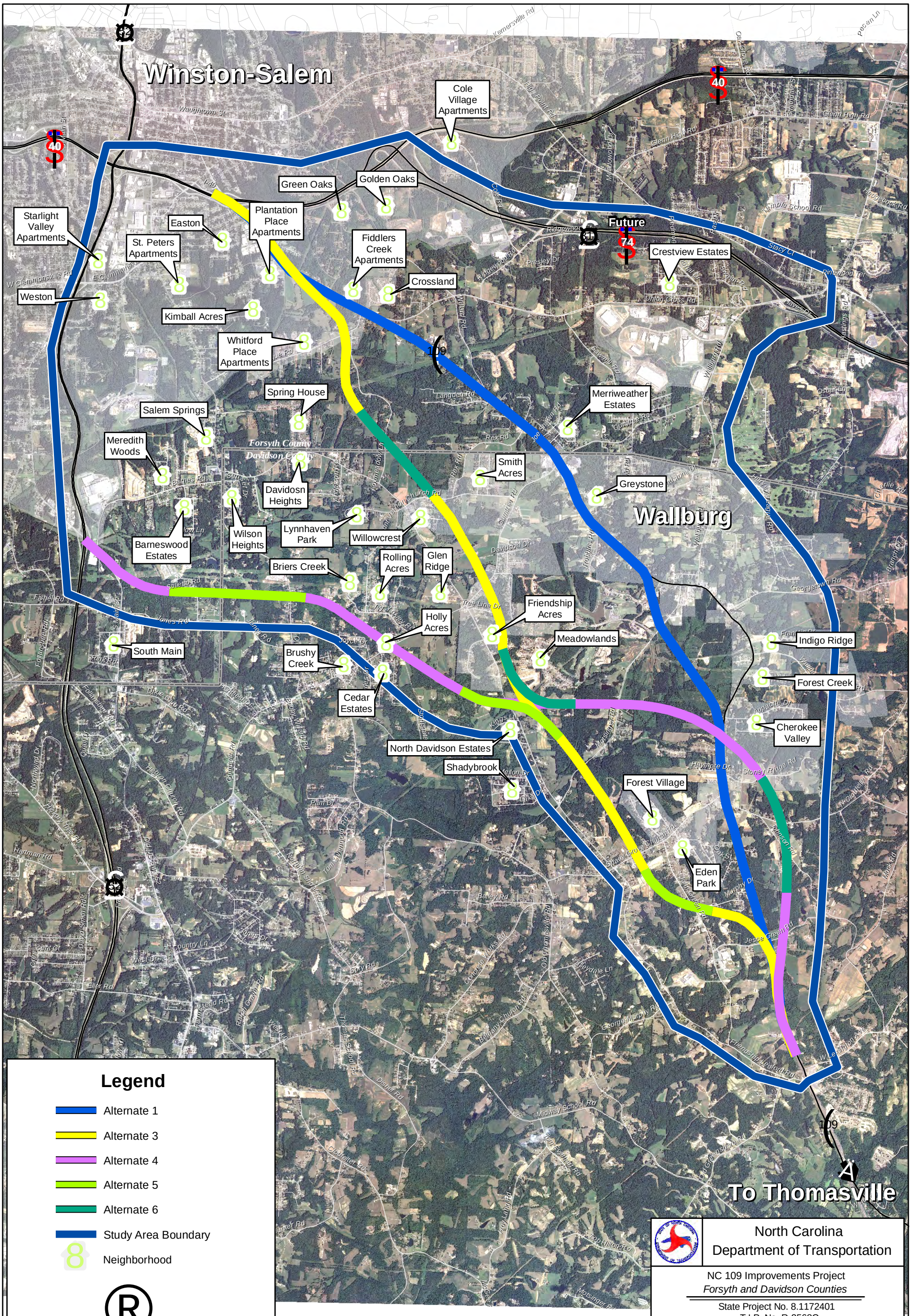
3.1.4 Community Cohesion

3.1.4.1 Neighborhoods

The northwestern corner of the study area, in Winston-Salem consists of older, urban neighborhoods. The Weston neighborhood is centered around Weston Park and the Easton neighborhood is centered around Easton Park. The Kimball Acres neighborhood is north of Teague Road and west of NC 109. The locations of these neighborhoods are shown on Figure 3-3.

In the southern and eastern parts of the study area, residential development is primarily low-density and rural in nature. There are few large subdivisions; the notable exception is the Meadowlands development, a golf course community off of Motsinger Road in Wallburg. It is currently under development and was approved for 682 residential units. The remainder of the subdivisions in the project area are small, generally consisting of 10-50 lots. Most are built out, but a small number of them are currently under development. The following small subdivisions and apartment complexes are within the project study area and are depicted on Figure 3-3:

- Fiddlers Creek Apartments
- Cole Village Apartments
- St. Peter's Heritage Place Apartments
- Whitford Place Apartments
- Plantation Place Apartments
- Starlight Valley Apartments
- Spring House
- Cherokee Valley
- Forest Creek
- Green Oaks
- Willowcrest
- Rolling Acres
- Lynnhaven Park
- Holly Acres
- Wilson Heights
- Davidson Heights
- Smith Acres
- Forest Village
- Eden Park
- Briers Creek
- Brushy Creek
- Indigo Ridge
- Glenn Ridge
- Cedar Estates
- Salem Springs
- Meredith Woods
- Barnswood Estates
- South Main
- Crossland
- Merriweather Estates
- Crestview Estates
- Greystone
- Friendship Acres
- Willowcrest


Winston-Salem
Wallburg
To Thomasville
Future
Cole Village Apartments
Golden Oaks
Green Oaks
Plantation Place Apartments
Easton
Starlight Valley Apartments
St. Peters Apartments
Fiddlers Creek Apartments
Crossland
Crestview Estates
Weston
Kimball Acres
Whitford Place Apartments
Spring House
Salem Springs
Meredith Woods
Merriweather Estates
Barneswood Estates
Wilson Heights
Davidosn Heights
Lynnhaven Park
Willowcrest
Rolling Acres
Glen Ridge
Briers Creek
Smith Acres
Greystone
Friendship Acres
Meadowlands
Holly Acres
South Main
Brushy Creek
Cedar Estates
North Davidson Estates
Shadybrook
Forest Village
Eden Park
Indigo Ridge
Forest Creek
Cherokee Valley
Forsyth County
Davidson County
Legend
Alternate 1
Alternate 3
Alternate 4
Alternate 5
Alternate 6
Study Area Boundary
Neighborhood
0
2,000
4,000
8,000
Feet
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI, USDA
North Carolina Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 3-3 Neighborhoods

3.2 LAND USE AND TRANSPORTATION PLANNING

3.2.1 Land Use Plans

3.2.1.1 Existing Land Use

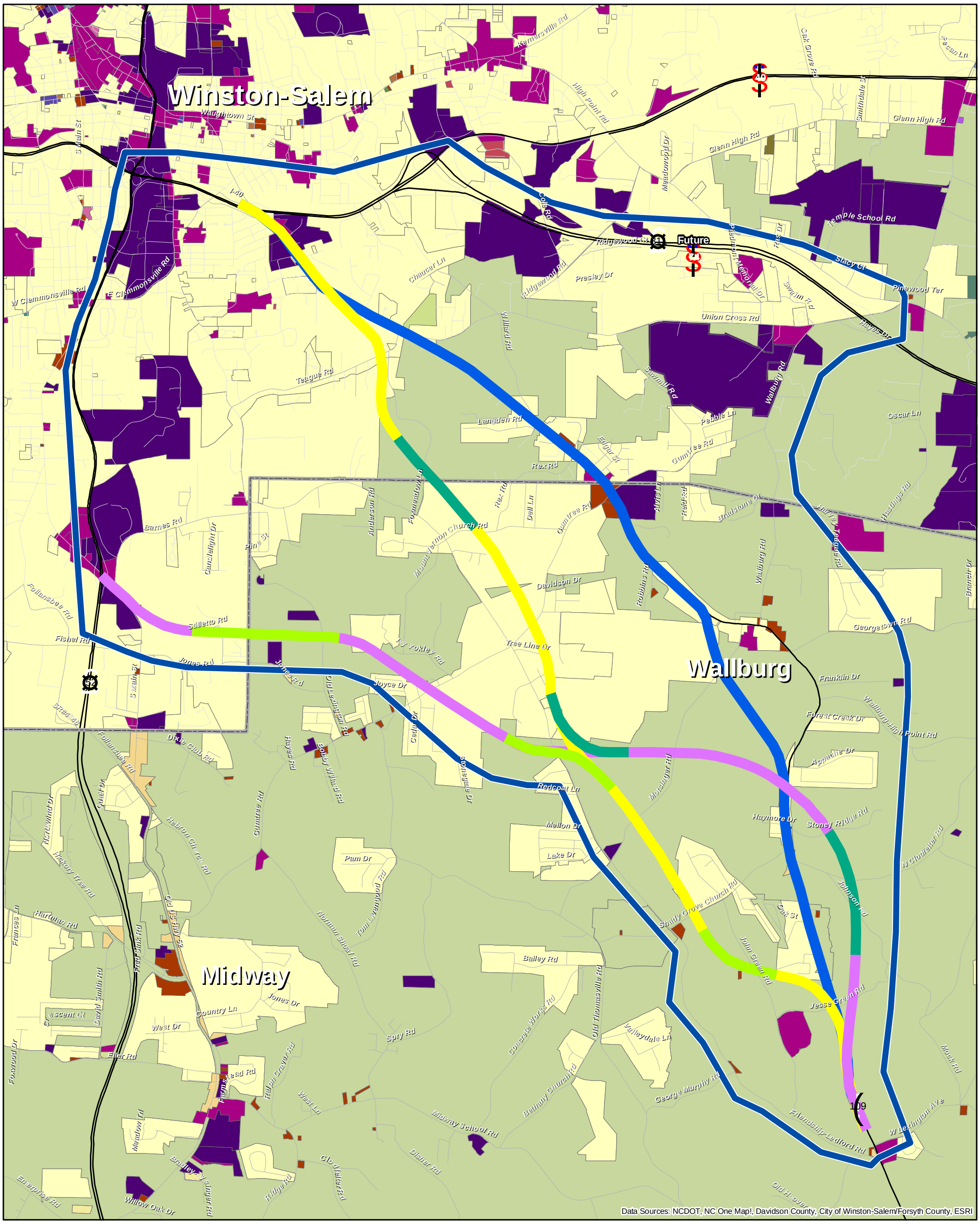
Most of the study area consists of rural residential and agricultural land uses, although suburban development is becoming more prevalent in parts of the area. The northwestern corner of the study area is more urban in nature, with higher-density residential development interspersed with commercial and industrial uses.

Rural residential and agricultural uses are found throughout the portion of the study area in Davidson County. There are few residential subdivisions in the area, with most of these subdivisions including fewer than 20 lots. The only major residential subdivision is the Meadowlands development, a golf-course oriented subdivision near central Wallburg. Commercial development is concentrated in a few areas: the intersection of Gum Tree Road and NC 109 contains two retail shopping centers, fast food restaurants, and service stations; central Wallburg contains a small number of retail stores, offices, restaurants and other commercial establishments; and the Midway area, just east of the US 52 interchange at Hickory Tree Road, contains two retail shopping centers along with service stations. Other commercial uses, including restaurants, auto-related businesses, and small offices, are lightly scattered along NC 109. A small number of rural commercial uses, including farm-oriented retail businesses, kennels, and stables are located in various parts of the area.

A similar pattern of land uses to that found in Davidson, characterized by rural residential uses and agricultural uses, is found in southern and southeastern Forsyth County. At the northwestern corner of the study area, residential development becomes somewhat more urban, with smaller lots and a mix of single-family and multi-family housing. Apartment complexes are found on NC 109 and Teague Road. Commercial uses, including service stations, restaurants, bars, and small offices, and light industrial uses, including building contracting businesses and auto-related businesses, are located near I-40 on NC 109, Old Lexington Road, and Clemmonsville Road. Two large industrial parks are located along US 52: the Salem Business Park, on Old Lexington Road, and the Piedmont Triad Industrial Center, located near the interchange at South Main Street. Industrial parks are also located in southeastern Forsyth, near US 311. The Centre 322 Industrial Park and Ridgewood Industrial Park are located along Ridgewood Road to the south and north of US 311, respectively. The Union Cross Business Park is a very large industrial park located on Wallburg Road south of US 311. While much of the residential development in southeastern Forsyth is rural, large-lot residential, there are some small residential subdivisions in this area.

3.2.1.2 Zoning Characteristics

As shown in Figure 3-4, the rural/agricultural and residential zoning categories are predominant in the study area. Industrial zoning is concentrated along the northern and western edges of the



Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary

Zoning

- Residential
- Rural - Agricultural
- Retail Center
- Office
- Industrial
- Open Space

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 3-4 **Zoning Categories**

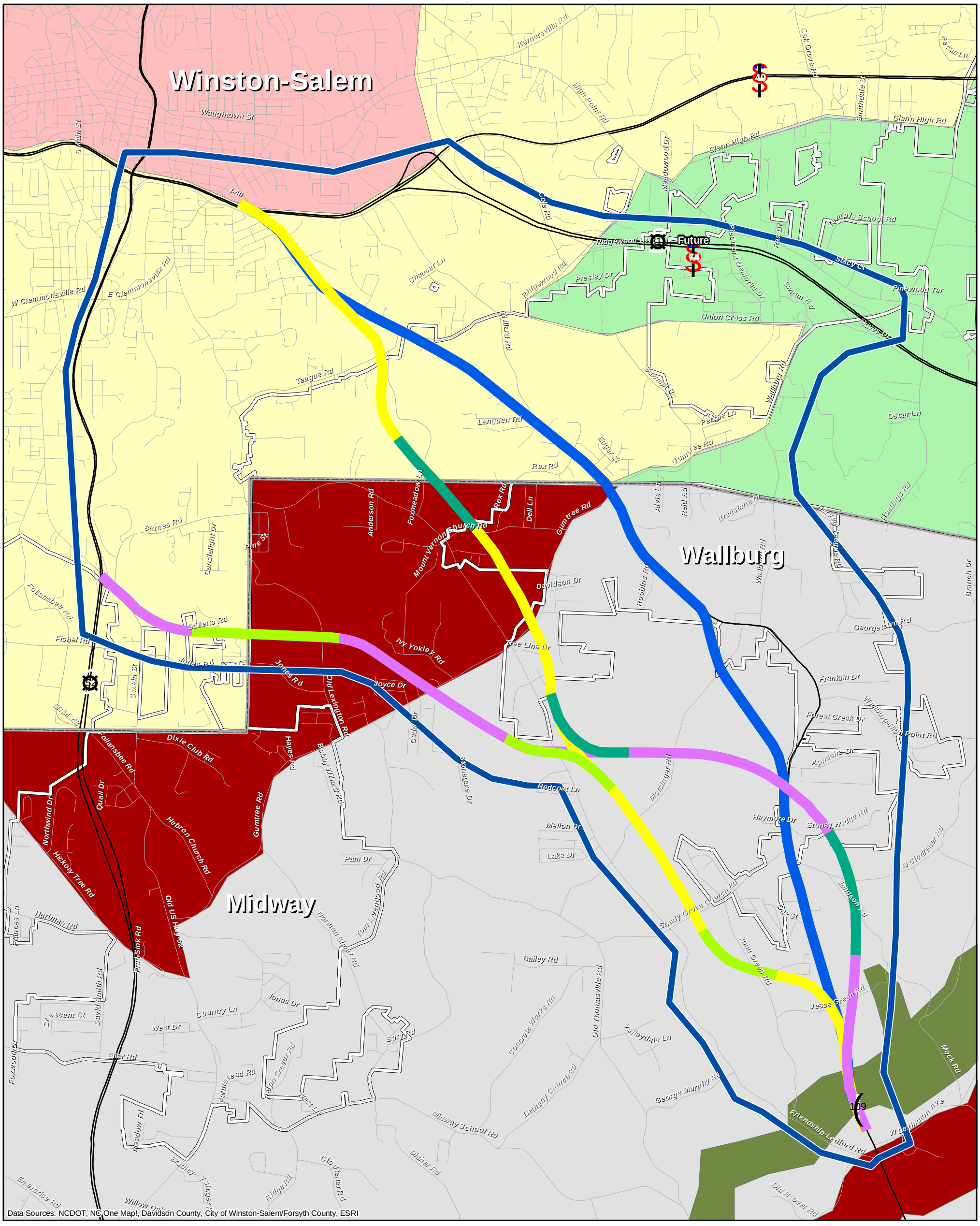
study area, particularly in the vicinity of US 52 and I-40/US 311. Commercial zoning is lightly scattered through the study area, mainly occurring along existing NC 109 and Gumtree Road.

3.2.1.3 Future Land Use Plans

The *Legacy Development Guide* (2001) is the general, long-range policy guide for growth and development in Forsyth County and its eight municipalities, including Winston-Salem. It includes the Forsyth County Growth Management Plan Map, which designates the County's desired future land use pattern. These designations for the portion of the County in the project area are shown in Figure 3-5. A key land use division is the County's Municipal Services Area (MSA) boundary. Areas within the MSA are currently served by adequate infrastructure and public services. Most of the study area in Forsyth is within the MSA. Land within the MSA is divided into several different designations; most of the study area is designated as "Suburban Neighborhoods," defined as the area where suburban development has already occurred and where most future residential, commercial and industrial development should occur. A small area at the northwestern edge of the study area is designated as "Urban Neighborhoods," where future infill development and revitalization are encouraged. Metro Activity Centers are proposed within Suburban Neighborhood Areas; one of these, the US 311 South Activity Center at US 311 and Ridgewood Road, is located within the study area. Metro Activity Centers are intended as the "focal point for community-wide activities—living, working, shopping, education, recreation and cultural, spiritual or civic activities."

The remainder of the study area in southeastern Forsyth County is designated as a Future Growth Area. While the *Legacy Development Guide* recognizes and values the rural nature and agricultural resources in this area, it also recognizes that factors including proximity to job centers and the regional road network will lead to significant development pressures in the area. The County developed the *Southeast Forsyth Area Plan* (2005) to address those pressures and encourage development that protects the natural and aesthetic resources of the area. The area plan designates most of the area east of Gum Tree Road and Wallburg Road for future Rural Conservation Subdivisions, in which 50% of land inside a residential development would be protected as open space.

Davidson Forward (2002) is the land development plan guiding future growth in Davidson County. As Wallburg does not have any adopted municipal land use plans, Davidson Forward also guides growth within the town. It includes the Davidson County Land Development Strategy Map, which designates most of the study area as "Preferred Rural/Agricultural Areas," defined as areas currently without public services such as sewer and water and unlikely to gain these services within the next 20 years. This is shown on Figure 3-5. The County seeks to preserve rural and agricultural uses in these areas. Residential lot sizes within this part of the study area, also included in the Lake Thom-A-Lex Water Supply Watershed, are limited to a minimum of 40,000 square feet. The southern edge of the study area, along Abbott's Creek, is identified as a "Preferred Conservation Area," where development is strictly limited. The northwestern portion of the study area within Davidson County is identified as an "Area of



Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary

Future Landuse

- Preferred Rural / Agricultural Area
- Area of Traditional or Greenspace Development
- Preferred Conservation Area
- Future Growth Area
- Urban Neighborhoods
- Surburban Neighborhoods

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C

Figure 3-5 Future Land Use Categories

Traditional or Greenspace Development." Typical large-lot suburban development is acceptable in this area. *Davidson Forward* also identifies Commercial Service Centers, areas of current and future concentrations of commercial development. The NC 109 intersection with Gum Tree Road is identified as a Commercial Service Center, as is the Midway area at the US 52 interchange at Hickory Tree Road. *Davidson Forward* specifically identifies the widening of NC 109 to four lanes as a policy supporting its vision for the County's future.

3.2.2 Transportation Plans

3.2.2.1 High Point Metropolitan Planning Organization

The High Point Metropolitan Planning Organization (HPMPO) coordinates all transportation planning activities in the High Point urbanized area. Within the project area this includes northeastern Davidson County, including Wallburg. The HPMPO *Thoroughfare Plan*, adopted in 2006, includes all proposed roadway improvements in the project area without regards to funding or timing. Projects on the Thoroughfare Plan are included in the HPMPO travel demand model. The HPMPO *2035 Long Range Transportation Plan* (LRTP), adopted in February 2009, is a tool for guiding transportation decisions through 2035 in the HPMPO area. The LRTP includes only fiscally constrained projects, so while many projects on the *Thoroughfare Plan* are included in the LRTP, those for which no funding or horizon date have been projected are not.

The LRTP integrates long-term and short-term considerations across all modes of transportation, including highways, pedestrian and bicycle facilities, and air and freight; also, it carefully balances operations and maintenance with capacity management. It emphasizes linkages between modes within the HPMPO area and to regional transportation systems. The LRTP supports the efficient movement of people and goods while balancing economic, social, and environmental goals and constraints. Included in the LRTP is a Roadway Element, which lists recommended roadway improvements for horizon years through 2035. Because the Thoroughfare Plan only includes roadway improvements, the Roadway Element is the only component of the LRTP to include *Thoroughfare Plan* projects. Both the LRTP and the *Thoroughfare Plan* include the widening of NC 109 through the project area. A Transit Element and a Bicycle/Pedestrian Element are also included in the LRTP, which lists recommended improvements to those transportation systems through 2035. No transit improvements in the project area are included in the Transit Element. In the Bicycle and Pedestrian Element, greenways are proposed along Abbott's Creek and Spurgeon Creek.

3.2.2.2 Winston-Salem Urban Area Metropolitan Planning Organization

The Winston-Salem Urban Area Metropolitan Planning Organization (MPO) coordinates transportation planning activities in the Winston-Salem urbanized area, which includes the northwestern portion of the study area in Davidson County and all of the study area within Forsyth County. As for the HPMPO, the Winston-Salem MPO has a *2035 Long Range Transportation Plan*, adopted in 2009. The Winston-Salem MPO *Comprehensive Transportation*

Plan (CTP), adopted in 2008, shows all proposed transportation improvements to meet anticipated travel demand but does not address timing or funding. The CTP is a multi-modal plan, listing proposed improvements to the roadway system, transit and rail network, and bicycle and pedestrian facilities. Both the CTP and the LRTP include the widening of NC 109 through the project area. The CTP includes a recommended high speed rail corridor just east of US 52 and recommends bicycle improvements along NC 109, Friendship-Ledford Road, Old Lexington Road, Gumtree Road, Union Cross Road, Teague Road, Barnes Road, and South Main Street in the project area. No bicycle, pedestrian, or transit improvements in the project area are included in the LRTP.

3.2.2.3 Davidson County Thoroughfare Plan

Davidson County adopted a *Thoroughfare Plan* in 1984, but this document has not been updated since then. Davidson County does not have its own MPO; all portions of the study area within Davidson County fall either within the HPMPO area or the Winston-Salem MPO area.

3.3 PHYSICAL ENVIRONMENT CHARACTERISTICS

3.3.1 Noise Characteristics

A preliminary Traffic Noise Analysis was prepared for this project (NCDOT 2008b) and is summarized in the following subsections.

The noise impacts for the proposed improvements have been assessed in accordance with FHWA guidelines published in 23 Code of Federal Regulations, Part 772. In order to determine the degree of impact of Highway traffic noise on human activity, the Noise Abatement Criteria (NAC) established by Part 772 were used. The NAC, listed in Table 3-11 for various activities, represent the upper limit of acceptable traffic noise conditions, as well as a measure of that which may be desirable with that which may be achievable. The NAC apply to areas having regular human use and where lowered noise levels are desired. They do not apply to the entire tract of land on which the activity is based, but only to that portion where the activity takes place.

TABLE 3-11: FHWA NOISE ABATEMENT CRITERIA

Activity Category	Leq (h) dB(A)	Description of Activity
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreational areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed land, properties or activities not included in Categories A or B above.
D	----	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels or dB(A). The A-weighted sound level is a single number measure of sound intensity with weighted frequency characteristics that correspond to human subjective response to noise. However, since most environmental noise fluctuates from moment to moment, it is common practice to condense all of this information into a single number called the equivalent sound level (Leq). The Leq is the value of a steady sound level that would represent the same sound energy as the actual time-varying sound levels evaluated over the same period. For highway traffic noise assessment, Leq is typically evaluated over a one-hour period, and is denoted as Leq(h). Traffic noise impacts occur when predicted traffic noise levels either: (1) approach or exceed the NAC or (2) create a substantial increase over existing noise levels. The NCDOT definition of "substantial increase" is shown in Table 3-12.

TABLE 3-12: CRITERIA FOR SUBSTANTIAL INCREASE IN NOISE

HOURLY A-WEIGHTED SOUND LEVELS – DECIBELS (dBA)	
Existing Noise Level in Leq(h)	**Increase in dBA from Existing Noise Levels to Future Noise Levels**
50 or less dBA	15 or more dBA
51 dBA	14 or more dBA
52 dBA	13 or more dBA
53 dBA	12 or more dBA
54 dBA	11 or more dBA
55 or more dBA	10 or more dBA

Source: North Carolina Department of Transportation Noise Abatement Policy

3.3.2 Air Quality

An Air Quality Analysis was prepared for the project in 2009 (Lochner 2009b) and describes existing air quality conditions in the project area. The air quality analysis was performed in accordance with the Federal-Aid Policy Guide.

The principal air pollutants of automotive emissions are Carbon Monoxide (CO), Hydrocarbons (HC), and Nitrogen Oxides. Other pollutants, such as sulfur dioxide and particulates, are produced to a lesser degree. A wide range of photochemical oxidants (ozone) also result through a complex series of light-induced reactions between emitted hydrocarbons and nitrous oxides. Automobiles are not regarded as significant source of particulate matter and sulfur dioxide. Nationwide, highway sources account for less then seven percent of particulate matter emissions and less than two percent of sulfur dioxide emissions.

All areas within North Carolina are designated as either attainment, non-attainment, or unclassifiable with respect to each of the six pollutants under the National Ambient Air Quality Standards (NAAQS). Areas that have pollutant concentrations below the NAAQS are designated as attainment. Areas where the NAAQS are exceeded are designated non-attainment. The project is located in the Greensboro-Winston-Salem-High Point nonattainment area for fine particles PM 2.5 as defined by the EPA. The area is in attainment with the NAAQS for the other criteria

pollutants. A qualitative PM 2.5 hotspot analysis was found not to be required for this project; the Clean Air Act and 40 CFR 93.116 requirements were met without a hotspot analysis since the project was found not to be of air quality concern under 40 CFR 93.123(b)(1). This project meets the statutory transportation conformity requirements without a hotspot analysis. FHWA concurred with this decision on June 16, 2006.

Highway vehicles are considered to be the major source of CO in the project area. For this reason, and because CO is a relatively non-reactive pollutant, CO was used in the analysis as an indicator of the air pollutants produced by traffic activities on the proposed roadway. CO 1-hour and 8-hour concentration of 2.7 parts per million (ppm) and 2.0 ppm, respectively, were used for background concentration in the analysis. These values were reported as average ambient background concentrations in the Forsyth County area by the Environmental Protection Agency (EPA) for 2007.

3.3.3 Farmlands

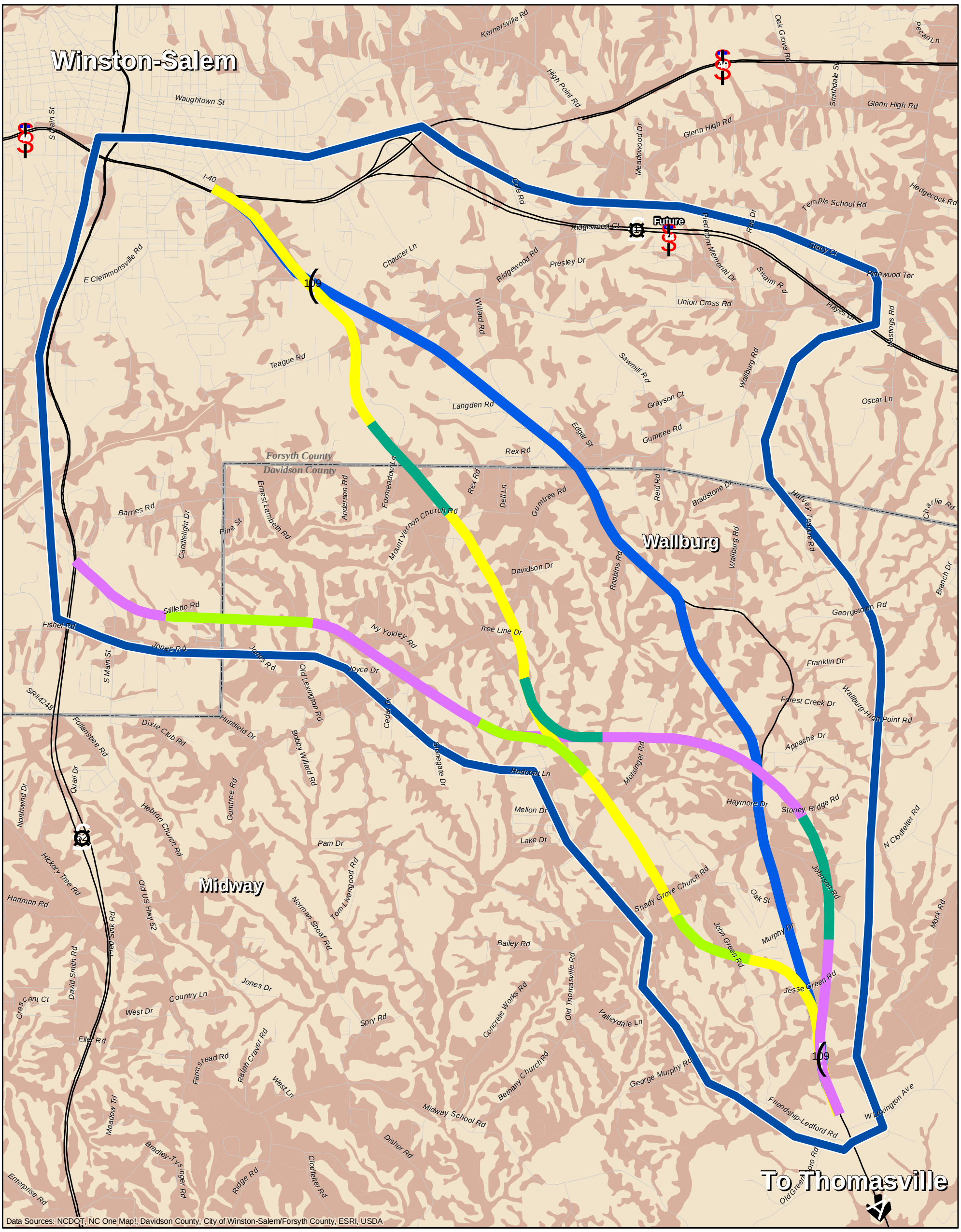
The Farmland Protection Policy Act of 1981 (7 CFR 658) requires all federal agencies to consider the impact of their activities on prime, unique, statewide and locally important farmland soils, as defined by the US Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) (Public Law 97-98, Subtitle 1, Section 1540). The NRCS, in cooperation with the state and local agencies, developed a listing of Prime and Statewide Important Farmland of North Carolina.

Prime Farmland is defined as soils best suited for producing food, feed, fiber, forage, and oil seed crops. These soils are favorable for all major crops common to the county, have a favorable growing season, and receive the available moisture needed to produce high yields on an average of eight out of every ten years. Land already in or committed to urban development or water storage is not included.

Unique Farmland is used for production of specific high-value food or fiber crops. It has the special combinations of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed.

State and Locally Important is defined by the appropriate state or local government agency as soils important in the agriculture of an individual county. These definitions are based on measures of the soil's capacity to support productive farm activity, not of current cultivation.

Soils in the study area considered to be prime or of statewide importance are listed in Table 3-13 and mapped in Figure 3-6 (USDA, 1994, 1976). There are no soils designated Unique Farmland in Davidson or Forsyth Counties.



Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary
- Prime Farmland Soils

0 0.5 1 2 Miles

North Carolina
Department of Transportation

NC 109 Improvements Project
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Figure 3-6 **Prime Farmland Soils**

TABLE 3-13: PRIME FARMLAND SOILS IN DAVIDSON AND FORSYTH COUNTIES

Map Symbol	Map Unit Name	Farmland Classification
AaA	Altavista fine sandy loam, 0 to 2 percent slopes	All areas are prime farmland
AlB	Altavista sandy loam, 1 to 6 percent slopes	All areas are prime farmland
ApB*	Appling sandy loam, 2 to 8 percent slopes	All areas are prime farmland
CcB*	Cecil sandy loam, 2 to 6 percent slopes	All areas are prime farmland
CcC*	Cecil sandy loam, 6 to10 percent slopes	All areas are prime farmland
CeB2*	Cecil clay loam, 2 to 8 percent slopes	All areas are prime farmland
Ch*	Chewacla loam	Prime farmland if drained
Co*	Congaree loam	All areas are prime farmland
DaB	Davidson loam, 2 to 8 percent slopes	All areas are prime farmland
EnB*	Enon fine sandy loam, 2 to 8 percent slopes	All areas are prime farmland
GeB	Georgeville silt loam, 2 to 8 percent slopes	All areas are prime farmland
HeB	Herndon silt loam, 2 to 8 percent slopes	All areas are prime farmland
HIB	Hiwasee loam, 2 to 6 percent slopes	All areas are prime farmland
KyB	Kirksey silt loam, 2 to 6 percent slopes	All areas are prime farmland
MaB	Madison fine sandy loam, 2 to 6 percent slopes	All areas are prime farmland
MeB*	Mecklenburg loam, 2 to 8 percent slopes	All areas are prime farmland
MeB2	Mecklenburg clay loam, 2 to 8 percent slopes	All areas are prime farmland
Ok	Oakboro silt loam	Prime farmland if drained
PaB*	Pacolet fine sandy loam, 2 to 8 percent slopes	All areas are prime farmland
PcB2*	Pacolet clay loam, 2 to 6 percent slopes	All areas are prime farmland
SfB*	Sedgefield sandy loam, 2 to 8 percent slopes	All areas are prime farmland
VaB*	Vance sandy loam, 2 to 8 percent slopes	All areas are prime farmland
WeB*	Wedowee sandy loam, 2 to 8 percent slopes	All areas are prime farmland
WkB*	Wickham fine sandy loam, 2 to 8 percent slopes	All areas are prime farmland

* Soil type found within the project area

3.3.4 Utilities

There are various utility systems operated throughout the project area, including electrical, water, sewer, and gas services.

3.3.4.1 Electric Power Transmission

Most of the project area is served with electric power by Duke Power, while some portions are served by Energy United, a smaller energy cooperative.

3.3.4.2 Water and Sewer

The Winston-Salem – Forsyth County Utilities Division provides water and sewer service to all individuals living within the Winston-Salem city limits and to most of the individuals residing in unincorporated areas south of the city. Individuals living in the southeastern part of Forsyth County (northeastern corner of the project area) are served by individual and community wells and septic systems. With the exception of the Meadowlands subdivision near Wallburg, which is served by Winston-Salem – Forsyth water and sewer, the portion of the study area in Davidson County is served by individual and community wells and septic systems.

3.3.4.3 Natural Gas

Piedmont Natural Gas provides natural gas service throughout the project area.

3.3.5 Visual Quality

The study area is rural with sporadic development consisting mainly of residential properties and farm complexes. Some commercial properties exist along the project area, consisting of a few small businesses.

The introduction of any large facility in an area alters the local perception of the visual environment. A location may be deemed visually sensitive for its visual quality, uniqueness, cultural importance, and viewer characteristics. According to Federal Highway Administration Guidelines, high visual quality is obtained when area landscape components have impressive characteristics that convey visual excellence. Striking landscapes are not limited to the natural environment and can be associated with urban areas as well. Visual quality is subjective in that it is also determined by a viewer's perception of an area.

A field review was conducted in order to investigate the area for its overall visual quality. The review did not yield any significant findings of special or unique natural areas, officially designated recreation areas, or officially designated scenic overlooks within the immediate project area. The farmlands and rolling terrain are characteristic of much of the North Carolina Piedmont. Several private historic properties do exist within the project area. These properties were investigated further for their visual sensitivity (see Section 4.3.5).

3.3.6 Hazardous Materials

In April 2009, NCDOT conducted a study to identify properties within the project study area that are or may be contaminated. Such properties may include, but are not limited to: active and abandoned underground storage tank (UST) sites, hazardous waste sites, regulated landfills, and unregulated dumpsites. Based on the study no hazardous waste sites or landfills were identified within the project corridor limits.

Twenty-seven possible UST facilities and eight other geoenvironmental concerns, including three automotive repair sites, three automotive salvage yards, one dry cleaner and one industrial site, were identified within the proposed project corridor. These sites are described in Table 3-14 and shown on Figure 3-7.

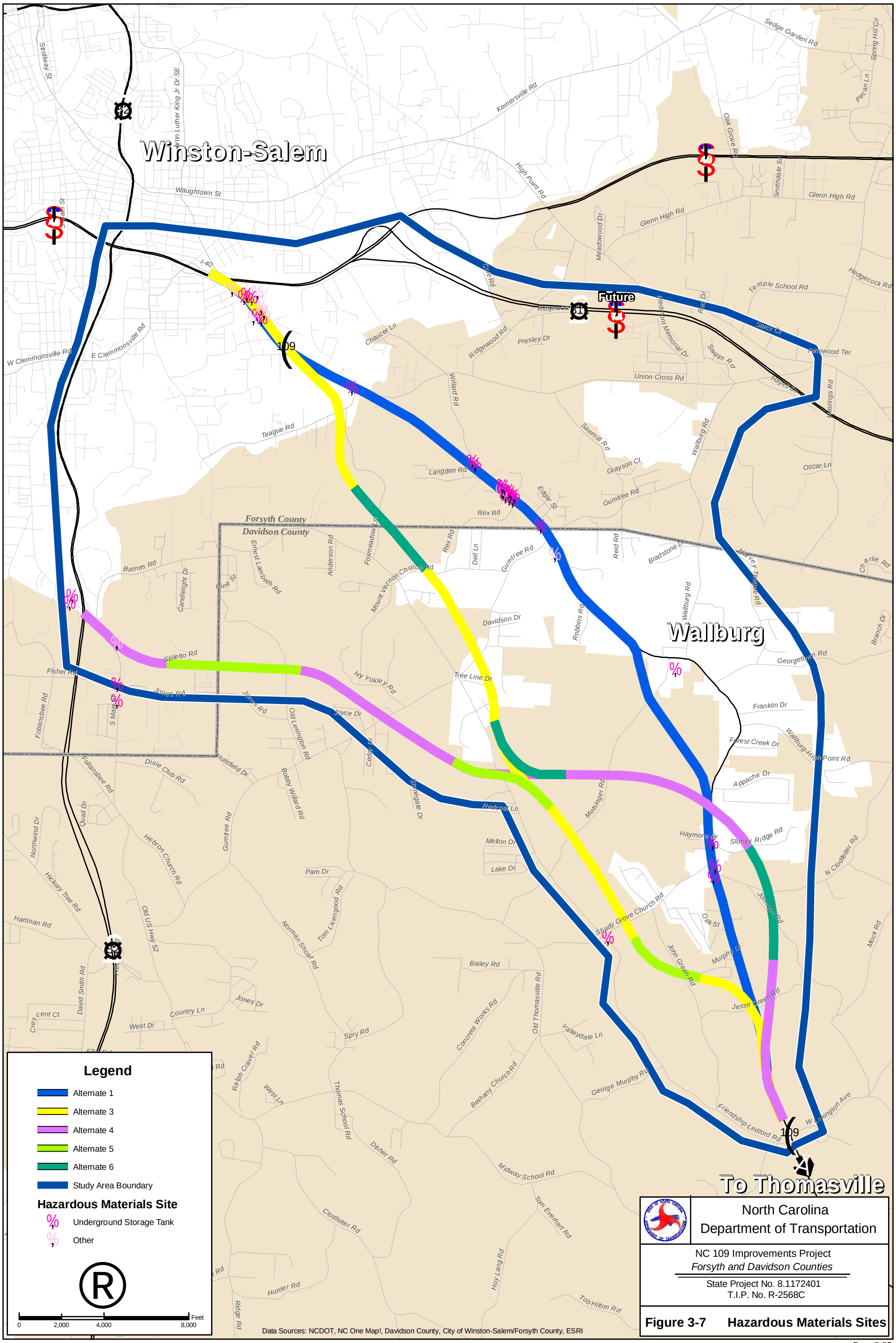
Winston-Salem
Wallburg
To Thomasville
Future
Forsyth County
Davidson County
I-40
109
52
Waughtown St
Strollway St
Martin Luther King Jr Dr SE
Kernersville Rd
Sedge Garden Rd
Spring Hill Cir
Pecan Ln
Oak Grove Rd
Smithdale St
Glenn High Rd
High Point Rd
Meadowood Dr
Hedgecock Rd
Temple School Rd
Cole Rd
Ridgewood Dr
Rae Dr
Piedmont Memorial Dr
Stacy Ct
Pinewood Ter
Swaim Rd
Hayes St
Hastings Rd
Union Cross Rd
Presley Dr
Ridgewood Rd
Chaucer Ln
Willard Rd
W Clemmonsville Rd
E Clemmonsville Rd
Teague Rd
Sawmill Rd
Wallburg Rd
Grayson Ct
Oscar Ln
Gumtree Rd
Edgar St
Rex Rd
Langden Rd
Barnes Rd
Candlelight Dr
Pine St
Ernest Lambeth Rd
Anderson Rd
Foxmeadow Ln
Mount Vernon Church Rd
Dell Ln
Reid Rd
Bradstone Dr
Harvey Teague Rd
Charlie Rd
Robbins Rd
Davidson Dr
Branch Dr
Georgetown Rd
Tree Line Dr
Ivy Yokley Rd
Stilletto Rd
Fishel Rd
Jones Rd
S Main St
Follansbee Rd
Old Lexington Rd
Joyce Dr
Cedar Dr
Dixie Club Rd
Huntfield Dr
Bobby Willard Rd
Springate Dr
Redcoat Ln
Motsinger Rd
Franklin Dr
Forest Creek Dr
Wallburg-High Point Rd
Appache Dr
Haymore Dr
Stoney Ridge Rd
N Clodfelter Rd
Mellon Dr
Lake Dr
Pam Dr
Quail Dr
Northwind Dr
Hebron Church Rd
Gumtree Rd
Hickory Tree Rd
Hartman Rd
Old US Hwy 52
Norman Shoaf Rd
Tom Livengood Rd
David Smith Rd
Country Ln
West Dr
Jones Dr
Spry Rd
Bailey Rd
Concrete Works Rd
Old Thomasville Rd
Valleydale Ln
Bethany Church Rd
George Murphy Rd
Friendship-Ledford Rd
W Lexington Ave
Shady Grove Church Rd
John Green Rd
Jesse Green Rd
Murphy Dr
Oak St
Johnson Rd
Mock Rd
Ralph Craver Rd
West Ln
Thomas School Rd
Disher Rd
Midway School Rd
Tom Everhart Rd
Clodfelter Rd
Hoy Lang Rd
Hunter Rd
Tob Hilton Rd
Ridge Rd
Legend
Alternate 1
Alternate 3
Alternate 4
Alternate 5
Alternate 6
Study Area Boundary
Hazardous Materials Site
Underground Storage Tank
Other
0
2,000
4,000
8,000
Feet
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 3-7 Hazardous Materials Sites

TABLE 3-14: POTENTIAL HAZARDOUS MATERIALS SITES				
Site #	Type	UST Facility ID	Anticipated Contamination	Anticipated Severity
1	UST	None	Petroleum contaminated soils and water	Low
2	UST	0-012072	Petroleum contaminated soils and water	Low
3	UST	None	Petroleum contaminated soils and water	Low
4	UST	None	Petroleum contaminated soils and water	Low
5	UST	0-032254	Petroleum contaminated soils and water	Low
6	UST	None	Petroleum contaminated soils and water	Low
7	UST	None	Petroleum contaminated soils and water	Low
8	Auto Salvage	None	Petroleum contaminated soils and water	Low
9	UST	0-031754	Petroleum contaminated soils and water	Low
10	UST	None	Petroleum contaminated soils and water	Low
11	Dry Cleaner	None	Contaminated soils and water	Low
12	UST	0-036650	Petroleum contaminated soils and water	Low
13	UST	0-015971	Petroleum contaminated soils and water	Low
14	UST	None	Petroleum contaminated soils and water	Low
15	UST	None	Petroleum contaminated soils and water	Low
16	UST	0-012934	Petroleum contaminated soils and water	Low
17	UST	None	Petroleum contaminated soils and water	Low
18	UST	None	Petroleum contaminated soils and water	Low
19	Auto Repair	None	Petroleum contaminated soils and water	Low
20	UST	0-016908	Petroleum contaminated soils and water	Low
21	UST	None	Petroleum contaminated soils and water	Low
22	UST	None	Petroleum contaminated soils and water	Low
23	UST	None	Petroleum contaminated soils and water	Low
24	UST	None	Petroleum contaminated soils and water	Low
25	UST	0-016024	Petroleum contaminated soils and water	Low
26	UST	None	Petroleum contaminated soils and water	Low
27	UST	0-016554	Petroleum contaminated soils and water	Low
28	Auto Repair	None	Petroleum contaminated soils and water	Low
29	Auto Salvage	None	Petroleum contaminated soils and water	Low
30	Auto Salvage	None	Petroleum contaminated soils and water	Low
31	Industrial	None	Contaminated soils and water	Low
32	UST	0-021235	Petroleum contaminated soils and water	Low
33	UST	0-016015	Petroleum contaminated soils and water	Low
34	UST	0-021657	Petroleum contaminated soils and water	Low
35	Auto Repair	None	Petroleum contaminated soils and water	Low

3.3.7 Mineral Resources

There are no mining operations or quarries within the project study area, although several quarries are located nearby. As such, none of the project alternatives would directly impact the production of mineral resources. Construction of the project may temporarily increase the demand for locally crushed stone and sand. However, such an increase in demand would not adversely impact mineral resources.

3.3.8 Floodplains/Floodways

Riverine floodplains are low-lying areas adjacent to stream channels that are prone to periodic flooding during heavy or prolonged rains. The 100-year floodplain is the area that has a one percent chance of flooding during any given year. The floodway is the channel area that needs to be kept free of encroachment so the 100-year flood can be carried without increasing the level and extent of flood elevations. Streams for which detailed hydrological studies have not been conducted do not have defined floodways, so only the 100-year floodplain boundaries are estimated and mapped. There are no FEMA buyout properties in the study area.

A floodplain evaluation was conducted in accordance with Executive Order 11988 "Floodplain Management" and with 23 CFR 650 Subpart A "Location and Hydraulic Design of Encroachments on Floodplains." This evaluation is based on the results of the Federal Emergency Management Agency's (FEMA) detailed flood insurance studies and FEMA's Federal Insurance Rate Mapping (FIRM) for the incorporated and unincorporated areas of Davidson and Forsyth Counties. FEMA completed detailed flood insurance studies for Davidson on March 16, 2009 and for Forsyth on January 2, 2009. Figure 3-8 shows the floodplains and floodways in the project study area. Named streams with defined floodplains in the project study area include Fiddlers Creek, South Fork Muddy Creek, Soakas Creek, Long Branch, Brushy Fork, Abbotts Creek and Spurgeon Creek.

3.3.9 Protected Lands

There are no federal or state protected lands within the study area. There are also no waters within the study are that are considered by the National Park Service to be Wild and Scenic Rivers (USDA-USFS 2009).

3.4 CULTURAL RESOURCES

This project is subject to compliance with Section 106 of the National Historic Preservation Act of 1996, as amended, and implemented by the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106, codified at 36 CFR Part 800. Section 106 requires Federal agencies to take into account the effect of their undertakings (federally-funded, licensed, or permitted) on properties included in or eligible for inclusion in the National Register of Historic Places and to afford the Advisory Council a reasonable opportunity to comment on such undertakings. The project is also subject to compliance with Section 4(f) of the United States Department of Transportation Act of 1966, as amended, codified at 49 U.S.C. Section 303. Section 4(f) states that FHWA and other DOT agencies cannot approve the use of land from a significant publicly owned public park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless there is no feasible and prudent alternative to the use of land and the action includes all possible planning to minimize harm to the property resulting from use.

The following sections summarize the cultural resources identified within the project study area.

Winston-Salem

Future

Wallburg

To Thomasville

Forsyth County
Davidson County

Tar Branch
Fiddlers Creek
Swaim Creek
Sawmill Branch
South Fork Muddy Creek
Soakas Creek
Leak Creek
Hartman Branch
Miller Creek
Little Brushy Fork
Brushy Fork
Buck Branch
Long Branch
Mary Reich Creek
Reedy Run
Sprugeon Creek
Abbotts Creek
Cool Branch
Oil Mill Branch

Martin Luther King Jr Dr SE
Waughtown St
Kernersville Rd
Sedge Garden Rd
Spring Hill Cir
Pecan Ln
Oak Grove Rd
Smithdale St
Glenn High Rd
High Point Rd
Meadowood Dr
Hedgecock Rd
Temple School Rd
Ridgewood Dr
Piedmont Memorial Dr
Rae Dr
Stacy Ct
Pinewood Ter
Ridgewood Rd
Presley Dr
Swaim Rd
Union Cross Rd
Hayes Dr
Hastings Rd
Willard Rd
Sawmill Rd
Wallburg Rd
Grayson Ct
Oscar Ln
Langden Rd
Gumtree Rd
Edgar St
Rex Rd
Dell Ln
Reid Rd
Bradstone Dr
Harvey Teague Rd
Charlie Rd
Barnes Rd
Regalwood Dr
Pine St
Ernest Lambeth Rd
Anderson Rd
Foxmeadow Ln
Mount Vernon Church Rd
Davidson Dr
Branch Dr
Georgetown Rd
Stilletto Rd
Fishel Rd
Ivy Yokley Rd
Tree Line Dr
Franklin Dr
Follansbee Rd
S Main St
Jones Rd
Joyce Dr
Old Lexington Rd
Forest Creek Dr
Wallburg-High Point Rd
Dixie Club Rd
Huntfield Dr
Cedar Dr
Appache Dr
Bobby Willard Rd
Stonegate Dr
Redcoat Ln
Motsinger Rd
Haymore Dr
Stoney Ridge Rd
Northwind Dr
Hebron Church Rd
Gumtree Rd
Mellon Dr
Lake Dr
Pam Dr
Hickory Tree Rd
Old US Hwy 52
Norman Shoaf Rd
Bailey Rd
Shady Grove Church Rd
Clearview Dr
John Green Rd
Murphy Dr
Johnson Rd
Jesse Green Rd
Mock Rd
NC Clodfelter Rd
David Smith Rd
Country Ln
West Dr
Jones Dr
Eller Rd
Spry Rd
Concrete Works Rd
Old Thomasville Rd
Valleydale Ln
Ralph Craver Rd
West Ln
Thomas School Rd
Bethany Church Rd
George Murphy Rd
Friendship-Ledford Rd
W Lexington Ave
Disher Rd
Clodfelter Rd
Tom Everhart Rd
Hoy Lang Rd
Hunter Rd
Tob Hilton Rd
Ridge Rd
W Clemmonsville Rd
E Clemmonsville Rd
Teague Rd
I-40
52
109

Legend

- Alternate 1
- Alternate 3
- Alternate 4
- Alternate 5
- Alternate 6
- Study Area Boundary
- National Wetland Inventory Area
- 100-Year Floodzone Area
- Water Supply Watershed Area

0 2,000 4,000 8,000 Feet

Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI, USDA, USFWS

North Carolina
Department of Transportation

NC 109 Improvements Project
Forsyth and Davidson Counties

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Figure 3-8 **Water Resources**

3.4.1 Historic Architectural Resources

Field surveys of the Historic Architectural Area of Potential Effects (APE) were conducted by NCDOT architectural historians in 1995, 1996, 2004 and 2005. The surveys in 1995 and 1996 addressed R-2568 as a whole while the 2004 and 2005 surveys focused on the APE for R-2568C. For each survey of the project, all structures over fifty years of age within the APE were photographed and evaluated for National Register of Historic Places (NRHP) eligibility. In August 1995 HPO concurred with NCDOT that the D. Austin Parker House and the Mark Parker House were each eligible for the NRHP under Criterion C for architecture. The following year, in November 1996, the HPO agreed with NCDOT that the John William Hiatt Farm was eligible for the NRHP under Criterion C for architecture.

Eight years later surveys for historic structures were redone for R-2568C. In August 2005, NCDOT architectural historians confirmed the eligibility determinations for the D. Austin Parker House, the Mark Parker House, and the Hiatt Farm. In addition, NCDOT recommended that the Yokeley Farm was eligible under Criteria A and C for agriculture and architecture. HPO concurred with the report in September 2005, but raised questions about three additional properties: the Friedland Lower Tier Rural Historic District, George W. Wall House, and Dempsey B. Clinard House. NCDOT responded to HPO inquiries, stating that and the Clinard House and Yokeley Farm were outside the APE for the project, and that none of the proposed alternatives would encroach upon the Friedland area. HPO concurred with these assessments in December 2009. Therefore there are three eligible properties within the architectural APE for the project: D. Austin Parker House, Mark Parker House and the George W. Wall House. A copy of the concurrence form between NCDOT, HPO and FHWA regarding the effects of the proposed project on the eligible properties in the architectural APE is in Appendix A.2. The locations of the historic properties in the project area are depicted on Figure 3-9.

3.4.2 Archaeological Resources

Overview studies of archaeological resources in the project area were conducted in 1993 and 1995 (NCDOT 1993, 1995). The study utilized previously-collected archaeological data from the project area and surrounding region to identify the types of archaeological resources that might be located in the highway project area. The potential effect of the project on significant archaeological resources was also considered.

The project's Archaeological APE consists mainly of the three separate 1,000-foot wide corridors and the 1,000-foot wide shared corridor, as well as additional area at proposed interchange locations. At the time of the study, the NC Office of State Archaeology had records of eleven archaeological sites within or near the study area (see Table 3-15). Nine of the sites have prehistoric components and five have historic era components.

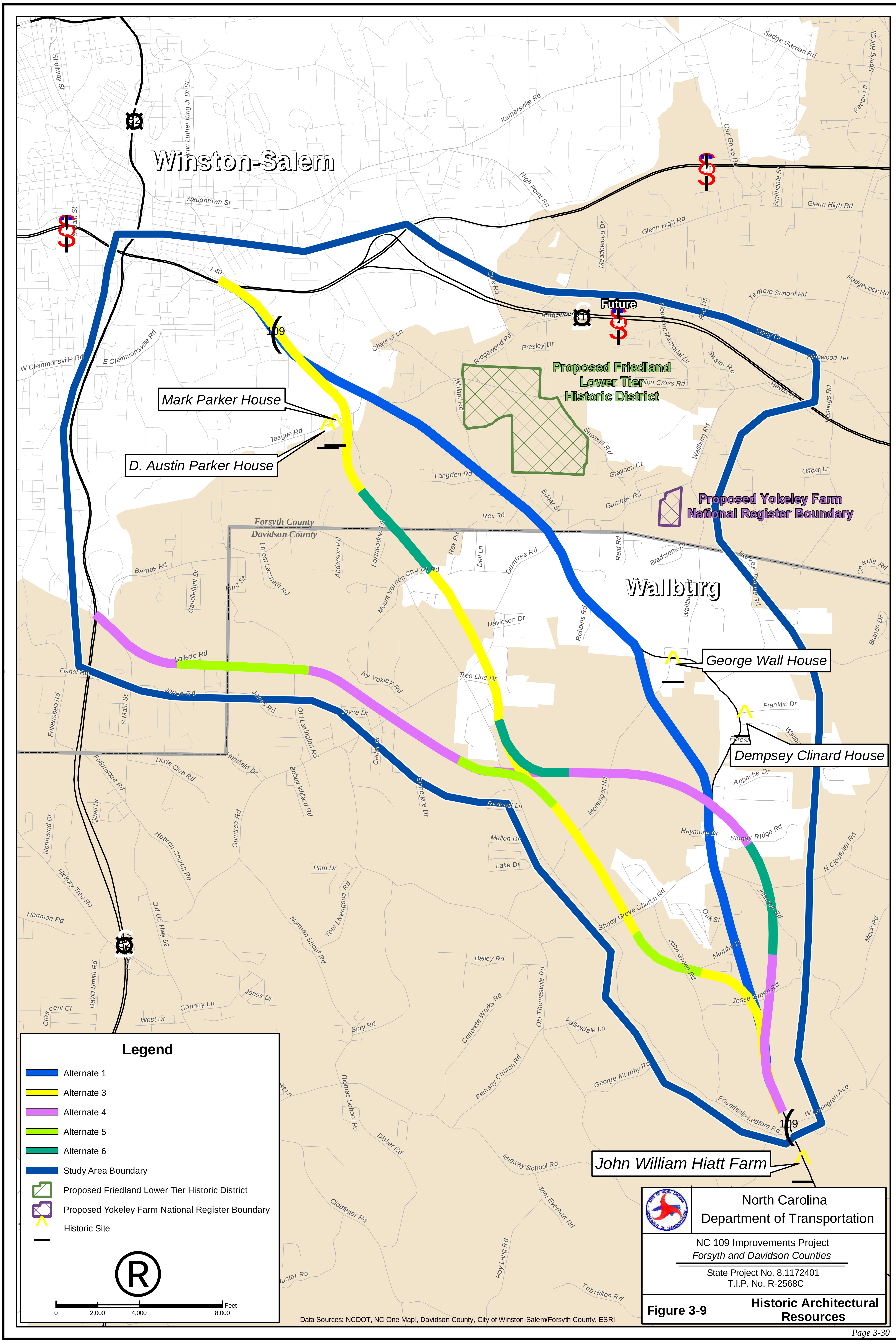


Figure 3-9 Historic Architectural Resources

Archaeological studies in Davidson and Forsyth Counties and the surrounding region indicate a fairly intensive occupation of the region throughout the prehistoric and historic past. Even though few archaeological sites are presently recorded in the study area, this can be attributed to a lack of archaeological survey rather than a lack of archaeological sites. It is likely the study area contains a number of archaeological sites, and a few of the sites could be significant enough to warrant intensive documentation under Section 106 of the National Historic Preservation Act of 1966, as amended. The Department of Cultural Resources found that the alternatives have roughly the same potential for containing archaeological resources. Therefore, the HPO agreed to postpone the archaeological survey until the final corridor is selected (see HPO letter in Appendix A.2).

TABLE 3-15: PREVIOUSLY IDENTIFIED ARCHAEOLOGICAL SITES LOCATED WITHIN OR NEAR THE PROJECT STUDY AREA

Site Number	Type of Site
31PT79	Prehistoric and historic
31PT82	Prehistoric
31PT85	Prehistoric
31PT86	Prehistoric
31PT87	Prehistoric
31PT88	Prehistoric
31PT266	Historic
31PT272	Prehistoric
31PT287	Prehistoric and historic
31PT288	Historic
31PT289	Prehistoric and historic

3.4.3 Section 4(f) and 6(f) Resources

Within the project area there are no public parks, recreation areas, or wildlife refuges affected by the proposed project. As described above, it is likely the study area contains archaeological sites, but a complete archaeological survey will be conducted once a Preferred Alternative is selected.

As described above, there are several historic architectural resources within the project area. Three of these resources, the George W. Wall House (NRHP listed) and the D. Austin Parker House and Mark Parker House (NRHP eligible) are within the Area of Potential Effect (APE) for the project. These three historic resources would be subject to the requirements of Section 4(f) of the Department of Transportation Act of 1966, as amended (49 USC 303).

Section 6(f) of the Land and Water Conservation Fund Act (LWCFA) addresses impacts to lands developed in public ownership using LWCFA funding. There are no Section 6(f) resources in the project area.

3.5 NATURAL ENVIRONMENT CHARACTERISTICS

3.5.1 Soils, Topography, and Geology

3.5.1.1 Soils

Soil development is dependent upon biotic and abiotic factors which include past geologic activities, nature of the parent material, environmental and human influences, plant and animal activity, the age of sediments, climate, and topographic position. General soil associations incorporate areas with distinctive patterns of soils, relief, and drainage.

The study area is located within the Chewacla-Congaree, Cecil-Pacolet, and Poindexter-Enon-Zion (Davidson County), and the Chewacla-Wehadkee-Congaree, Pacolet-Cecil (Forsyth County) soil association (USDA 1994, 1976). Soil associations contain one or more mapping units occupying a unique natural landscape. Mapping units are named for the major soil series within the unit, but may contain minor inclusions of other soil series.

The Chewacla-Congaree soil associate is characterized by nearly level, very deep, somewhat poorly to well-drained soils that have a loamy surface layer and subsoil; formed in recent alluvium on flood plains. The Cecil-Pacolet soil association is characterized by gently sloping to moderately steep, very deep, well-drained soils that have a loamy surface layer and a clayey subsoil. The Poindexter-Enon-Zion soils are characterized by gently sloping to steep, moderately deep and very deep, well-drained soils that have a loamy surface layer and a loamy or clayey subsoil (USDA 1994).

In Forsyth County the Chewacla-Wehadkee-Congaree soil association contains somewhat poorly drained and poorly drained, grayish and brownish, loamy soils that have a dominantly grayish subsoil. This association is found on flood plains subject to overflow. The Pacolet-Cecil soil association is characterized on uplands by broad smooth ridgetops, long side slopes, and long narrow drainage ways, with well-drained brownish, loamy soils which have a reddish clayey subsoil (USDA 1976).

As shown in Table 3-16, the proposed project study area contains 23 soil series in 37 soil mapping units (USDA 1994, 1976). Of these soil mapping units, four are classified as hydric.

TABLE 3-16: SUMMARY OF NATURAL RESOURCE CONSERVATION SERVICE (NRCS) MAPPED SOILS FOUND WITHIN THE STUDY AREA

Map Code	Soil Series Name	Taxonomic Classification	Hydric Soil
AaA	Altavista fine sandy loam, 0 to 2 percent slopes	Fine-loamy, mixed, semiactive, thermic Aquic Hapludults	Yes
AlB	Altavista sandy loam, 1 to 6 percent slopes	Fine-loamy, mixed, semiactive, thermic Aquic Hapludults	Yes
ApB	Appling sandy loam 6 to 10 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
CcB	Cecil sandy loam 2 to 8 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
CcC	Cecil sandy loam, 6 to 10 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	
CcD	Cecil sandy loam 8 to 15 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
CeB2	Cecil clay loam 2 to 8 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
Ch	Chewacla loam	Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts	Yes
Co	Congaree complex	Fine-loamy, mixed, nonacid, thermic Typic Udifluvents	Yes
DaB	Davidson loam, 2 to 8 percent slopes	Clayey, kaolinitc, thermic Rhodic Kandiudults	No
EnB	Enon fine sandy loam, 2 to 8 percent slopes	Fine, mixed, active, thermic Ultic Hapludalfs	No
GeB	Georgeville silt loam, 2 to 8 percent slopes	Fine, kaolinitc, thermic Typic Kanhapludults	No
HeB	Herndon silt loam, 2 to 8 percent slopes	Clayey, kaolinitic, thermic Typic Hapludalfs	No
HIB	Hiwasee silt loam, 2 to 6 percent slopes	Fine, kaolinitic, thermic Rhodic Kanhapludults	No
MeB	Mecklenburg loam, 2 to 8 percent slopes	Fine, mixed, active, thermic Ultic Hapludalfs	No
Ok	Oakboro silt loam	Fine-loamy, mixed, thermic Fluvaquentic Dystrochrepts	Yes
PaB	Pacolet sandy loam, 2 to 8 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
PaC	Pacolet sandy loam, 6 to 10 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
PaD	Pacolet sandy loam, 8 to 15 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
PaE	Pacolet sandy loam, 15 to 25 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
PcB2	Pacolet clay loam, 2 to 6 percent slopes	Clayey, kaolinitic, thermic Typic Kanhapludults	No
PcC2	Pacolet clay loam, 6 to 10 percent slopes	Clayey, kaolinitic, thermic Typic Kanhapludults	No
PcD2	Pacolet clay loam, 10 to 15 percent slopes	Clayey, kaolinitic, thermic Typic Kanhapludults	No
PnB	Poindexter and Zion sandy loams, 2 to 8 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
PnD	Poindexter and Zion sandy loams, 8 to 15 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
PnE	Poindexter and Zion sandy loams, 15 to 25 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No

TABLE 3-16 CONTINUTED			
PnB	Poindexter and Zion sandy loams, 2 to 8 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
PnD	Poindexter and Zion sandy loams, 8 to 15 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
PnE	Poindexter and Zion sandy loams, 15 to 25 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
PnF	Poindexter and Zion sandy loams, 25 to 45 percent slopes	Fine-loamy, mixed, active, thermic Typic Hapludalfs; Fine, mixed, active, mesic Ultic Hapludalfs	No
SfB	Sedgefield sandy loam, 2 to 8 percent slopes	Fine, mixed, active, thermic Aquultic Hapludalfs	No
VaB	Vance sandy loam, 2 to 8 percent slopes	Clayey, mixed, thermic Typic Hapludults	No
VaD	Vance sandy loam, 8 to 15 percent slopes	Clayey, mixed, thermic Typic Hapludults	No
WeB	Wedowee sandy loam, 2 to 8 percent	Fine, kaolinitic, thermic Typic Kanhapludults	No
WeC	Wedowee sandy loam, 6 to 10 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
WeD	Wedowee sandy loam, 8 to 15 percent slopes	Fine, kaolinitic, thermic Typic Kanhapludults	No
Wh	Wehadkee soils	Fine, kaolinitic, thermic Typic Kanhapludults	No
WkB	Wickham fine sandy loam, 2 to 8 percent slopes	Fine-loamy, mixed, thermic Typic Kapludults	No
WlC	Wilkes soils, 6 to 10 percent slopes	Loamy, mixed, thermic, shallow Typic Hapludalfs	No
WlF	Wilkes soils, 15 to 45 percent slopes	Loamy, mixed, thermic, shallow Typic Hapludalfs	No

3.5.1.2 Climate and Topography

The climate of the Winston-Salem area is influenced by elevation, distance from the Atlantic Ocean, and by latitude and location of the county. The lowest temperature ever recorded was -7 degrees and the highest on record was 107 degrees. The average high temperature in July is 89 degrees and the average low temperature in January is 30 degrees. The average length of the freeze-free growing period is approximately 200 days, lasting from early March through late October.

Thunderstorms account for a large part of the rainfall received during the growing season. During this time of year precipitation is highly variable from month to month, day to day, and place to place within the county. By autumn, rainfall amounts frequently increase overall. Tropical storms in late summer and fall sometimes contribute to this increase. Rainfall in winter is usually associated with large low-pressure systems moving over the Eastern seaboard. Snow and sleet usually occur annually, but amounts are typically small.

The sun shines, on average, more than half the total number of daylight hours in winter and nearly two-thirds of the total number of daylight hours in other seasons. The average relative humidity is approximately 85 percent, dropping to about 50 percent by midafternoon (USDA 1976).

The study area is located in the Piedmont physiographic province of central North Carolina. The topography in the project study area is generally characterized as gently rolling to hilly landscapes. Elevations in the study area range from 740 to 920 feet above mean sea level (USGS 1994). The lowest elevations are near Soakas Creek and US 52 at the western edge of the project area area and the highest elevations near Union Cross Road in the northeastern corner of the project area.

3.5.1.3 Geology

The northern part of the study area lies within the Milton Belt and the southern part lies within the Charlotte Belt, two major geologic belts located in the North Carolina Piedmont. The Charlotte Belt is the core of an ancient volcanic island archipelago. Ash blown out of volcanoes erupting during the collision blanketed much of the Charlotte Belt. The area is characterized by felsic (light-colored) and mafic (dark-colored) igneous rocks. Felsic rocks are more common in the study area. The felsic rocks, primarily granites, can be divided into two main types—rocks that have all minerals of about the same size and rocks that have large feldspar crystals surrounded by smaller grains. The Milton Belt is characterized by volcanic and sedimentary rocks and consists of gneiss, schist and metamorphosed intrusive rock. Metamorphosed intrusive rock is intermediate in hardness between the parent sedimentary rocks and slate and is classified as argillite. A variety of rocks and minerals are being mined or have been mined in Davidson and Forsyth Counties.

3.5.2 Biotic Communities and Wildlife

Terrestrial and aquatic communities are included in this description of biotic resources. Living systems described in the following sections include communities of associated plants and animals. These descriptions refer to the dominant flora and fauna in each community and the relationships of these biotic components. Descriptions of the terrestrial systems are presented in the context of plant community classifications. These classifications follow Schafale and Weakley (1990) where possible. Representative faunal species that are likely to occur in these habitats (based on published range distributions) are also cited. Scientific nomenclature and common names (when applicable) are used for the floral species described. Subsequent references to the same species are by the common name only.

3.5.2.1 Terrestrial Plant Communities

Distribution and composition of plant communities throughout the project study area reflect landscape-level variations in topography, soils, hydrology, and past and present land use practices. Agriculture, development, and forestry practices have resulted in the present vegetative

patterns. There is often some degree of overlap, or intergrade, between biotic communities, where characteristics of multiple community types are present. All community types have had some degree of past or continued human disturbance and do not reflect, in totality, the characteristics of "natural communities" described in Schafale and Weakley (1990). Six plant communities occur within the study area: Dry-Mesic Oak-Hickory Forest, Piedmont/Low Mountain Alluvial Forest, Pure Pine Community, Clearcut Community, Agricultural Community, and Disturbed-Maintained Community. Two of these communities (Dry-Mesic Oak-Hickory Forest and Piedmont/Low Mountain Alluvial Forest) can be classified as natural communities by Schafale and Weakley (1990). A description of each community type follows.

Dry-Mesic Oak-Hickory Forest

This forest type is found throughout the Piedmont and Coastal Plain and possibly ranges into some of the lower elevation areas of the Blue Ridge. Landscapes typically include mid-slopes, low ridges, upland flats and other dry-mesic upland areas, especially on acidic soils. Under natural conditions these forests are uneven-aged, with old trees present. Natural reproduction occurs primarily in canopy gaps. Rare severe natural disturbances, such as wind storms, open these canopy gaps, allowing pulses of increased regeneration of less shade-tolerant species. Shade-intolerant tulip poplar can reproduce in sufficient numbers within natural gaps to persist into the climax in Piedmont forests. Disturbed areas have increased amounts of pine and pioneer hardwood species including red maple (*Acer rubrum*) tulip poplar (*Liriodendron tulipifera*), and sweetgum (*Liquidambar styraciflua*). Dominance of these species will depend on the amount of disturbance. Areas that were cultivated are generally dominated by even-aged pine stands which are replaced by the climax oaks and hickories only as the pine ages out and dies from the stand. Logged areas may regenerate with a mixture of pine and hardwoods.

Within the study area, this plant community generally dominates the uplands. This forest can be found on side slopes, upland flats, and some lower slopes where natural vegetation remains. This forest type is dominated by oaks and hickories, with white oak (*Quercus alba*) being the most prevalent. Other dominant species include red oak (*Quercus rubra*), mockernut hickory (*Carya alba* [*tomentosa*]), Southern red oak (*Quercus falcata*), and pignut hickory (*Carya glabra*),. Occasionally American beech (*Fagus grandifolia*) may be common as well. Virginia pine (*Pinus virginiana*), tulip poplar (*Liriodendron tulipifera*), and sweetgum are also common in disturbed areas. Typical understory species include flowering dogwood (*Cornus florida*), red maple, sourwood (*Oxydendrum arboreum*), and American holly (*Ilex opaca*). Shrub species include dwarf pawpaw (*Asimina parviflora*), downy arrowwood (*Viburnum rafinesquianum*), sassafras (*Sassafrs albidum*), and American strawberry bush (*Euonymus americanus*). Muscadine grape (*Vitis rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*) are the vines present. Herbs are usually sparse and include heartleaf (*Hexastylis* sp.), Christmas fern (*Polystichum acrostichoides*), downy rattlesnake orchid (*Goodyera pubescens*), and pipsissewa (*Chimaphila maculata*).

Piedmont/Low Mountain Alluvial Forest

This forest type is found throughout the Piedmont and ranges into the lower Blue Ridge valleys. This plant community type occurs along river and stream floodplains in which separate alluvial landforms and associated vegetation zones are too small to distinguish. This community type typically has an open to dense understory or shrub layer and a sparse to dense diverse herb layer. The canopy can consist of a diverse mixture of bottomland and mesophytic species including river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), tulip poplar, sweetgum, American elm (*Ulmus americana*), sugarberry (*Celtis laevigata*), black walnut (*Juglans nigra*), green ash (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformis*). Understory species may include boxelder (*Acer negundo*), southern sugar maple (*Acer saccharum*), red maple, American holly (*Ilex opaca*), Chinese privet (*Ligustrum sinense*), and ironwood (*Carpinus caroliniana*). Shrubs may include spicebush (*Lindera benzoin*), and American strawberry-bush, among others. Vines that are frequently prominent include poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), wild grape (*Vitis* sp.), and greenbrier (*Smilax* sp.). The herb layer is as diverse as the other vegetation layers in this community. Common species include touch-me-not (*Impatiens capensis*), Japanese honeysuckle (*Lonicera japonica*), violets (*Viola* sp.), wingstem (*Verbesina alternifolia*), bamboo grass (*Microstegium vimineum*), and heart-leaved aster (*Aster divaricatus*).

Pine Community

Pine forests are present in many locations within the study area, including areas of planted pine and areas of naturally-occuring pine. The plantations are generally dominated by white pine (*Pinus strobus*) or Virginia pine and are generally greater than five years old. The stands of natural pine are typically dominated by Virginia pine, and are more than ten years in age. The pine creates a dense overstory, blocking sunlight and allowing a sparse or absent understory and herbaceous layer. Understory species may include red maple, tulip poplar, and sweetgum. Woody vines such as poison ivy and greenbrier may also be present.

Clearcut Community

The clearcuts within the project area were created in the recent past, and are generally covered by dense, scrubby vegetation. Young red maple, Virginia pine, and sweetgum are the most common woody species present. Vines such as greenbrier, blackberry (*Rubus* sp.), and poison ivy may also be prominent. The herbaceous layer is generally dense and may include broomsedge (*Andropogon virginicus*), goldenrods (*Solidago* sp.), asters (*Aster* spp.), Queen Anne's lace (*Daucus carota*), multiflora rose (*Rosa multiflora*) and other herbaceous species. Invasive species such as Japanese honeysuckle, Chinese privet, and kudzu (*Pueraria montana* var. *lobata*), are very common in these highly disturbed situations.

Agricultural Community

Agricultural fields are the third most abundant land use in the study area. Most of the fields are actively farmed for tobacco (*Nicotiana tabacum*), and soybeans (*Glycine max*), with few tracts left fallow. Livestock pastures are also common, with a cover of fescue (*Festuca* sp.) being the most common cover type. Species common to disturbed habitats, particularly cocklebur

(*Xanthium strumarium*), morning glory (*Ipomoea purpurea*), henbit (*Lamium amplexicaule*), and rabbit tobacco (*Gnaphalium obtusifolium*) frequently occur along field edges.

Disturbed-Maintained Community

This community includes three types of habitat that have been or are currently being impacted by human disturbance. These four habitat types are regularly maintained roadside shoulders, utility and railroad rights-of-way, and residential and commercial areas. For purposes of this report, the floras of these areas have been included together into a more simplified "disturbed/maintained community". The majority of these habitats are kept in a low-growing, early successional state. A comparable community type is not described by Schafale and Weakley (1990).

The regularly maintained roadside and railroad rights-of-way are mowed frequently and are dominated by herbaceous vegetation. The dominant species include fescue, Japanese honeysuckle, dog-fennel (*Eupatorium capillifolium*), Queen Anne's lace, ragweed (*Ambrosia artemisiifolia*), wild onion (*Alllium canadense*), blackberry, broomsedge (*Andropogon virginicus*), plantain (*Plantago* sp.), crabgrass (*Digitaria* sp.), a variety of asters and goldenrods, and dandelion (*Taraxacum officinale*).

The utility rights-of-way are generally covered by dense vegetation, somewhat similar to the vegetation found in the surrounding natural communities. Within the project study area, common herbaceous species include broomsedge, dandelion, aster, fescue, dogfennel, sunflower (*Helianthus* sp.), asters, ragweed, and goldenrods. Saplings of Virginia pine, sweetgum, and red maple are also prevalent in these rights-of-ways. Prominent vines include trumpet creeper (*Campsis radicans*), blackberry, poison ivy, Japanese honeysuckle, and kudzu.

The residential and commercial areas include maintained lawns and landscaped areas surrounding businesses. Species found in these areas include fescue, nandina (*Nandina domestica*), lily turf (*Liriope muscari*), crape myrtle, (*Lagerstroemia indica*), boxwood (*Buxus* sp.), butterfly bush (*Buddleia davidii*), burning bush (*Euonymus alatus*), and Chinese privet. Native vegetation may also be present in transition zones between residential/commercial and natural areas.

3.5.2.2 Terrestrial Wildlife

Species that prefer open areas to feed and nest can be found in the disturbed communities. The faunal species present in these disturbed habitats are opportunistic and capable of surviving on a variety of resources, ranging from vegetation to both living and dead faunal components. The European starling*[1] (*Sturnus vulgaris*), northern mockingbird* (*Mimus polyglottos*) and American robin* (*Turdus migratorius*) are common birds that use these habitats to find insects, seeds, or worms. The eastern meadowlark (*Sturnella magna)* and the eastern bluebird* (*Sialis sialia*) may utilize fences for perching and preening. Mourning doves* (*Zenaida macroura*) and red-tailed hawks* (*Buteo jamaicensis*) may be found perching on overhead power lines. The

[1] An asterisk (*) indicates that the species, or evidence of the species, was observed during field surveys in the project area.

American crow* (*Corvus brachyrhynchos*) and the Virginia opossum (*Didelphis virginiana*) are true opportunists and will eat virtually any edible items including vegetation, fruits, seeds, insects, and carrion.

Many species are highly adaptive and may utilize the edges of forests, and clearings or prefer a mixture of habitat types. The eastern cottontail* (*Sylvilagus floridanus*) prefers a mix of herbaceous and woody vegetation and may be found in the dense shrub vegetation or out in the roadside and residential areas. White-tailed deer* (*Odocoileus virginianus*) will utilize the forested areas as well as the adjacent open areas. The black rat snake (*Elaphe guttata*) will come out of forested habitat to forage on rodents in open areas. Indigo bunting (*Passerina cyanea*), brown thrasher (*Toxostoma rufum*), and common yellowthroat (*Geothlypis trichas*) are neotropical migrants that inhabit dense, shrubby vegetation along transitional areas and in clearcuts. The blue jay* (*Cyanocitta cristata*), song sparrow (*Melospiza melodia*), eastern towhee (*Pipilo erythrophthalmus*), and northern cardinal* (*Cardinalis cardinalis*) can be seen utilizing edge habitat all year round.

Forested areas are important habitat for many wildlife species, providing crucial foraging, nesting, and/or denning areas. Raccoons* (*Procyon lotor*) are generally associated with swamps and streamside forests, and their tracks are often seen along stream banks. The barred owl (*Strix varia*) utilizes river bottoms and moist woodlands for nesting as well as feeding. Neotropical migratory birds, in particular, are dependent on these areas. Species such as the northern parula (*Parula americana*) and the Louisiana waterthrush (*Seiurus motacilla*) thrive in wooded riparian areas, while the summer tanager (*Piranga olivacea*), and the red-eyed vireo (*Vireo olivaceus*) prefer the upland woods. Species such as the downy woodpecker* (*Picoides pubescens*), wild turkey* (*Meleagris gallopavo*), red-bellied woodpecker* (*Melanerpes carolinus*), Carolina wren* (*Thryothorus ludovicianus*), Carolina chickadee* (*Parus carolinensis*), and the tufted titmouse* (*Parus bicolor*) are found in wooded areas throughout the year. Other species that live in forested areas but are seldom seen include the gray fox (*Urocyon cinereoargenteus*), bobcat (*Felis rufus*), and worm snake (*Carphphis amenus*). Forested areas dominated by pine are especially appealing to the pine warbler (*Dendroica pinus*), ruby-crowned kinglet (*Regulus calendula*), and screech owl (*Otus asio*).

In the leaf litter of the terrestrial forested habitats, the woodland vole (*Microtus pinetorum*) and the white-footed mouse (*Peromyscus leucopus*) may be found. The gray squirrel* (*Sciurus carolinensis*) is often observed foraging in wooded areas, both on the ground or in trees. The spring peeper (*Hyla crucifer*) and the five-lined skink (*Eumeces fasciatus*) can be found under forest litter and in brushy undergrowth, while the red salamander (*Pseudotriton ruber*) and the slimy salamander (*Plethodon glutinosus*) forage in the same leaf litter. The eastern box turtle* (*Terrapene carolina*) is a terrestrial turtle but will often be found near streams in hot, dry weather.

3.5.2.3 Aquatic Communities

Aquatic habitats within the project study area range from ephemeral waters present in intermittent, channelized, first order streams to permanent, riverine habitat. Abbott's Creek, South Fork Muddy Creek, and Fiddler's Creek are the largest streams within study area. Large streams with good water quality and a diversity of aquatic habitats are expected to support a more diverse assemblage of fish and other aquatic organisms than smaller tributaries.

During field studies for this project, a visual survey of the stream banks within the project study area was conducted to document the aquatic community. No distinct areas containing significant amounts of aquatic vegetation were observed in channels within the project area.

Fish species expected to occur in drainages within the project vicinity include bluehead chub (*Nocomis leptocephalus*), brown bullhead (*Ictalurus nebulosus*), redbreast sunfish (*Lepomis auritus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salonoides*), and white sucker (*Catostomus commersoni*) (NCDWQ 2006).

Forested wetlands are especially appealing to the eastern newt (*Notophthalmus viridescens*), the gray tree frog (*Hyla chrysoscelis*) and the northern dusky salamander (*Desmognathus fuscus*). Northern water snake (*Nerodia sipedon*), snapping turtles* (*Chelydra serpentina*), bullfrogs (*Rana catesbeiana*), and green frogs* (*Rana clamitans*) may be plentiful near larger waterways, while two-lined salamander (*Eurycea bislineata*) and mud salamander (*Pseudotriton montanus*) are common in smaller streams, seepages, and springs. Suitable aquatic habitat exists in the project study area to support bird species such as the great blue heron* (*Ardea herodias*), wood duck* (*Aix sponsa*) and belted kingfisher* (*Megaceryle alcyon*). According to North Carolina Wildlife Resources Commission (NCWRC), no in-water work moratoriums are required for fisheries concerns, including anadromous fish, at any of the proposed stream crossings in the study area.

Within the study area, one type of wetland system exists: palustrine. The palustrine system (denoted in the classification system by a "P") consists of all nontidal wetlands dominated by trees, shrubs, and persistent emergents. Subclasses for this system and the corresponding definitions include:

- Forested (FO) – Characterized by woody vegetation over 20 feet in height
- Emergent (EM) – Characterized by erect, herbaceous vegetation present for most of the growing season.
- Scrub-Shrub (SS) – Characterized by woody vegetation less than 20 feet tall.

All three subclasses of wetland are present in the project area. Detailed descriptions of each wetland are included in the *Natural Resources Technical Report* (Lochner 2007c).

3.5.2.4 Natural Heritage Areas, Natural Area, and Natural Communities

Natural Heritage Areas are North Carolina registered protected areas with known occurrences of protected plant or animal species. Natural Areas are areas with no current protection status but with known occurrences of protected plant or animal species. Natural Communities represent exceptional examples of a particular natural community. There are no Natural Heritage Areas, Natural Areas, or Natural Communities within the study area.

3.5.3 Water Resources

This section summarizes information contained in the *Preliminary Hydraulics Study* (Mulkey 2008) and the *Natural Resources Technical Report* (Lochner 2007c) prepared for the project.

3.5.3.1 Groundwater

The principal aquifer in the project area is the Piedmont and Blue Ridge carbonate-rock aquifer. Most of the rocks that compose the crystalline-rock and undifferentiated sedimentary-rock aquifers are crystalline metamorphic and igneous rocks of many types. Unconsolidated material called regolith overlies the crystalline-rock and undifferentiated sedimentary-rock aquifers almost everywhere. The regolith consists of saprolite, colluviums, alluvium, and soil.

Recharge is highly variable in the Piedmont province because it is determined by local precipitation and runoff, which are highly variable and are influenced by topographic relief and the capacity of the land surface to accept infiltrating water. The relatively gentle topographic relief of the Piedmont favors accumulating of a thick regolith.

3.5.3.2 Surface Waters

The project study area is located within sub-basin 03-07-04 and 03-07-07 of the Yadkin-Pee Dee River Basin (NCDWQ 2003) and is part of the USGS hydrologic unit for the Yadkin River (Hydrologic Unit Code 03040101) (USGS 1972).

Best Usage Classification

A Best Usage Classification is assigned to waters of the state of North Carolina based on the existing or contemplated best usage of various streams or segments of streams in the basin. Four named streams within the project study area are crossed by the project alternatives, and five other named streams receive drainage from the project area. The unnamed tributaries (UT) present within the project area have not been individually classified by NCDWQ; therefore, they carry the same classification as their receiving streams.

Table 3-17 lists the Stream Index Numbers (SIN) for the named streams that are either crossed by the alternatives or that receive drainage from the project study area. Best Usage Classifications, and Subbasin Numbers are also listed (NCDWQ 2002, NCDWQ 2003).

All of the streams that receive drainage from the study area have been assigned a Best Usage Classification of C or WS-III. Class C waters are freshwaters protected for secondary recreation, fishing, aquatic life (including propagation and survival), and wildlife. Secondary recreation is any activity involving human bodily contact with water on an infrequent or incidental basis (NCDWQ 2003c). WS-III waters are protected for Class C uses and are used as sources of water supply where a more protective WS-I or WS-II classification is not feasible (NCDWQ 2003c).

TABLE 3-17: SUMMARY OF RIVER BASIN CLASSIFICATION DATA

Stream Name	Stream Index Number (SIN)*	Best Usage Classification (BUC)*	Subbasin Number (SBN)*
Abbott's Creek	12-119-(1)	WS-III	03-07-07
Reedy Run	12-119-4	WS-III	03-07-07
Spurgeon Creek	12-119-3	WS-III	03-07-07
Brushy Fork	12-119-5-(1)	WS-III	03-07-07
Long Branch	12-119-5-2	WS-III	03-07-07
Cool Branch	12-119-5-4	WS-III	03-07-07
Buck Branch	12-119-5-1.5	WS-III	03-07-07
Soakas Creek	12-94-13-4	C	03-07-04
South Fork Muddy Creek	12-94-13	C	03-07-04
Fiddler's Creek	12-94-13-3	C	03-07-04
Salem Creek	12-94-12-(4)	C	03-07-04

*NCDWQ 2002, 2003

No waters classified as High Quality Waters (HQW), Outstanding Resource Waters (ORW), Water Supplies (WS I or WS II), which are waters that are afforded special protection, occur within one mile of the project area.

Benthic Macroinvertebrate Ambient Network

Basinwide water quality assessments are conducted by the Environmental Sciences Branch, Water Quality Section of the NCDWQ through the Benthic Macroinvertebrate Ambient Network (BMAN). BMAN is part of an ongoing ambient water quality monitoring program which addresses long term trends in water quality. The program assesses water quality by sampling for selected benthic macroinvertebrate organisms at fixed monitoring sites. Macroinvertebrates are sensitive to very subtle changes in water quality; thus, the species richness and overall biomass of these organisms are interpreted as reflections of water quality. The samples are evaluated on the number of intolerant taxa groups (i.e., Ephemeroptera, Plecoptera, and Trichoptera (EPT)) present and a taxa richness value, or EPT S. A biotic index value is also calculated for the sample that summarizes tolerance data for all species of each collection. The taxa richness and biotic index values are given equal weight in final site classification. Streams can then be given a bioclassification ranging from Poor to Excellent.

According to the *Basinwide Assessment Report, Neuse River Basin* (NCDWQ 2007), there are no BMAN monitoring stations within the study area. In the Neuse River subbasin 03-04-07, the benthic macroinvertebrate monitoring station closest to the project area is on South Fork Muddy

Creek approximately 5.0 miles west of the project study area. This monitoring site (B-38) was sampled in 2006, and received a bioclassification of Good-Fair.

Section 303(d) Waters

North Carolina's §303(d) List is a comprehensive public accounting of all impaired waterbodies. An impaired waterbody is one that is damaged by pollutants, such as nitrogen, phosphorus, fecal coliform bacteria, or by pollution such as hydromodification or habitat degradation. The source of impairment might be from point sources, non-point sources, and atmospheric deposition. The standards violation might be due to an individual pollutant, multiple pollutants, or an unknown cause of impairment.

Salem Creek is the only stream within the project area on the current current §303(d) List. It is on the list due to impaired biological integrity from Salem Lake to Middle Fork Muddy Creek (north of the project area). Rich Fork Creek (SIN 12-119-7), approximately 0.5 miles south of the project area, is on the §303(d) list due to impaired biological integrity, fecal coliform, and low dissolved oxygen from its source to Abbott's Creek. (NCDWQ 2006).

Permitted Dischargers

Discharges that enter surface waters through a pipe, ditch, or other well-defined point of discharge are broadly referred to as "point sources." Wastewater "point source" discharges include municipal (city and county) and industrial wastewater treatment plants, and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions, and individual homes. Storm water "point source" discharges include storm water collection systems for municipalities and storm water discharges associated with certain industrial activities. "Point source" dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program and delegated to NCDWQ by the Environmental Protection Agency (EPA).

There are two permitted point source discharges located within the project vicinity (NCDWQ 2009a). One discharge is permitted to an individual, John F. Fulk, and discharges into Soakas Creek, less than half a mile north and downstream of the project study area. Lucent Technologies, at 3370 Lexington Road discharges into an unnamed tributary of Middle Fork of Muddy Creek, located within the project study area

Non-Point Source Discharges

Unlike pollution from industrial and sewage treatment, non-point source (NPS) pollution comes from many non-discrete sources. As rainfall or snowmelt runoff moves over the earth's surface, natural and man-made pollutants are collected, carried, and ultimately deposited into lakes, rivers, wetlands, coastal waters, and groundwater. Non-point source pollution includes fertilizers, herbicides, and insecticides from farms and residential areas; hydrocarbons and chemicals from urban runoff; sediments from construction sites, land clearing, and eroding stream banks; bacteria and nutrients from livestock, animal wastes, and faulty septic systems; and atmospheric deposition. The effects of NPS pollutants on water resources vary, and in many instances, may

not be known. These pollutants generally have harmful effects on drinking water supplies, recreation, wildlife, and fisheries.

Biologists conducted a visual observation of potential NPS discharges located within and near the project study area. Atmospheric deposition from passing vehicles; fertilizers, herbicides, and insecticides from nearby residential and agricultural areas; and hydrocarbon and chemical runoff from nearby residential driveways were identified as potential sources of NPS pollution near the project area. Despite the fact that riparian buffers are found along most of the streams in the project study area, NPS pollution has a detrimental effect on these streams because they are in the very upper reaches of a highly urbanized watershed, with a population estimate of more than 100,000 and a high population density that includes a lot of impervious surfaces (NCDWQ 2003). According to the *Basinwide Water Quality Plan, Yadkin-Pee Dee River Basin*, non-point sources of pollution within the basin are primarily runoff from the urban areas of Winston-Salem, High Point, and Thomasville (NCDWQ 2003).

3.5.4 Jurisdictional Issues

3.5.4.1 Wetlands, Streams, and Ponds

Water bodies such as rivers, lakes, and streams are subject to jurisdictional consideration under the Section 404 program of the Clean Water Act (CWA). Additionally, wetlands are also classified as "Waters of the United States" and are subject to jurisdictional consideration by the USACE. Wetlands have been defined by EPA and USACE as:

> "Those areas that are inundated or saturated by groundwater at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" [33 CFR §328.3(b)(1986)].

Wetlands subject to review under Section 404 of the CWA (33 USC 1344) are defined by the presence of three primary criteria: hydric soil; hydrophytic vegetation; and evidence of wetland hydrology at or near the surface for a portion (12.5 percent) of the growing season (Environmental Laboratory 1987). Wetlands and streams within the project study area are depicted on Figure 3-8.

3.5.4.2 Riparian Buffers

The Yadkin-Pee Dee River basin is not subject to vegetated riparian buffer requirements by the State of North Carolina.

3.5.4.3 Protected Species

Species with the federal classification of Endangered (E), Threatened (T), or officially Proposed (P) for such listing, are protected under provisions of Section 7 and Section 9 the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) as amended. Federally protected species listed

as occurring in Davidson and Forsyth Counties (USFWS 2009a, 2009b) are shown in Table 3-18. Descriptions of these federally protected species, along with habitat requirements, are presented in the following table. Impacts to these species, including Biological Conclusions, are discussed in Section 4.5.4.5.

TABLE 3-18: FEDERALLY LISTED SPECIES LISTED FOR DAVIDSON AND FORSYTH COUNTIES

Common Name	Scientific Name	County	Federal Status*	Potential Habitat Present
Vertebrates				
Bog turtle	*Clemmys muhlenbergii*	Davidson Forsyth	T(S/A)	Yes
Red-cockaded woodpecker	*Picoides borealis*	Forsyth	E	No
Vascular Plants				
Small-anthered bittercress	*Cardamine micranthera*	Forsyth	E	Yes
Schweinitz's sunflower	*Helianthus schweinitzii*	Davdison	E	Yes

*E – Endangered, T – Threatened, T(S/A) – Threatened due to similarity of appearance

Bog turtle *(Clemmys muhlenbergii)*
Family*: Emydidae*
Federally Listed: 1997
The bog turtle is a small freshwater turtle reaching a maximum carapace length of 4.5 inches. These turtles have a somewhat domed carapace that is weakly keeled and is light chestnut brown to ebony in color. The scutes have a lighter–colored starburst pattern in some individuals. The plastron is brownish-black with contrasting yellow or cream areas along the midline. This species is distinguished by a conspicuous orange to yellow blotch on each side of the head.

The bog turtle is semi-aquatic and is typically found in freshwater wetlands characterized by open wet fields, meadows, and spring-fed seeps with slow-moving streams, ditches, and boggy areas. The bog turtle is also found in wetlands in agricultural areas subject to light to moderate livestock grazing, which helps to maintain an intermediate stage of succession. During the winter, this species hibernates among rootstocks of shrubs and sedges. Mating occurs in April and May, and the female deposits one to six eggs in sphagnum moss or sedge tussocks from late May to before July. The diet of the bog turtle is varied, consisting of beetles, lepidopteran, snails, millipedes, pondweed and sedge seeds, and carrion (USFWS 2009c).

Red-cockaded woodpecker *(Picoides borealis)*
Family*: Picidae*
Federally Listed: 1970
This small, non-migratory woodpecker measures 7 to 8.5 inches long, has a black head, prominent white cheek patch, and black-and-white barred back (USFWS 2001). Males often have red markings (cockades) behind the eye, but the cockades may be absent or difficult to see (Potter et al. 1980). Primary nest sites for red-cockaded woodpecker include open pine stands greater than 60 years of age with little or no mid-story development. Foraging habitat is

comprised of open pine or pine/mixed hardwood stands 30 years of age or older (Henry 1989). Primary habitat consists of mature to over-mature southern pine forests dominated by loblolly, long-leaf, slash, pond, or other southern pine species.

Nest cavities are constructed in the heartwood of living pine trees, generally older than 60 years that have been infected with red-heart disease. Excavation of a cavity usually initiates through an old dead branch opening in the bole of the tree. An aggregate of cavity trees is called a cluster and may include 1 to 20+ cavity trees on 3.0 to 60 acres. The average size of a cluster is about 10 acres. The typical cluster is occupied by a related group of individuals called a clan. The woodpecker drills holes into the bark around the excavated cavity entrance, resulting in a shiny, resinous buildup around the entrance that allows for easy detection of active nest trees.

The typical territory for a clan will range from 60 to 600 acres in size. Red-cockaded woodpecker prefers mature, open, pine forests and will not generally range greater than about 130 feet over cleared ground or hardwood stands. The clan will only exploit those pine stands for food that are contiguous with their nesting habitat. Pine flatwoods and pine-dominated savannas, which have been maintained by frequent natural fires, serve as ideal nesting and foraging sites for this woodpecker. Development of a thick understory may result in abandonment of cavity trees.

Small-anthered bittercress *(Cardamine micranthera)*
Family*: Brassicaceae*
Federally Listed: 1989
Small-anthered bittercress is a slender, erect perennial herb, usually with one but occasionally with multiple stems, either simple or branched, 8-16 inches (20-40 cm) high. Roots are fibrous. Leaf edges have shallow, rounded teeth. Bottom (basal) leaves are lobed, 0.4-0.8 inch (1-2 cm) long, and 0.2-0.24 inch (0.5-0.6 cm) wide. Upper leaves are alternate and usually unlobed, 0.4-0.6 inch (1-1.5 cm) long, and wedge shaped, with the narrow point at the stem. Reduced leaves (bracts) occur at the base of the flowers. The flowers have four white petals, 0.08-0.12 inch (2-3 mm) long, six stamens, and small, round anthers. Flowering and fruiting occur April-May. Seeds are brown, about 0.04 inch (1 mm) long. The brown seeds are approximately 0.04 inch (1 mm) long.

Very little is known about the life history of this species, including the identity of pollinators although ants have been observed on the flowers. This plant is primarily found along seeps and wet rock crevices of stream banks, adjoining sandbars, moist woods near small streams fully to partially shaded by trees and shrubs. Occasionally found in full sun (one population in Virginia). Although the species also was known historically from Forsyth County in North Carolina, the single population there was destroyed when the site was converted to cattle pasture in the early 1960s. All other North Carolina populations are located in the Dan River drainage (USFWS 1991).

Schweinitz's sunflower (*Helianthus schweinitzii*)
Family: Asteraceae
Federally Listed: 1991
Schweinitz's sunflower is a rhizomatous perennial herb that grows from 3 to 6 ft (1 to 2 m) tall from a cluster of carrot-like tuberous roots. Stems are usually solitary, branching only at or above mid-stem. The stem is usually pubescent but can be nearly glabrous; it is often purple. The lanceolate leaves are opposite on the lower stem, changing to alternate above. They are variable in size, being generally larger on the lower stem, and gradually reduced upwards. The pubescence of the underside of the leaves is distinctive and is one of the best characters to distinguish Schweinitz's sunflower from its relatives. The upper surface of the leaves is rough, with the broad-based spinose hairs directed toward the tip of the leaf. From September to frost, Schweinitz's sunflower blooms with comparatively small heads of yellow flowers.

The species occurs in clearings and edges of upland woods on moist to dryish clays, clay-loams, or sandy clay-loams that often have high gravel content and are moderately podzolized. Schweinitz's sunflower usually grows in open habitats not typical of the current general landscape in the piedmont of the Carolinas. Some of the associated species, many of which are also rare, have affinities to glade and prairie habitats of the Midwest. Other species are associated with fire-maintained sandhills and savannas of the Atlantic Coastal Plain and piedmont. The habitat of this sunflower tends to be dominated by members of the aster, pea, and grass families, an association emphasizing affinities of the habitat to both longleaf pine-dominated sandhills and savannas of the southeastern coastal plain and to glades, barrens, and prairies of the Midwest and Plains (USFWS 2009e).

Federal Species of Concern and State Listed Species
Federal Species of Concern (FSC) are those plant and animal species that may or may not be listed in the future. These 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. Organisms that are listed as Endangered (E), Threatened (T), or Special Concern (SC) on the North Carolina Natural Heritage Program list of Rare Plant and Animal Species are afforded state protection under the North Carolina State Endangered Species Act of 1987 and the North Carolina Plant Protection and Conservation Act of 1979. However, state listed species are not protected from NCDOT activities.

Table 3-19 includes FSC and state-listed species for Davidson and Forsyth Counties and their state classifications (USFWS 2006A, 2006B). The table also includes information on whether suitable habitat is present for each species (Franklin and Finnegan 2006 and LeGrand, *et al.* 2006). Organisms that are listed as Endangered (E), Threatened (T), or Special Concern (SC) on the North Carolina Natural Heritage Program list of Rare Plant and Animal Species are afforded state protection under the State Endangered Species Act (GS 113-331) and the North Carolina Plant Protection and Conservation Act of 1979 (GS 106-202.12 et seq.). However, the level of protection given to state-listed species does not apply to NCDOT activities. Species with the

status of Candidate (C), Significantly Rare (SR), Watch List (WL), and Proposed (P) do not receive State protection.

TABLE 3-19: FEDERAL SPECIES OF CONCERN (FSC) AND STATE-LISTED SPECIES FOR DAVIDSON AND FORSYTH COUNTIES

Common Name	Scientific Name	County	Federal Status	State Status[a]	Potential Habitat Present
Vertebrates					
Carolina darter	*Etheostoma collis collis*	Davidson	FSC	SC[b]	Yes
Eastern small-footed bat	*Myotis leibii*	Davidson	FSC	SC[c]	Yes
Invertebrates					
Brook floater	*Fusconaia masoni*	Forsyth	FSC	E	Yes
Vascular Plants					
Prairie birdsfoot-trefoil	*Lotus unifoliolatus* var. *helleri*	Davidson	FSC	SR-T	Yes
Georgia aster	*Symphyotrichum georgianum*	Davidson	FSC	T	Yes

a E=Endangered, T=Threatened, SC=Special Concern, SR=Significantly Rare, SC – Special Concern, T – Rare throughout its range

b Obscure: The date the element was last observed in the county is uncertain.

c Listed by USFWS, tracked by NCNHP, but no occurrences have been reported in this county.

NCNHP records reviewed August 20, 2009 (http://207.4.179.50/nhp/county.html)

No FSC species were observed during the project's field investigations. One FSC species, Prairie birdsfoot-trefoil, was recorded as occurring within one mile of the project study area. The NCNHP elemental occurrence database records were consulted on October 16, 2006. Prairie birdsfoot-trefoil population 013 is situated along Abbott's Creek on the west side of NC109 about 6 miles south of Wallburg. The first and last observation was on September 14, 1956. This observation would be considered historic, as it was made over 50 years ago.

Bald eagle and Golden Eagle Protection Act

Habitat for nesting bald eagles primarily consists of mature forest in proximity to large bodies of open water for foraging. Large, dominant trees are utilized for nesting sites, typically within 1.0 mile of open water. The bald eagle ranges throughout all of North America. Breeding sites in the southeast are concentrated in Florida, coastal South Carolina, and coastal Louisiana, and sporadically located elsewhere (USFWS 1987).

3.5.4.4 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801 et seq.) requires the US Secretary of Commerce to develop guidelines assisting regional fisheries management councils in the identification and creation of management and conservation plans for essential fish habitat (EFH). There is no essential fish habitat in the project area.

3.5.4.5 Areas of Environmental Concern

The North Carolina Coastal Resources Commission issues Coastal Area Management Act (CAMA) permits for development in Areas of Environmental Concern (AECs). As this project is not located in a coastal area, there are no AECs in the project area.

3.5.4.6 Anadromous Fish Habitat

Anadromous fish habitat consists of low salinity areas that contain the physical, chemical, and biological attributes necessary for anadromous fish to spawn successfully. No anadromous fish habitat is in the project area.

SECTION 4
ENVIRONMENTAL CONSEQUENCES

This section describes potential positive and negative impacts of the five build alternatives (Corridors 1, 3, 4, 5 and 6) on the social, physical, and natural environments within the project study area. Where applicable the No-Build Alternative is also discussed.

Preliminary plans were prepared for each of the alternatives and slope stake limits (width of side slope). Quantitative impacts are based on slope stake limits plus twenty-five feet of clear zone on each side to more accurately estimate the impacts. These limits may be revised during the final design, as alternatives are shifted to accommodate design requirements or further impact minimization efforts. A summary of the environmental consequences is provided in Section 4.3.

4.1 DIRECT IMPACTS

4.1.1 Human Environment

Impacts to the human environment may include impacts to communities, changes in community access, relocations, disruption of community services or facilities, and economic impacts. Many of the direct impacts to the human environment presented in this section are thoroughly detailed in the *Community Impact Assessment Report* (Lochner 2007a) prepared for this project.

4.1.1.1 Community

4.1.1.1.1 Neighborhood Impacts

Community cohesion impacts include the effects of neighborhood division, social isolation, changes in community character, increased/decreased neighborhood access, and shortened travel times.

In the cases of all neighborhoods directly impacted by the alternative corridors, the neighborhoods' rural visual character and surroundings would be altered with the presence of a major highway facility. The following sections describe the impacts specific to neighborhoods identified within the study area. These neighborhoods are shown on Figure 3-3. The No-Build Alternative would not impact community cohesion.

Most of the neighborhoods in the project area would not experience residential displacements as a result of the project alternatives. There are a few key exceptions. Alternatives 3 and 6 would impact the Meadowlands community, off Motsinger Road in Wallburg. These impacts would likely be limited to displacements from parcels along Heatherwood Drive, near the western edge of the development. Alternatives 4 and 5 would impact three neighborhoods along Gumtree Road west of Friendship-Ledford Road. Displacements would likely affect a small number of parcels on the north end of Bradley Road in Cedar Estates, along the western edge of Lamore

Court in Holly Acres, and along the southwestern edge of the Briers Creek neighborhood, off Ivy Yokeley Road. Alternative 1 would require displacements within subdivisions along NC 109, although access to Plantation Place Apartments, near the north end of the project on the west side of NC 109, would be altered such that Cedar Springs Drive and Baden Road would be combined to create one access point with a traffic signal at NC 109.

4.1.1.1.2 Community Access

While the proposed NC 109 improvements will use directional crossovers at major intersections, the proposed project will provide improved mobility throughout the study area and should reduce congestion on existing NC 109. Each alternative would provide improved access to employment centers in Winston-Salem and would also provide for faster travel between Thomasville and Winston-Salem. Relative to Corridor 1, Corridors 3 and 6 would provide more direct access to I-40/US 311 and southeast Winston-Salem and Corridors 4 and 5 would provide more direct access to US 52, on Winston-Salem's southern outskirts. By providing access to these regional facilities, the project would provide for faster travel times to regional destinations. Through traffic traveling on existing NC 109 would be anticipated to transfer to the new location alternatives (Alternatives 3, 4, 5 or 6). Local community and social patterns, however, are not expected to change. Since through traffic would be diverted from existing NC 109 by the new location alternatives, accessibility to facilities and services within the developed community centers is expected to improve for local traffic.

While no major cross streets connecting to any of the residential areas would be closed as part of the proposed project, there may be individual and community property access impacts due to relocation of driveways and local roads. The NCDOT provides new access wherever possible to properties isolated by a project. All property access changes and proposed solutions developed for the preferred alternative will be presented to affected property owners through NCDOT's public involvement process.

4.1.1.2 Relocations

Potential residential and business relocation impacts based on preliminary designs for each alternative are shown in Table 4-1. The number of relocations is based on information provided with the NCDOT Relocation report (2009) for the project.

TABLE 4-1: RELOCATIONS*

	Business Relocations	Residential Relocations
Alternative 1	39	165
Alternative 3	5	87
Alternative 4	3	75
Alternative 5	4	70
Alternative 6	5	97

* Based on NCDOT Relocation report from September 2009.

Alternative 1 would require the greatest number of relocations, requiring 165 residential relocations and 39 business relocations. Alternative 5 would require the fewest number of relocations, requiring 70 residential relocations and 4 business relocations.

It is the policy of NCDOT to ensure that comparable replacement housing is available for relocatees prior to construction of state and/or federally assisted projects. Furthermore, the NCDOT has three programs to minimize the inconvenience of relocation: relocation assistance, relocation moving payments, and relocation replacement housing payments or rent supplements.

With the Relocation Assistance Program, experienced NCDOT staff will be available to assist displacees with information such as; availability and prices of homes, apartments, or businesses for sale or rent, and financing or other housing programs. The Relocation Moving Payment Program, in general, provides for payment of actual moving expenses encountered in relocation. Where displacement will force an owner or tenant to purchase or rent property at higher cost or to lose a favorable financing arrangement (in case of ownership), the Relocation Replacement Housing Payments or Rent Supplement Program will compensate up to $22,500 to owners who are eligible and qualify, and up to $5,250 to tenants who are eligible and qualify.

The relocation program for the proposed action will be conducted in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) and the North Carolina Relocation Assistance Act (GS-133-5 through 133-18). This program is designed to provide assistance to displaced persons in relocation to a replacement site in which to live or do business. At least one relocation officer is assigned to each highway project for this purpose.

The relocation officer will determine the needs of displaced families, individuals, businesses, non-profit organizations, and farm operations without regard to race, color, religion, sex, or national origin. The NCDOT will schedule its work to allow ample time, prior to displacement, for negotiation and possession of replacement housing that meets decent, safe, and sanitary standards. The relocatees are given a 90-day written notice after NCDOT purchases the property. Relocation of displaced persons will be offered in areas not generally less desirable in regard to public utilities and commercial facilities. Rent and sale prices of replacement housing will be within the financial budget of the families and individuals displaced and will be reasonably accessible to their places of employment. The relocation officer also will assist owners of displaced businesses, non-profit organizations, and farm operations in searching for and moving to replacement property.

All tenant and owner residential occupants who may be displaced will receive an explanation regarding all available options, such as: 1) purchases of replacement housing; 2) rental of replacement housing, either private or public; and 3) moving existing owner-occupied housing to another site (if practicable). The relocation officer also will supply information concerning other state or federal programs offering assistance to displaced persons and will provide other advisory

services as needed in order to minimize hardships to displaced persons in adjusting to a new location.

Last Resort Housing is a program used when comparable replacement housing is not available, or is unavailable within the displacee's financial means, and the replacement payment exceeds the federal and state legal limitation. The purpose of the program is to allow broad latitudes in methods of implementation by the state so that decent, safe, and sanitary replacement housing can be provided. Since opportunities for replacement housing appear adequate within the study area, it is not likely that the Last Resort Housing Program would be necessary for the proposed project. However, this program will still be considered as mandated by State law.

4.1.1.3 Community Facilities and Services

4.1.1.3.1 Schools

No schools will be displaced or otherwise directly impacted by any of the project alternatives.

4.1.1.3.2 Places of Worship

Alternative 1 will displace three places of worship—Marantha Baptist Church, Cornerstone Baptist Church, and Shady Grove United Methodist Church, all on NC 109. Alternative 1will also impact the driveway at First Fellowship Baptist Church, a small portion of the parking lot at Berean Baptist Church, near the northern end of NC 109. Alternatives 3 and 6 will displace the Marantha Baptist Church and will also require acquisition of a portion of the Fellowship Baptist Church parcel, along Teague Road. Corridors 4 and 5 will have no impacts on any churches.

4.1.1.3.3 Parks and Recreational Facilities

No parks or recreational facilities will be directly impacted by the project. The Wallburg Athletic Complex is just east of the new location segment of Alternative 1 but access to this property will not change.

4.1.1.3.4 Police, Fire and Emergency Services

The proposed project would not relocate any emergency facilities. By improving capacity in the area, the project may improve accessibility through the area for emergency reasons and could have a small positive impact on response times. In general, positive effects on emergency services would be similar for each of the alternatives. Alternative 1 may particularly improve traffic flow near the Wallburg Fire Station, as it is located along the segment of NC 109 that would be bypassed by the new location portion of the alternative. Near intersections that would not allow direct left turns, and instead require first a right turn and then a U-turn at a median opening a short distance away from the intersection, response times for emergency vehicles could be lengthened slightly.

4.1.1.4 Environmental Justice

Legislative Background

It is important to take into consideration the effects the project would have on minority and low-income groups. This is supported by several federal laws and regulations that require the evaluation of the effects of a transportation action on communities which, historically, have not actively participated in the decision-making process.

Impacts to individuals are covered through Title VI of the 1964 Civil Rights Act, which requires that Federal agencies ensure that no person is excluded from participation in, denied the benefit of, or subjected to discrimination under any program or activity that receives Federal financial assistance on the basis of their race, color, national origin, age, sex, disability, or religion.

This protection is expanded to communities through the Federal-aid Highway Act of 1970 (23 CFR Section 109 (h)), which emphasizes the equitable treatment of communities being affected by transportation projects. This act requires the consideration of the anticipated effect of proposed transportation projects on residences, businesses, accessibility of public facilities, tax base, and other community resources.

The need to identify low-income and minority populations and include them in the project's decision-making process gained greater emphasis as a result of Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations (February 11, 1994). This order directs all federal agencies to determine whether a proposed action would have an adverse or disproportionate impact on minority and/or low-income populations.

FHWA guidelines regarding environmental justice are contained in FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (December, 1998). This publication serves as guidance for analysis in compliance with Executive Order 12898 and defines Low-Income/Minority Population as:

> "any readily identifiable group of low-income/minority persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed FHWA program, policy, or activity."

Analysis

An analysis of demographic data at the Census Tract level showed that the area along existing NC 109 between Teague Road and I-40/US 311 has significantly larger percentages of non-white residents and residents in poverty than the project area as a whole and also as compared to Winston-Salem as a whole. To further analyze the demographic characteristics of this area, a comparison of minority and low income populations at the Census Block level was performed. Based on 2000 Census data, four Census Blocks along this part of NC 109 have significantly higher percentages of non-white and/or Hispanic residents than the area as a whole (poverty data

are not available at the Block level, but at the Census Tract level these data correlate with high non-white and/or Hispanic populations). For comparison, Winston-Salem's overall non-white population is 44 percent and its Hispanic population is 9 percent. The population of Census Tract 34.01-Block 2009 (east side of NC 109 between Meadowview Drive and Nathan Avenue) is 67 percent non-white. The population of Census Tract 35-Block 1003 (west side of NC 109 between Cash Drive and Cedar Springs Road is 63 percent Hispanic. The population of Census Tract 35-Block 1004 (west side of NC 109 between Cedar Springs Road and Louise Road) is 85 percent non-white. The population of Census Tract 35-Block 1005 (west side of NC 109 between Louise Road and Charles Street) is 90 percent non-white and 19 percent Hispanic.
Alternatives 1, 3, and 6 would impact the areas described in the above paragraph. Based on the NCDOT Relocation Report (2009) prepared for this project, approximately ten percent of the relocations required by each of these three alternatives would affect minority residents or minority-owned businesses. This is a much smaller proportion than the percent of nonwhite residents in the project study area as a whole (approximately twenty percent), so these alternatives would not have an adverse or disproportionate direct impact on minority or low-income communities. These alternatives would have relatively few minority displacements due in part to the fact that small proportions of the total displacements associated with each of the three alternatives affect minority neighborhoods. Alternatives 4 and 5 would not affect areas with high percentages of non-white residents or residents below the poverty level, so neither of these alternatives would have an adverse or disproportionate impact on minority or low-income communities.

Although Alternatives 1, 3, and 6 would require relocations within minority communities, it is unlikely that any of these alternatives would result in significant community disruptions in neighborhoods with large minority populations. For all three alternatives, impacts to minority communities would be largely limited to the portions on existing NC 109. It is unlikely that the impacts associated with widening the existing roadway would isolate existing neighborhoods or disrupt activities in those neighborhoods because these alternatives would not create a new disruption. Access from these neighborhoods onto NC 109 may change slightly (e.g., full access may change to right-in/right-out access), but there will otherwise be minimal disruptions associated with the project.

Avoidance and Minimization Efforts
The alternative corridors were located to avoid passing through the centers of neighborhoods and subdivisions. Preliminary engineering designs further minimized relocations where possible.

Public Involvement Opportunities
NCDOT has attempted to include all residents and property owners in the study area in the project's decision-making process. Efforts to include residents of communities within the area are discussed in Section 7.

4.1.1.5 Economic

The proposed improvements to NC 109 have the potential to encourage positive economic growth in the project area. Businesses along NC 109 would receive direct benefit from an upgraded existing facility (Alternative 1) as traffic capacity and mobility improve and the route becomes more attractive to traffic traveling between Thomasville and Winston-Salem. The existing commercial development around the Gum Tree Road intersection in particular would benefit. It is possible that by diverting through traffic from central Wallburg, Alternative 1 could negatively impact businesses located along NC 109 in that area. By possibly diverting traffic from existing NC 109, the remaining alternatives could also have a negative impact on existing businesses along the roadway; however, many of the existing businesses along NC 109 appear to serve local rather than regional markets. It is also possible that the use of directional crossovers at major intersections, in which traffic on the secondary highways would be limited to making right turns onto NC 109, could have a somewhat negative impact on some types of businesses near these intersections.

Alternatives 4 and 5 would have a positive economic effect in the vicinity of the existing US 52 interchange at South Main Street as more of the regional traffic traveling between Thomasville and Winston-Salem would travel through this interchange area, increasing the market for highway-oriented commercial development. These two alternatives would also provide improved mobility near the Piedmont Triad Industrial Center at the US 52 interchange, increasing access for workers and for movement of goods.

4.1.2 Land Use and Transportation Planning

4.1.2.1 Land Use Plans

Since all five alternatives include new location, existing land uses within the project corridor would be changed under any of the build alternatives. The No-Build Alternative would not introduce any impacts to existing land use.

4.1.2.1.1 Existing Land Use and Zoning

Land use impacts resulting from highway construction include physical displacement or alteration of adjacent land uses (direct impacts) and alteration of existing or planned uses of lands occurring because of the project, but removed from the project in time or space (indirect impacts). Land use decisions are typically made by the land owner in concert with local jurisdictions (county and municipal governments). These decisions are guided by the inclinations of the owners, economic conditions, physical constraints of the land, local land use policies, zoning restrictions, and the issuance of building permits. State or federal governments have no controls over these decisions except through regulatory permitting legislation. As such, a detailed discussion of development trends and potential indirect impacts of the project is included in Section 4.2, Indirect and Cumulative Impacts.

4.1.2.1.2 Compatibility with Future Land Use Plans

Land use plans typically address the general area of a proposed transportation improvement rather than a specific location; therefore, the anticipated land use plan impacts of the proposed project would be the same for each of the five alternatives.

The proposed project has been under consideration for many years and is acknowledged and supported in all area highway plans (see Section 4.1.2.2.1) and is also specifically identified in *Davidson Forward* as a project which supports the County's vision for the future. Davidson Forward identifies most of the project area as a Preferred Rural/Agricultural Area and seeks to preserve rural and agricultural uses in the area. While improved traffic capacity and increased accessibility in the area could help stimulate additional residential development, the fact that most of the project area lacks sewer and water service and is unlikely to gain these services will limit this development.

Forsyth County's *Legacy Development Guide* (2001) identifies the future land use vision for most of the project area as Suburban Neighborhoods. A small area at the northwest edge of the project area is designated as Urban Neighborhoods, where future infill development and revitalization are encouraged. The proposed project would support each of these visions in this part of the study area.

4.1.2.2 Transportation Planning

4.1.2.2.1 Compatibility with Highway Plans

The proposed project is consistent with local and state transportation plans for the area. The project is listed as a Strategic Highway Corridor Project in the NCDOT 2009-2015 TIP as Project Number R-2568C. The southern terminus of the project is Old Greensboro Road, in Davidson County, and the northern terminus is I-40/US 311 in Winston-Salem.

The HPMPO *Thoroughfare Plan* (2006), the Winston-Salem MPO CTP, and the Davidson County *Thoroughfare Plan* (1984) all recommend the widening of NC 109 to a four-lane divided roadway. The HPMPO LRTP (2009) includes the widening of NC 109 as a Horizon Year 2025 project. The Winston-Salem MPO LRTP (2008) identifies widening of NC 109 through the project area to I-40/US 311, including a bypass of Wallburg, as a 2025 project and indicates that the project may include some new location.

4.1.2.2.2 Compatibility with Transit and Bicycle/Pedestrian Plans

The proposed project is consistent with all local transit and bicycle/pedestrian plans.

4.1.3 Physical Environment

This section describes potential impacts of the proposed project to the following aspects of the existing physical environment: noise, air quality, farmlands, utilities, visual environment, hazardous materials, floodplains and floodways, and protected lands.

4.1.3.1 Noise

A preliminary traffic noise analysis for this project was conducted using FHWA Traffic Noise Model software (TNM 2.5) to predict future noise levels and to determine if noise levels generated along each alternate would exceed criteria established by FHWA. A more detailed traffic noise analysis will be performed once the LEDPA for this project is selected. The results of the preliminary analysis are presented in a Traffic Noise Analysis memorandum (NCDOT 2008b), summarized below. A copy of the full memorandum is available for review in the NCDOT Project Development and Environment Analysis office, at 1 South Wilmington Street in Raleigh.

The TNM traffic noise predictions are for highway related noise during the years 2006 and 2035. Noise levels have been predicted for that hour of the day when the vehicle volume, operating speed and number of heavy trucks combine to produce the worst traffic noise conditions. This condition usually occurs at Level of Service (LOS) C. If the Design Hourly Volume (DHV) is not predicted to exceed the LOS C volume for a given segment, the DHV was used in the model. If the DHV for a given segment exceeds the LOS C volume, then the LOS C volume was used. Using this method, noise levels at all other time periods would be lower than those indicated in this discussion.

TNM was used to determine the number of receptors that would be impacted by noise during this worst-case traffic noise level condition for design year 2035. As described in Section 3.3.1, a receptor is considered impacted when exposed to noise levels approaching or exceeding the FHWA NAC and/or predicted to sustain a substantial increase (see Tables 3-11 and 3-12).

Table 4.2 lists the number of receptors impacted by each alternative based on the above criteria. Receptors to be acquired for proposed right-of-way based on preliminary designs were not included in these calculations. Based on this analysis, Alternative 1 would impact the most receptors (97) and Alternative 5 would impact the fewest (31).

TABLE 4-2: SUMMARY OF NOISE IMPACTS

	Impacted Receptors
Alternative 1	97
Alternative 3	61
Alternative 4	33
Alternative 5	31
Alternative 6	61

Based on this analysis, and in accordance with the NCDOT Traffic Noise Abatement Policy, traffic noise abatement measures such as sound barriers could be considered feasible or reasonable for this project. When a final alternative is selected for the project, a full traffic noise study will need to be conducted, including identifying all new and existing land use areas along the proposed project corridor.

Information on Noise for Local Officials

It is the policy of NCDOT that the type of material used in construction of noise abatement measures be an engineering decision based on economics, effectiveness, and to a limited degree, visual impact. Visual impact considerations assure that a barrier meets a basic aesthetic level and a basic durability level such that excessive deterioration or corrosion will not occur.

It is also a part of this policy to have traditional highway resources pay for the required noise abatement. Should a local jurisdiction request that a material be used for the noise barrier that is more costly than that proposed by NCDOT, the requesting body must assume all of the additional cost.

If a local jurisdiction insists on the provision of a noise abatement measure deemed feasible but not reasonable by NCDOT, a noise barrier may be installed, provided the locality is willing to assume all of the cost of the abatement measure, including but not limited to preliminary engineering, construction, maintenance, and that NCDOT's material, design and construction specifications are met.

In an effort to prevent future noise impacts on currently undeveloped lands, NCDOT uses the following criteria:

- The "Date of Public Knowledge" is the approval date of the final environmental document. For this project, this will be the Record of Decision (ROD). After the Date of Public Knowledge, Federal/State governments are no longer responsible for providing noise abatement measures for new development for which building permits are issued within the noise impact area of the proposed highway project.

For development occurring after this public knowledge date, it is the responsibility of the local governing bodies to ensure that noise compatible designs are utilized.

- The date for determining when undeveloped land is "…planned, designed and programmed…" for development will be the issuance of a building permit for an individual site.

4.1.3.2 Air Quality

The air quality analysis conducted for this project, *Air Quality Analysis Technical Memorandum* (Lochner 2009b), evaluated the impacts of the proposed improvements on future air quality conditions in the project vicinity. A copy of the full report is available for review in the NCDOT Project Development and Environment Analysis office, at 1 South Wilmington Street in Raleigh. A summary of the methodology, procedures, and conclusions is provided below.

Methodology

The air quality analysis was performed in accordance with the Federal-Aid Policy Guide.

The principal air pollutants of automotive emissions are Carbon Monoxide (CO), Hydrocarbons (HC), and Nitrogen Oxides (NOx). Other pollutants, such as sulfur dioxide and particulates, are produced to a lesser degree. A wide range of photochemical oxidants (ozone) also result through a complex series of light-induced reactions between emitted hydrocarbons and nitrous oxides.

Automobiles are not regarded as significant sources of particulate matter and sulfur dioxide. Nationwide, highway sources account for less than seven percent of particulate matter emissions and less than two percent of sulfur dioxide emissions. Particulate matter and sulfur dioxide emissions are predominantly the result of non-highway sources (e.g., industrial, commercial, and agricultural). Because emissions of particulate matter and sulfur dioxide from automobiles are very low, there is no reason to suspect that traffic on the project will cause air quality standards for particulate matter and sulfur dioxide to exceed the National Ambient Air Quality Standard (NAAQS).

The Clean Air Act Amendments of 1990 make the sale, supply, or transport of leaded gasoline or lead additives unlawful after December 31, 1995. Because of these reasons, it is not expected that traffic on the proposed project will cause the NAAQS for lead to be exceeded.

Highway vehicles are considered to be the major source of CO in the project area. For this reason, and because CO is a relatively non-reactive pollutant, CO was used in the analysis as an indicator of the air pollutants produced by traffic activities on the proposed roadway.

In order to evaluate the future air quality effects of the proposed project, two concentration components must be identified; background and local. Added together, the two concentrations indicate the concentration of CO in the study area and can be compared to the NAAQS. Local CO concentrations were predicted at selected sensitive sites adjacent to the proposed alignments for specified years using a line source model. The combined CO concentrations (background and local) were then assessed against the NAAQS to determine the extent of the impact the proposed project would have on the air quality in the project study area.

Two intersections along Alternative 3, which were identified as having the potential for generating the highest CO concentration because they are the locations in the study area with the highest projected traffic volumes, were used for the analysis. The determination of which intersections have the potential for generating the highest concentration of CO is primarily dependant on traffic volume and congestion. The two intersections with the highest volume of entering vehicles are the intersections of the proposed Alternative 3 alignment with Gum Tree Road and Shady Grove Church Road.

Air quality projections were calculated for the project completion year (2015, subject to availability of funds), interim year after project completion (2020), and the design year (2035).

CO 1-hour and 8-hour concentrations of 2.7 parts per million (ppm) and 2.0 ppm, respectively, were used for background concentrations in the analysis. These values were reported as average ambient background concentrations in the Forsyth County area by the EPA for 2007.

Microscale CO projections were made using the EPA-approved MOBILE6.2 and CAL3QHC (Version 2.0) computer models. MOBILE6.2 was used to determine CO emission factors which in turn were used in the CAL3QHC model to generate CO concentrations. CAL3QHC is a versatile dispersion model which predicts CO concentration for roadway segments and/or intersections. It utilizes CALINE3 for all concentration computations.

Analysis Results

Table 4-3 lists the predicted one-hour and eight-hour carbon monoxide concentrations for the No-Build and Build Alternatives for receptors located at the right-of-way line. In comparing the projected CO concentration levels in Table 4-4 with the National Ambient Air Quality Standards, no violations of the 1-hour standard (35 ppm) or 8-hour standard (9 ppm) are expected. The 1-hour and 8-hour CO concentrations are not expected to exceed 3.7 and 2.8 ppm (including background contributions), respectively, at any of the sites for any of the three years investigated.

TABLE 4-3: AIR QUALITY ANALYSIS RESULTS

1-Hour Concentrations for Alternative 3 – Gum Tree Road Intersection*												
Year	Analysis Site											
	1	2	3	4	5	6	7	8	9	10	11	12
2015	3.1	3.1	3.0	3.1	3.3	3.2	3.0	3.0	3.1	3.1	3.1	3.2
2025	3.2	3.2	3.0	3.2	3.4	3.3	3.1	3.0	3.2	3.2	3.2	3.2
2035	3.4	3.4	3.7	3.6	3.5	3.5	3.5	3.5	3.3	3.3	3.3	3.4

1-Hour Concentrations for Alternative 3 – Shady Grove Church Road Intersection*									
Year	Analysis Site								
	1	2	3	4	5	6	7	8	9
2015	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	3.0
2025	3.1	3.0	2.9	2.9	3.0	2.9	3.0	3.0	3.1
2035	3.3	3.1	3.1	3.0	3.1	3.1	3.1	3.2	3.2

8-Hour Concentrations for Alternative 3 – Gum Tree Road Intersection^												
Year	Analysis Site											
	1	2	3	4	5	6	7	8	9	10	11	12
2015	2.3	2.3	2.2	2.3	2.5	2.4	2.2	2.2	2.3	2.3	2.3	2.4
2025	2.4	2.4	2.2	2.4	2.6	2.5	2.3	2.2	2.4	2.4	2.4	2.4
2035	2.6	2.6	2.6	2.8	2.7	2.7	2.7	2.7	2.5	2.5	2.5	2.6

8-Hour Concentrations for Alternative 3 – Shady Grove Church Road Intersection ^									
Year	Analysis Site								
	1	2	3	4	5	6	7	8	9
2015	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
2025	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3
2035	2.5	2.3	2.3	2.2	2.3	2.3	2.3	2.4	2.4

* Includes 2.7ppm background concentration
^ Includes 2.0ppm background concentration

State Implementation Plan (SIP) Consistency

The project is located in Davidson County, which is within the Greensboro-Winston-Salem- High Point nonattainment area for fine particles PM 2.5 as defined by the EPA. This area was designated nonattainment for the PM2.5 standard in accordance with the Clean Air Act Amendments (CAAA) on January 5, 2005, with an effective date of April 5, 2005. Section 176(c) of the CAAA requires that transportation plans, programs, and projects conform to the intent of the state air quality implementation plan (SIP) (or base year emissions, in areas where no SIP is approved or found adequate). The current SIP does not contain any transportation control measures for Davidson County. The High Point Metropolitan Planning Organization (MPO) 2035 Long Range Transportation Plan (LRTP), the Winston Salem MPO 2035 LRTP and the 2009-2015 Transportation Improvement Programs (TIPs) conform to the intent of the SIP. The USDOT made a conformity determination on the High Point MPO LRTP on February 26, 2010, the Winston Salem MPO LRTP on February 26, 2010, the High Point MPO TIP on February 26, 2010 the Winston Salem MPO TIP on February 26, 2010 and Davidson County projects from the State Transportation Improvement Program (STIP) on February 26, 2010. For the donut area of Davidson County, the projects from the 2009-2015 STIP conform to the intent of the SIP (or base year emissions, in areas where no SIP is approved or found adequate). The USDOT made a conformity determination on Davidson County projects from the STIP on February 26, 2010. The current conformity determination is consistent with the final conformity rule found in 40 CFR Parts 51 and 93. There are no significant changes in the project's design concept or scope, as used in the conformity analyses.The current SIP does not contain any transportation control measures for Davidson or Forsyth County. All local transportation plans, as well as the 2009-2015 TIP projects in the area, have been found to conform to the intent of the SIP. The current conformity determination is consistent with the final conformity rule found in 40 CFR Parts 51 and 93. There are no significant changes in the project's design concept or scope, as used in the conformity analyses.

The project is located in Forsyth County, which is within the Winston-Salem nonattainment area for carbon monoxide (CO) as defined by the EPA. The 1990 Clean Air Act Amendments (CAAA) designated this area as moderate nonattainment area for CO. However, due to improved monitoring data, this area was redesignated as maintenance for CO on November 7, 1994. Section 176(c) of the CAAA requires that transportation plans, programs, and projects conform to the intent of the state air quality implementation plan (SIP). The current SIP does not contain any transportation control measures for Forsyth County. The Winston-Salem Metropolitan Planning Organization (MPO) 2035 Long Range Transportation Plan (LRTP), the High Point MPO 2035 LRTP and the 2009-2015 Transportation Improvement Programs (TIPs) conform to the intent of the SIP. The USDOT made a conformity determination on the Winston-Salem MPO LRTP on February 26, 2010, the High Point MPO LRTP on February 26, 2010, the Winston Salem MPO TIP on February 26, 2010, and the High Point MPO TIP on February 26, 2010. The current conformity determination is consistent with the final conformity rule found in 40 CFR Parts 51 and 93. There are no significant changes in the project's design concept or scope, as used in the conformity analyses.

Davidson and Forsyth Counties were designated as moderate nonattainment for ozone under the eight-hour ozone standard on April 15, 2004. However, on April 2, 2008, the EPA reclassified the area as attainment for the 8-hour ozone standard. Because the proposed project is located in an attainment area, the provisions of the November 24, 1993, USDOT regulation provisions (40 CFR Parts 51 and 93) are not currently applicable. This project is not anticipated to create any adverse effect on the air quality of this attainment area.

The temporary air quality impacts from construction are not expected to be significant. During construction, all materials resulting from clearing and grubbing, demolition, or other operations will be removed from the project, burned, or otherwise disposed of by the Contractor. Any burning will be done in accordance with applicable local laws and ordinances and regulations of the North Carolina State Implementation Plan for air quality in compliance with 15 NCAC 2D.0520. Care will be taken to ensure that burning will be done at the greatest distance practicable from dwellings and not when atmospheric conditions are such as to create a hazard to the public. Burning will be performed under constant surveillance. Also, measures will be taken in allaying the dust generated by construction when the control of dust is necessary for the protection and comfort of motorists or area residents.

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, air toxics are also federally regulated. Mobile Source Air Toxics (MSATs) are a subset of 21 of the 188 air toxics defined by the Clean Air Act. Six of these are priority MSATs: benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,2-butadiene. MSATs are emitted from highway vehicles and non-road equipment. With available technical tools, it is not possible to accurately estimate health impacts of MSATs at the project level. However, it is possible to qualitatively assess the levels of future MSAT emissions under the projects.

For each project alternative, the amount of MSATs emitted would be proportional to vehicle miles traveled (VMT), assuming other variable s such as fleet mix are the same for each alternative. The VMT estimated for each of the Build Alternatives is slightly higher than for the No-Build Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. Increased VMT would lead to higher MSAT emissions along each Build Alternative, but corresponding decreases in emissions along parallel routes. The emissions increase is offset somewhat by lower emission rates due to increased speeds; according to EPA's MOBILE6.2 model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Because estimated VMT is similar for each of the Build Alternatives, it is expected there would be no appreciable difference in overall MSAT emissions among the various alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT

emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases. A more detailed discussion of the qualitative MSAT analysis for this project is presented in the *Air Quality Analysis Technical Memorandum* (Lochner 2009b). More information about MSAT analysis is available in the FHWA memorandum *Interim Guidance Update on Mobil Source Air Toxic Analysis in NEPA Documents* (2009).

4.1.3.3 Farmlands

In accordance with the Farmland Protection Policy Act of 1981 (7 CFR Part 658) and State Executive Order Number 96, an assessment was undertaken of the potential impacts of land acquisition and construction activities in prime, unique, and local or statewide important farmland soils, as defined by the US Natural Resource Conservation Service (NRCS). In order to determine the potential impacts to farmlands, the acreage of soil types within the proposed corridors has been determined (see Table 3-13 for a listing of these soils). Table 4-4 summarizes impacts to farmland soils.

TABLE 4-4: IMPACTS TO PRIME FARMLAND SOILS

Build Alternative	Prime Farmland Soils Impacted (acres)
Alternative 1	230.13
Alternative 3	124.81
Alternative 4	137.41
Alternative 5	139.13
Alternative 6	124.98

As required by the FPPA, coordination with the NRCS for this project was initiated by submittal of Form AD-1006, Farmland Conversion Impact Rating. A separate form for each county (Davidson and Forsyth) was prepared because the NRCS assessment is completed by individual county. This coordination effort served as the basis for determining the relative farmland impacts of each alternative. The NRCS responded by completing their portions of this form and providing a relative value of farmland that may be affected (converted) by the proposed project. The NRCS assigns ratings to potential farmland impacts in order to determine the level of significance of these impacts. The ratings are comprised of two parts. The Land Evaluation Criterion Value represents the relative value of the farmland to be converted and is determined by the NRCS on a scale from 0 to 100 points. The Corridor Assessment, which is rated on a scale of 0 to 160 points, evaluates farmland soil based on its use in relation to the other land uses and resources in the immediate area. The two ratings are added together for a possible total rating of 260 points. Sites receiving a total score of less than 160 should be given a minimal level of protection, and sites receiving a total score of 160 or more are given increasingly higher levels of consideration for protection (7 CFR Section 658.4). Because separate Land Evaluation Criterion Values were assessed for each county, these values had to be combined in order to assign a total value to each alternative. A weighted average of the two values for each alternative (one for its portion in Davidson and one for its portion in Forsyth) was calculated based on the percent of the alternative length in each county.

Completed AD-1006 Farmland Conversion Rating Forms are provided in Appendix D. None of the proposed alternatives resulted in a total site assessment score greater than 160 points. Therefore, in accordance with the Farmland Protection Policy Act, no mitigation for farmland loss is required for the project.

4.1.3.4 Utilities

Electric

Most of the project area receives electrical service from Duke Power; limited portions are served by Energy United, a smaller energy cooperative. Alternatives 3 and 6 would each cross Duke Power transmission line easements in two locations, near the Friendship Acres and Glen Ridge neighborhoods. Alternative 1 would not cross any existing power transmission lines, although it may impact a planned transmission line in the Meadowlands community, depending on the eventual location of that infrastructure. Alternatives 4 and 5 would not cross any transmission lines. All five alternatives likely would directly impact power transmission line towers: Alternative 1 would impact three towers, Alternatives 3 and 6 may each impact one tower depending on final project design, and Alternatives 4 and 5 would each impact three towers.

Through coordination with the electric power companies during development of final plans and construction, the alternatives are not expected to affect customers.

Water and Sewer

Existing water and sewer lines serve limited portions of the project area, mainly in the northern part of the area. These lines are underground and generally follow existing roads. None of the corridors would impact major water facilities, such as treatment plants or pump stations. Temporary disruptions in service could result during construction of any of the alternatives; however, this impact would be minimized through coordination with Winston-Salem – Forsyth Utilities or other providers.

Natural Gas

Natural gas service lines are located within portions of the study area. As with water and sewer service lines, natural gas service is more concentrated in northern portions of the project area and the lines are underground and generally follow existing roads. The Transcontinental natural gas pipe lines, which consist of a 36-inch pipe and a 30-inch pipe, extend east to west across the project area near the Meadowlands neighborhood. Alternatives 1, 3 and 6 would cross the pipe lines, although the pipe lines would not need to be relocated. Temporary disruptions in service are possible during construction of any of the alternates; however, this impact would be minimized through coordination with Piedmont Natural Gas.

There are several North Carolina Voluntary Agricultural District (VAD) properties in the project area but none would be impacted by any of the project alternatives.

Railroads
Alternatives 4 and 5 cross the Winston-Salem Southbound Railway tracks near US 52. These two alternatives follow a common alignment at this location and would include a bridge over the tracks. Bridging should not impact railroad facilities or operations.

4.1.3.5 Visual Quality

The introduction of any large facility in a rural area alters the local perception of the visual environment. A location may be deemed visually sensitive for its visual quality, uniqueness, cultural importance, and viewer characteristics. According to Federal Highway Administration guidelines, high visual quality is obtained when area landscape components have impressive characteristics that convey visual excellence. Striking landscapes are not limited to the natural environment and can be associated with urban areas as well. Visual quality is subjective in that it is also determined by a viewer's perception of an area.

Due to the rolling topography of the project area and the agricultural nature of much of the area, scenic views are plentiful, particularly in Davidson County. All of the alternatives would introduce a visual intrusion into the landscape, although this impact would be smaller for Alternative 1 because most of this alternative follows the existing NC 109 alignment. While trees and vegetation could be lost due to widening existing NC 109, the widening would not involve introducing a new visual intrusion. The other four alternatives would all have similar visual impacts on the project area, with Alternatives 4 and 5 possibly having slightly greater impacts than Alternatives 3 and 6 because they include more new alignment. The overall visual character of the project area would be negatively impacted by the introduction of a new roadway facility, but measures have been and will continue to be taken to minimize these impacts. These include avoiding dense residential areas and minimizing cut and fill slopes by following existing ground lines where possible.

Visually Sensitive Resources
Several private historic properties and a proposed rural historic district do exist within the project area. Visual impacts to these sites have been categorized using the following rating:

- No Impact – The view of the alternative has minor implications to the existing landscape or there is no impact at all.
- Low Impact – The view of the project is limited, the visual resource is limited in importance, there are dominating visual intrusions in the viewshed from other sources, or there is a weak visual contact between the facility and the landscape. If any of the proposed actions are closer to the resource than the existing facility, but do not necessarily create a visual impact due to visual intrusions, it has been rated as having a low impact.
- Moderate Impact – The view of the project is a moderate intrusion into the visual environment with greater contrast than the low impact but not as great as a high impact.

- High Impact – The project is in proximity and visible to viewers, has a strong contrast with the landscape, is in an area of importance with limited visual intrusions, or involves substantial view sensitivity.

The George W. Wall House is located in central Wallburg near the location where the northern end of the new alignment portion of Alternative 1 would tie back into existing NC 109. The roadway improvements for Alternative 1 near this location may have a low impact on the visual quality of this property. The other alternatives would not impact this property.

The D. Austin Parker House is located on Teague Road just to the west of Alternatives 3 and 6. Due to the open, rural quality of the home's property, these alternatives may be visible from the property. These two alternatives would have a moderate impact on the visual quality of the property as they could create a moderate intrusion into the agricultural landscape. The Mark Parker House is located just west of the D. Austin Parker House. The D. Austin Parker House property creates a visual buffer between the Mark Parker House and Alternatives 3 and 6, so these alternatives would have a low impact on the visual quality of the property. Alternatives 1, 4 and 5, would have no impact on the visual quality of these two properties.

The remaining historic properties in the project area, the Dempsey B. Clinard House, the John William Hiatt Farm, the Yokeley Farm, and the proposed Friedland Lower Tier Historic District are outside of the APE for the project and are therefore unlikely to receive negative visual impacts due to the project.

4.1.3.6 Hazardous Materials

Based on field surveys described in Section 3.3.6, twenty-seven facilities with the possibility for underground storage tanks (USTs), three automotive repair sites, three automotive salvage yards, one dry cleaner and one industrial site were identified in the project study area.

Table 4-5 lists the number of sites potentially affected by each alternative. If any of the potential hazardous materials sites cannot be avoided by the Preferred Alternative, further assessments of the properties will be conducted and the results reported in the Final Environmental Impact Statement. These assessments will evaluate the properties for specific types and amounts of hazardous materials and will include right of way acquisition recommendations. It is not expected that conditions at any of these sites would preclude construction of any of the alternatives.

TABLE 4-5: SUMMARY OF IMPACTS TO HAZARDOUS MATERIALS SITES

Alternative	Number of Hazardous Materials Sites within Corridor
Alternative 1	25
Alternative 3	9
Alternative 4	3
Alternative 5	4
Alternative 6	3

4.1.3.7 Floodways and Floodplains

All five alternatives would cross the 100-year floodplain associated with Abbotts Creek. All five would also cross the 100-year floodplain associated with Brushy Fork, although they would cross this floodplain in different locations. Alternatives 1, 3 and 6 would cross the 100-year floodplains associated with South Fork Muddy Creek and Fiddlers Creek. Alternatives 4 and 5 would cross the 100-year floodplain associated with Soakas Creek. Alternative 5 would have the greatest area of floodplain impacts (10.46 acres) while Alternative 6 would have the smallest area (5.35 acres). These impacts are presented in Table 4-6. Major drainage structures proposed for the project would cross the floodplain at or near perpendicular angles, minimizing the length of floodplain traversed. All hydraulic structures would be designed such that the proposed structures would not significantly increase upstream flooding and would not increase the flood hazard potential of the existing floodplain.

TABLE 4-6: 100-YEAR FLOODPLAIN IMPACTS

Alternative	Number of Floodplain Crossings	Total Floodplain Impacts (acres)
Alternative 1	4	10.44
Alternative 3	4	9.94
Alternative 4	3	5.87
Alternative 5	3	10.46
Alternative 6	4	5.35

Construction of any of the alternatives under consideration would increase the amount of impervious surface area within the study area, thereby increasing stormwater runoff to local waterways. The area impacted by this increased runoff would be minor in relation to the remaining pervious surface areas. The increased amount of road surface draining into the area would be small in relation to overall drainage areas.

Major Drainage Structures

Each of the alternatives under consideration crosses several streams or drainages for which box culverts or pipe culverts would be required to maintain hydraulic flow. A field investigation and preliminary hydraulic study was conducted for the major stream crossings along the project alternatives. This investigation is documented in the hydraulic technical report prepared for the project (Mulkey 2008). The report identifies the stream crossings for which a hydraulic structure would be required (streams or drainages requiring a 72-inch pipe or larger culvert) and describes the type and size of hydraulic structure required at each site. Twenty-three stream crossing sites were determined to require a hydraulic structure. These sites are listed in Table 4-7. None of the wetland or pond impact sites along the alternatives were determined to require a hydraulic structure.

TABLE 4-7: SUMMARY OF HYDRAULIC RECOMMENDATIONS						
Site	**Stream**	**Alternatives**	**Existing Structure**	**Drainage Area (sq. mi.)**	**Flood Zone**	**Recommended Structure**
1	Abbott's Creek	1,3,4,5,6	Bridge 1@ 51'; 1@ 50'; 1@ 51'	33.08	Yes	Retain and add additional bridge
2	UT Reedy Run	1,3,5	6' x 6' RCBC (1)	0.28	No	8' x 7' RCBC (1)
3	Brushy Fork	1	None	0.24	No	12' x 6' RCBC (1)
4	UT Brushy Fork	1	None	0.19	No	9' x 7' RCBC (1)
5	UT Brushy Fork	1	5' x 5' RCBC (1)	0.15	No	7' x 5' RCBC (2)
6	Brushy Fork	1	6' x 7' RCBC (3)	1.36	Yes	9' x 8' RCBC (2)
7	UT South Fork Muddy Creek	1	9' x 9' (4)	6.50	Yes	180' Dual 45" bridge
8	Fiddler's Creek	1	10' x 11.5' RCBC (4)	9.73	Yes	280' Dual 54" bridge
9	UT Spurgeon Creek	4,6	None	0.92	No	10' x 7' RCBC (2)
10	Brushy Fork	4,6	None	3.09	Yes	325' Dual 54" bridge
11	Long Branch	3,6	None	0.41	No	6' x 7' RCBC (2)
12	South Fork Muddy Creek	3,6	None	8.17	Yes	250' Dual 54" bridge
13	Fiddler's Creek	3,6	None	9.81	Yes	300' Dual 54" bridge
14	UT Reedy Run	3,5	None	0.32	No	7' x 6' RCBC (2)
15	UT Reedy Run	3,5	None	0.59	No	8' x 7' RCBC (3)
16	UT Brushy Fork	3,5	None	2.01	Yes	12' x 8' RCBC (3)
17	Brushy Fork	3,5	None	3.30	Yes	300' Dual 54" bridge
18	Long Branch	4,5	None	0.71	No	6' x 7' RCBC (2)
19	Long Branch	4,5	None	0.17	No	7' x 7' RCBC (1)
20	UT Soakas Creek	4,5	None	0.58	No	7' x 7' RCBC (2)
21	UT Soakas Creek	4,5	None	0.16	No	5' x 6' RCBC (2)
22	Soakas Creek	4,5	10' x 13' RCBC (2)	4.57	Yes	Retain and extend RCBC
23	Soakas Creek	4,5	10' x 9.5' RCBC (3)	4.77	Yes	Retain and extend RCBC

4.1.3.8 Protected Lands

The project would not impact any Wild and Scenic Rivers, State or National Forests, gamelands or preservation areas.

4.1.4 Cultural Resources

4.1.4.1 Historic Architectural Resources

The potential effect of the proposed project on historic architectural resources was evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended. According to the criteria for Effect and Adverse Effect developed by the Advisory Council on Historic Preservation, potential effect is based upon the following:

- No Effect – There would be no effect, neither adverse nor beneficial, on potential cultural resources.
- No Adverse Effect – There would be an effect, but it is determined that the effect would not compromise those characteristics which qualify the property for listing on the National Register.
- Adverse Effect – There would be an effect that would compromise the integrity of the property.

As discussed in Section 3.4.1, there are three properties within the Area of Potential Effect (APE) which are either listed on the National Register of Historic Places or have been determined to be eligible for listing on the National Register. These resources, shown in Figure 3-8, include the George W. Wall House, the D. Austin Parker House, and the Mark Parker House. The George W. Wall House is listed on the National Register.

None of the proposed alternatives would require right of way from any of these three properties. For the George W. Wall House, the HPO concurred with the determination of **No Adverse Effect** for Alternative 1 and **No Effect** for the other four alternatives. For the D. Austin Parker House and the Mark Parker House, the HPO concurred with the determination of **No Adverse Effect** for Alternatives 3 and 6 and **No Effect** for Alternatives 1, 4, and 5. A copy of the HPO concurrence form, dated December 11, 2009, is in Appendix A.2.

4.1.4.2 Archaeological Resources

Based on the prior archaeological reviews of the project study area (NCDOT 1993, 1995), it was determined that all the build alternatives under consideration would have equal likelihood of impacting prehistoric and historic archaeological sites. Therefore, NCDOT, in coordination with the State Historic Preservation Office, has determined that no further detailed studies of the corridors will be completed until a preferred corridor is selected. Once the preferred alternative is selected, NCDOT and HPO will determine a survey protocol for evaluating archaeological resources within the corridor (see HPO letter in Appendix A.2). Should items be located, NCDOT will coordinate with the Office of State Archaeology as needed to determine what further action should be taken.

4.1.4.3 Section 4(f) Analysis

As described in Section 4.1.4.1, HPO has reached a finding of No Effect or No Adverse Effect for each of the alternatives on the three resources within the APE for the project. No part of any of these three properties would be used by any of the alternatives. Impacts to these three properties would be limited to minor visual and/or noise effects: Alternative 1 may have a slight effect on the George W. Wall House and Alternatives 3 and 6 may have slight effects on the D. Austin Parker and Mark Parker Houses from this perspective. These effects would not, however, constitute substantial impairment of any of these properties, so the impacts would not constitute constructive use under Section 4(f). For this reason, Section 4(f) would not apply to any of the historic properties in the project area. As indicated in Section 4.1.1.3.3, none of the alternatives

would impact any parks or recreation areas; Section 4(f) therefore would not apply to any parks or recreation areas in the project area.

4.1.5 Natural Environment

This section describes potential impacts of the proposed project to the following aspects of the existing natural environment: soils, biotic communities and wildlife, and water resources.

4.1.5.1 Soils

Review of available information for the project area indicates that there are no soils or geological features that would preclude or alter the corridors of the alternatives under consideration. Detailed geotechnical investigations will be undertaken as part of the design phase if one of the five build alternatives is selected as the preferred alternative.

4.1.5.2 Biotic Communities and Wildlife

4.1.5.2.1 Terrestrial Plant Communities

Table 4-8 summarizes acreages of terrestrial communities located within the study area. Maintained communities may include the impervious surface associated with the existing roads. Detailed descriptions of these communities are included in Section 3.5.2.1 and in the *Natural Resources Technical Report* (Lochner, 2007c).

The maintained-disturbed community type accounts for the majority of the vegetative cover in all of the alternatives. The dry-mesic oak hickory forest is the next most abundant community type within the study area. Piedmont/low mountain alluvial forest communities are represented least within the study area.

TABLE 4-8: TERRESTRIAL PLANT COMMUNITY IMPACTS (ACRES)

Terrestrial Community	Alternative 1	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Piedmont/Low Mountain Alluvial Forest	0.34	2.24	0.53	0.84	2.11
Dry-Mesic Oak-Hickory Forest	30.94	131.21	86.16	117.02	104.31
Agriculture	15.37	81.42	71.16	76.86	75.05
Pine	1.10	15.81	7.65	5.58	16.21
Clear Cut	22.86	8.10	19.22	20.30	7.02
Maintained-Disturbed	146.56	53.87	89.61	74.84	69.47
TOTAL	217.17	292.67	274.33	295.43	274.17

4.1.5.2.2 Wildlife

Most of the project area is rural in character with scattered residential and small commercial developments. Large forested areas are still present near the project study area, but are limited

primarily to lands immediately adjacent to the larger streams. Clearing and conversion of land for highways, railroads, agricultural, timberland, commercial, and residential uses has eliminated cover and protection for many species of wildlife, but has increased habitat for others that are able to utilize these anthropogenic habitats. There is little habitat for interior species, but woodland strips bordering small tributaries often serve as travel corridors between habitat types. Agricultural fields and residential areas not only provide food for wildlife, but also create edge habitat favored by many species.

Any of the project alternatives would impact area wildlife. Due to the existing amount of urban development in the project area, wildlife habitat is fragmented. The new location alternatives and the portion of Alternative 1 on new location would add further fragmentation to the area. Wildlife expected to occur in the project area are generally acclimated to fragmented landscapes in this area. However, fragmentation and loss of forested habitat may impact other wildlife in the area by reducing potential nesting and foraging areas, as well as displacing animal populations. Furthermore, forested areas provide connectivity between populations of conspecifics, allowing for gene flow, as well as a means of safe travel from one foraging area to another. In particular, songbirds may be heavily affected by fragmented forests because this increases their susceptibility to predation and nest parasitism.

Measures to be implemented during design and construction of the project that can minimize impacts to local wildlife include Best Management Practices (BMPs) to minimize erosion and sedimentation, and the construction of culverts that can provide passage from one side of the road to the other. No bridges are recommended for wildlife crossings on this project.

4.1.5.2.3 Aquatic Communities

The diversity of streams within the project study area provide habitat for a variety of aquatic species. Large streams with good water quality and a diversity of aquatic habitats are expected to support a more diverse assemblage of fish and other aquatic organisms than smaller tributaries.

Water resource impacts may result from the physical disturbance of the forested stream buffers that adjoin most of the streams within the study area. Removing streamside vegetation increases direct sunlight penetration, which ultimately elevates water temperatures within the stream. An increase in stream water temperatures often stresses or reduces the population of aquatic organisms. Disturbing stream buffers can also create unstable stream banks, further increasing downstream sedimentation. Shelter and food resources, both in the aquatic and terrestrial portions of these organisms' life cycles, will be affected by losses in the terrestrial communities. The loss of aquatic plants and animals will affect terrestrial fauna that rely on them as a food source.

The removal of the riparian buffer may also increase the amount of sediment released into the stream. Temporary and permanent impacts to aquatic organisms may result from this increased sedimentation. Sediments have the potential to affect fish and other aquatic life in several ways, including the clogging and abrading of gills and other respiratory surfaces, affecting the habitat

by scouring and filling of pools and riffles, altering water chemistry, and smothering different life stages. Increased sedimentation may cause decreased light penetration through an increase in turbidity.

Stockpiled material should be kept a minimum of 50 feet from the stream channels. In situations where water depth is 3 to 18 feet and the velocity is slow (such as in a swamp) silt fences should also be erected around any stockpiled material in order to minimize the chance of erosion or run-off from affecting the stream channel. Wet concrete should not come into contact with surface water during bridge construction as it can adversely affect aquatic life. NCDOT's *Best Management Practices (BMPs) for the Protection of Surface Waters* (1997) should be strictly enforced to reduce impacts during all construction phases.

4.1.5.3 Water Resources

4.1.5.3.1 Groundwater

The northern and western parts of the proposed project occur in the Muddy Creek subbasin and the southern parts occur in the Abbotts Creek subbasin.

Short-term impacts to water quality, such as sedimentation and turbidity, may result from construction-related activities. Temporary construction impacts due to erosion and sedimentation would be minimized through implementation of a stringent erosion control schedule and the use of Best Management Practices (BMPs). The contractor would be required to follow contract specifications pertaining to erosion control measures as outlined in 23 CFR 650 Subpart B and Article 107-13 entitled *Control of Erosion, Siltation, and Pollution* pursuant to NCDOT's *Standard Specifications for Roads and Structures*. These measures include the use of dikes, berms, silt basins, and other containment measures to control runoff. Measurements include the elimination of construction staging areas in floodplains and adjacent waterways. Disturbed sites will be revegetated with herbaceous cover after construction to help reduce runoff and sediment loadings. Direct discharges into streams should be avoided whenever possible. Runoff effluent should be permitted to filter through roadside vegetation in order to remove possible contaminants and to decrease runoff velocities.

Long-term impacts on water quality are also possible due to particulates, heavy metals, organic matter, pesticides, herbicides, nutrients, and bacteria that are often found in highway runoff. The following mitigation measures to eliminate or reduce short-term and long-term water quality impacts would be incorporated wherever practicable:

- Development of roadway alignments that avoid streams and ponds to the extent possible;
- Use of design measures to protect water supplies, minimizing stream crossings, and minimizing segments of roadway that closely parallel streams;
- Use of grass shoulders, grass lined ditches, and vegetative buffers to intercept highway runoff;

- Implementation of construction practices that protect stream bottom habitat from siltation by sedimentation control, retention of riparian vegetation buffers, and restoration of stream bottom habitat taken by construction; and
- Restricting use of bridge deck drains in bridges.

4.1.5.3.2 Surface Water

Only one stream, an unnamed tributary to Salem Creek, is within any of the build alternative corridors. It is at the far northwest corner of Alternative Corridors 1, 3 and 6. It is north of I-40 and would not be impacted by the alternatives within these corridors.

Expected effects of the project on surface water are similar among the build alternatives. Stormwater runoff rates would increase slightly due to the increase in impervious roadway surface area. This is an unavoidable, long-term impact resulting from construction of any build alternative. The No-Build Alternative would have no impact on surface water.

Pollutants that may be contained in the stormwater runoff include:

- Sediment eroded during construction activity;
- Pesticides, herbicides, and fertilizers used to plant and maintain highway landscaping;
- Petrochemicals, oil, grease, and heavy metals associated with operation of vehicles;
- Trash and debris discarded by highway users; and,
- Chemicals and hazardous materials accidentally spilled during transport.

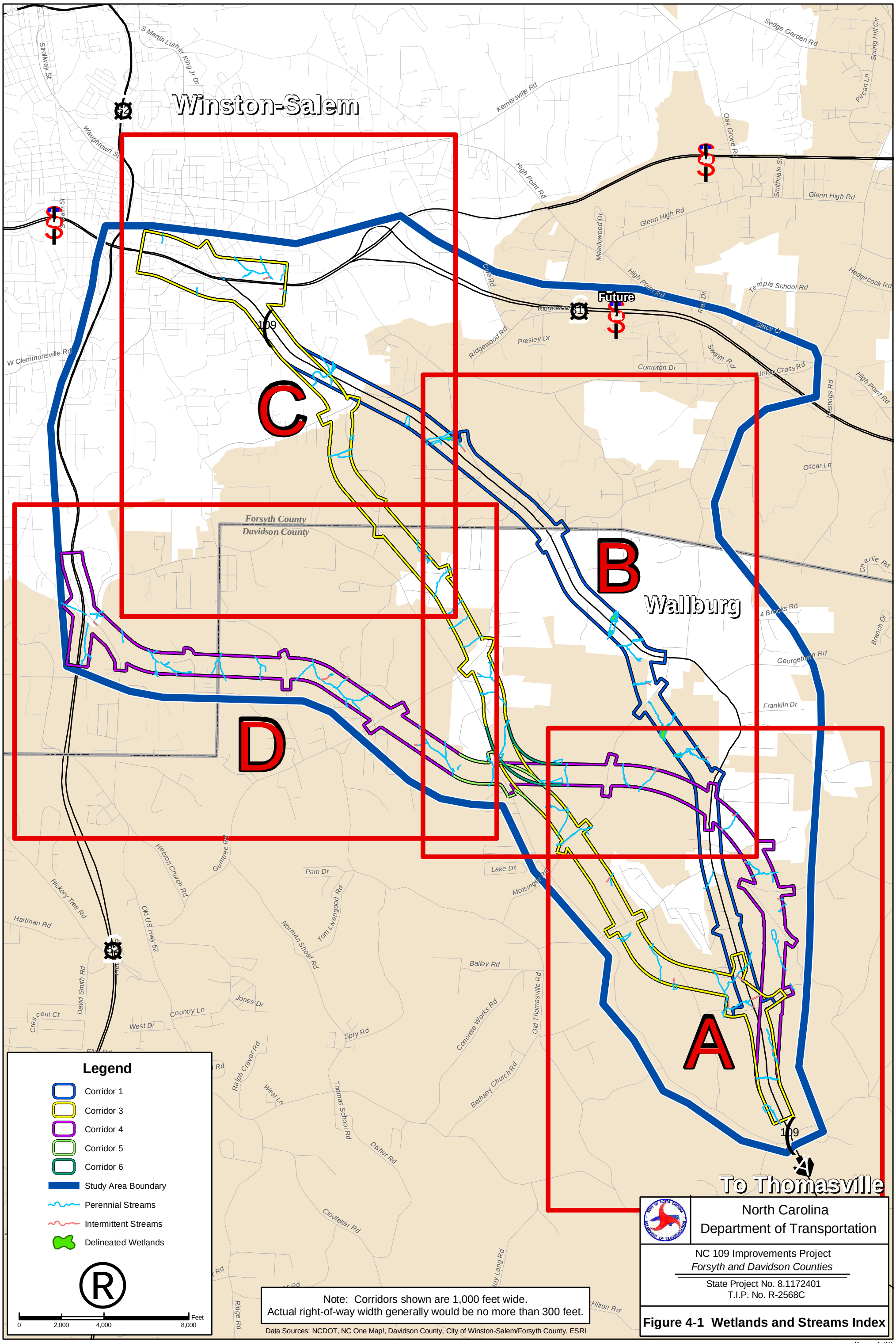
The project has the potential to temporarily degrade the quality of water in surrounding streams by means of soil erosion during construction. Construction impacts are presented in Section 4.1.6.

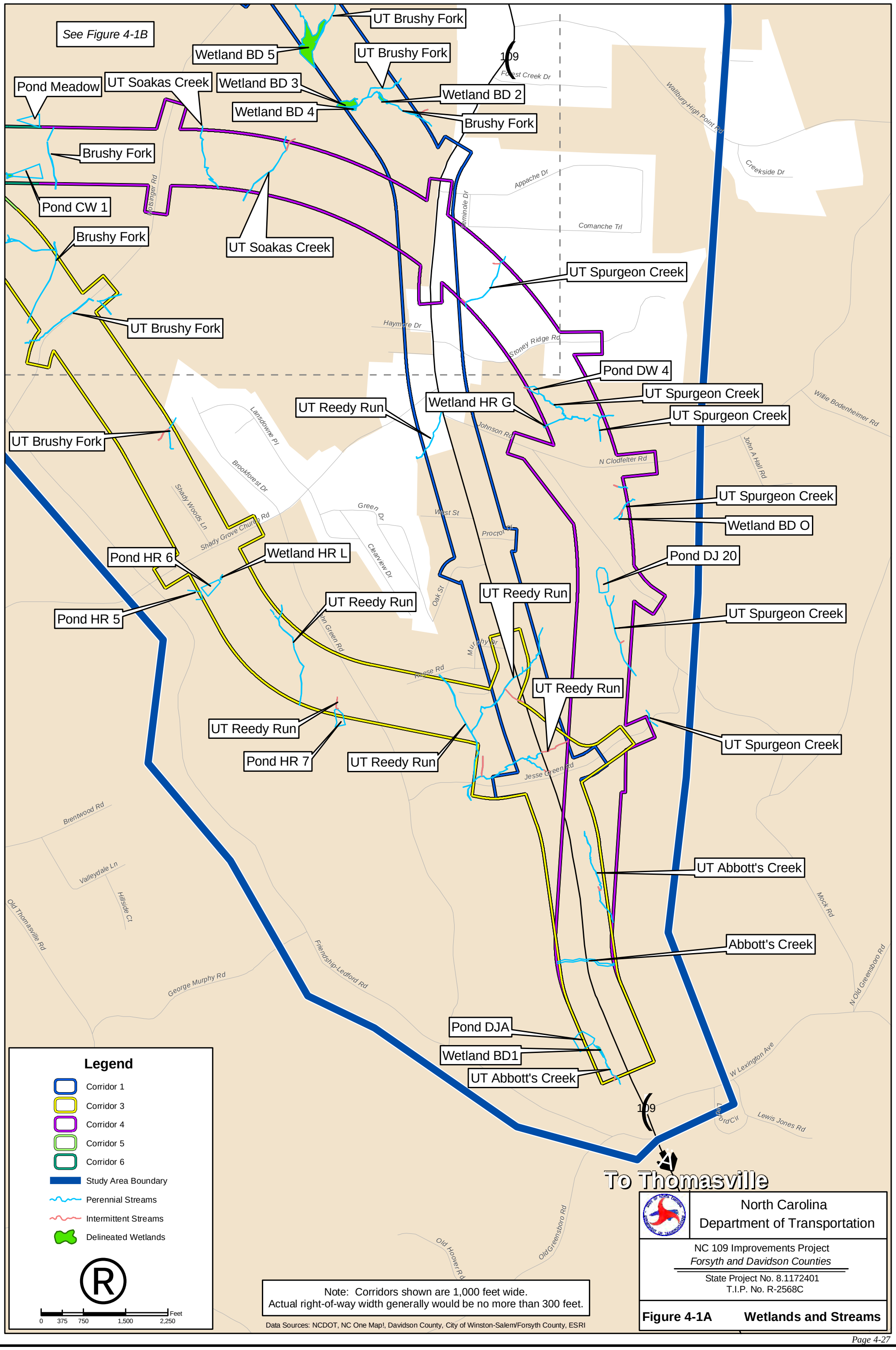
4.1.5.4 Jurisdictional Issues

4.1.5.4.1 Wetlands, Streams and Ponds

Project construction for any of the detailed study alternatives (DSAs) cannot be accomplished without infringing on jurisdictional waters, including streams, wetlands and ponds. 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.

The locations of streams, wetlands, and ponds estimated to be impacted by each DSA are shown in Figure 4-1. Table 4-9 presents the amount of streams, wetlands, and ponds to be impacted by each DSA. Detailed impacts are presented in the *Natural Resources Technical Report* (Lochner,


Winston-Salem
Future
Walburg
To Thomasville
A
B
C
D
Forsyth County
Davidson County
Legend
Corridor 1
Corridor 3
Corridor 4
Corridor 5
Corridor 6
Study Area Boundary
Perennial Streams
Intermittent Streams
Delineated Wetlands
0
2,000
4,000
8,000
Feet
Note: Corridors shown are 1,000 feet wide.
Actual right-of-way width generally would be no more than 300 feet.
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 4-1 Wetlands and Streams Index


See Figure 4-1B
UT Brushy Fork
Wetland BD 5
UT Brushy Fork
109
Forest Creek Dr
Pond Meadow
UT Soakas Creek
Wetland BD 3
Wetland BD 2
Wetland BD 4
Brushy Fork
Wallburg-High Point Rd
Creekside Dr
Brushy Fork
Appache Dr
Seminole Dr
Comanche Trl
Pond CW 1
Dotsinger Rd
Brushy Fork
UT Soakas Creek
UT Spurgeon Creek
UT Brushy Fork
Haymore Dr
Stoney Ridge Rd
Pond DW 4
UT Spurgeon Creek
UT Reedy Run
Wetland HR G
UT Spurgeon Creek
Willie Bodenheimer Rd
Johnson Rd
UT Brushy Fork
Lansdowne Pl
Brookforest Dr
N Clodfelter Rd
John A Hall Rd
UT Spurgeon Creek
Green Dr
West St
Shady Woods Ln
Shady Grove Church Rd
Wetland BD O
Proctor St
Pond HR 6
Wetland HR L
Pond DJ 20
Clearview Dr
Oak St
UT Reedy Run
Pond HR 5
UT Reedy Run
John Green Rd
UT Spurgeon Creek
Murphy Dr
Reese Rd
UT Reedy Run
UT Reedy Run
Pond HR 7
UT Reedy Run
UT Spurgeon Creek
Jesse Green Rd
Brentwood Rd
Valleydale Ln
Hillside Ct
UT Abbott's Creek
Mock Rd
Old Thomasville Rd
Friendship-Ledford Rd
Abbott's Creek
N Old Greensboro Rd
George Murphy Rd
Pond DJA
Wetland BD1
UT Abbott's Creek
W Lexington Ave
109
Lewis Jones Rd
To Thomasville
Old Hoover Rd
Old Greensboro Rd
Legend
Corridor 1
Corridor 3
Corridor 4
Corridor 5
Corridor 6
Study Area Boundary
Perennial Streams
Intermittent Streams
Delineated Wetlands
0 375 750 1,500 2,250 Feet
Note: Corridors shown are 1,000 feet wide.
Actual right-of-way width generally would be no more than 300 feet.
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
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NC 109 Improvements Project
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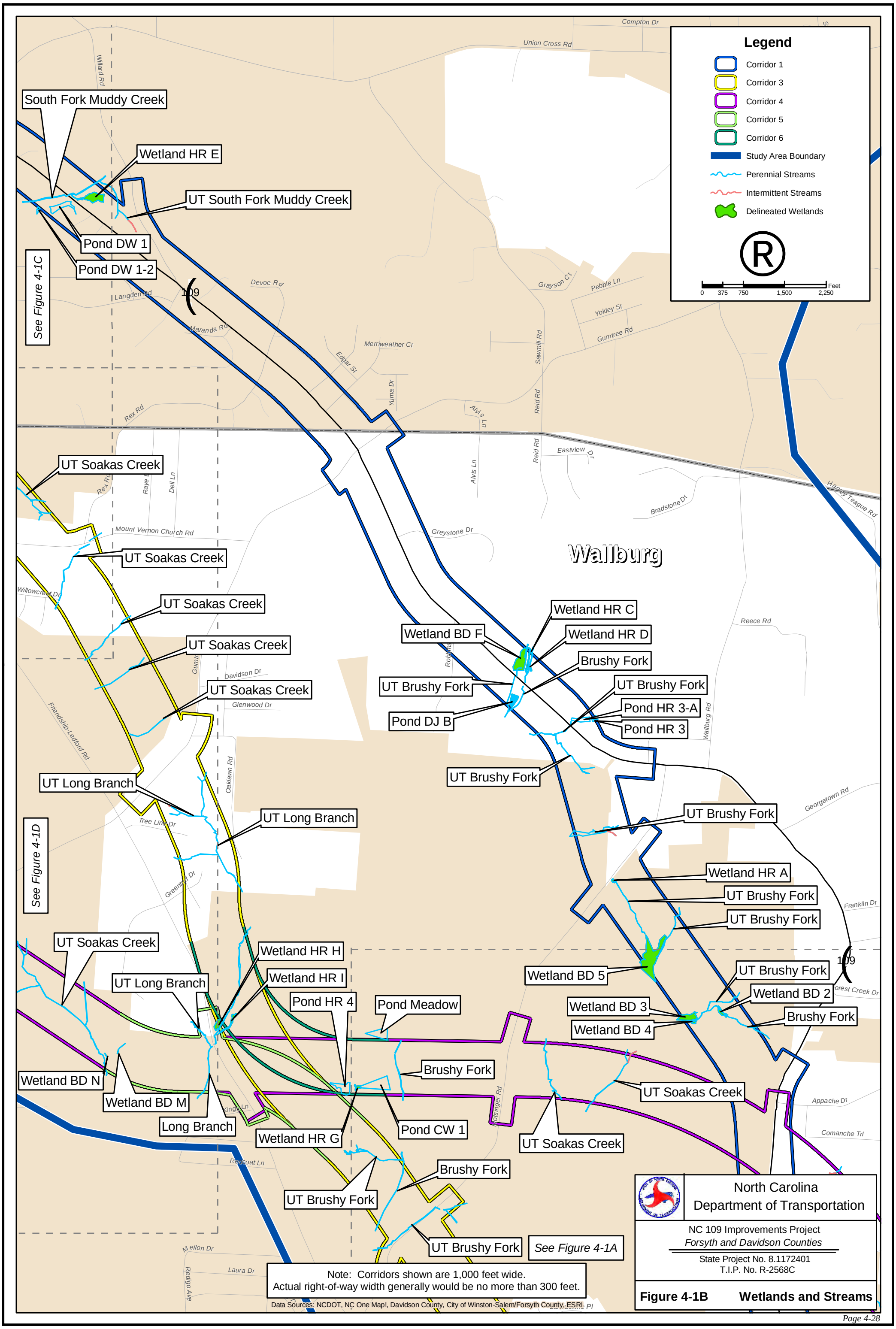
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 4-1A Wetlands and Streams


Legend
Corridor 1
Corridor 3
Corridor 4
Corridor 5
Corridor 6
Study Area Boundary
Perennial Streams
Intermittent Streams
Delineated Wetlands
0 375 750 1,500 2,250 Feet
South Fork Muddy Creek
Wetland HR E
UT South Fork Muddy Creek
Pond DW 1
Pond DW 1-2
See Figure 4-1C
UT Soakas Creek
UT Soakas Creek
UT Soakas Creek
UT Soakas Creek
UT Soakas Creek
UT Long Branch
UT Long Branch
See Figure 4-1D
UT Soakas Creek
Wetland HR H
Wetland HR I
Pond HR 4
Pond Meadow
UT Long Branch
Wetland BD N
Wetland BD M
Long Branch
Wetland HR G
Brushy Fork
Pond CW 1
UT Brushy Fork
Brushy Fork
Wetland BD F
Wetland HR C
Wetland HR D
Brushy Fork
UT Brushy Fork
Pond DJ B
UT Brushy Fork
Pond HR 3-A
Pond HR 3
UT Brushy Fork
UT Brushy Fork
Wetland HR A
UT Brushy Fork
UT Brushy Fork
Wetland BD 5
UT Brushy Fork
Wetland BD 2
Wetland BD 3
Wetland BD 4
Brushy Fork
UT Soakas Creek
Wetland HR B
UT Brushy Fork
See Figure 4-1A
Wallburg
Union Cross Rd
Compton Dr
Willard Rd
Devoe Rd
Langden Rd
Maranda Rd
Merriweather Ct
Edgar St
Yuma Dr
Sawmill Rd
Grayson Ct
Pebble Ln
Yokley St
Gumtree Rd
Rex Rd
Alvis Ln
Reid Rd
Eastview Dr
Bradstone Dr
Greystone Dr
Harpers Teague Rd
Mount Vernon Church Rd
Willowcreek Dr
Davidson Dr
Glenwood Dr
Friendship-Ledford Rd
Oaklawn Rd
Tree Line Dr
Greenleaf Dr
Robbins Rd
Reece Rd
Wallburg Rd
Georgetown Rd
Franklin Dr
Forest Creek Dr
Appache Dr
Comanche Trl
Kingsinger Rd
Kings Ln
Redcoat Ln
Mellon Dr
Laura Dr
Redigo Ave
Dell Ln
Raye Ln
109
109
Note: Corridors shown are 1,000 feet wide.
Actual right-of-way width generally would be no more than 300 feet.
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
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NC 109 Improvements Project
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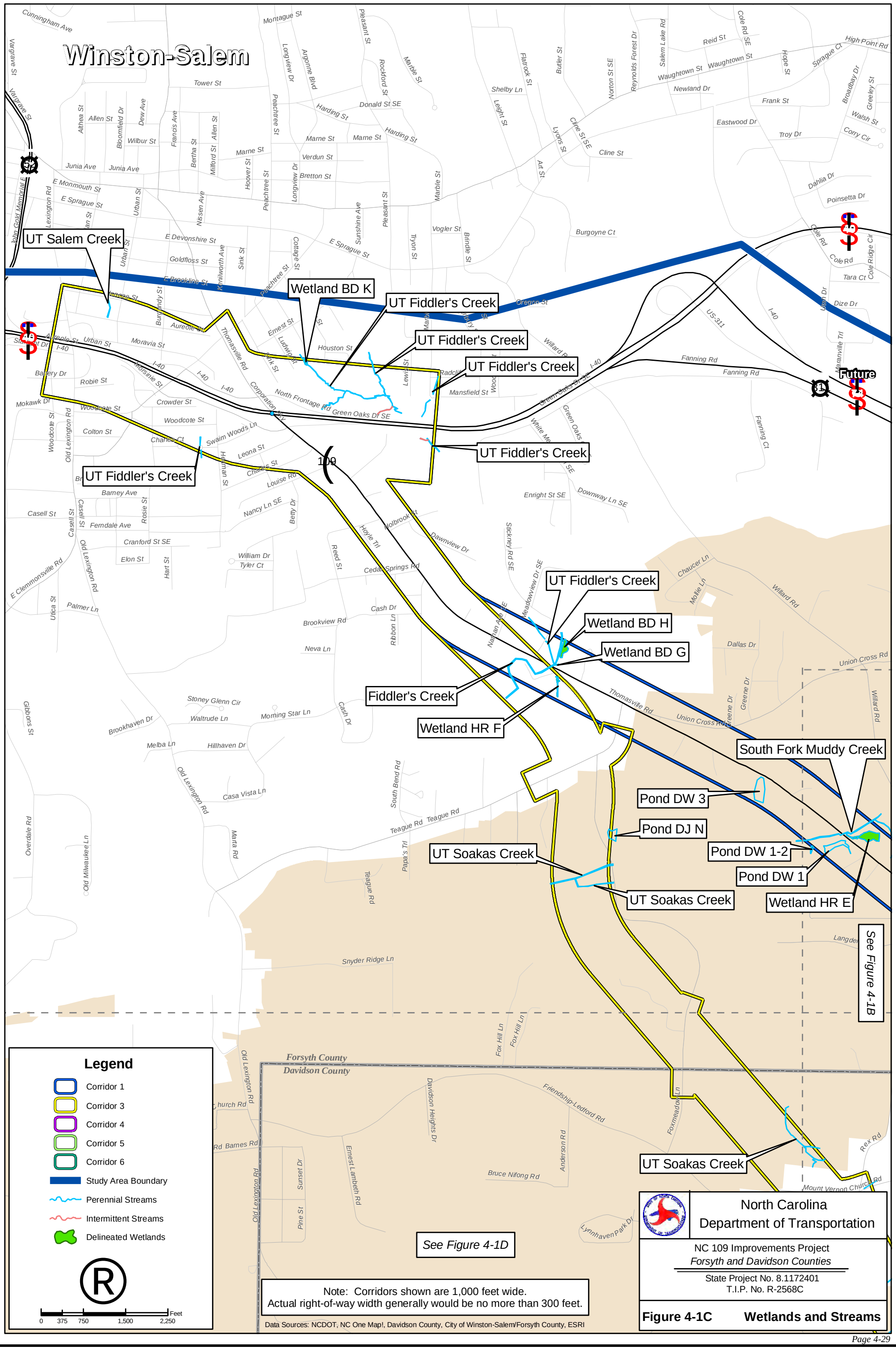
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 4-1B Wetlands and Streams


Winston-Salem
UT Salem Creek
Wetland BD K
UT Fiddler's Creek
UT Fiddler's Creek
UT Fiddler's Creek
UT Fiddler's Creek
UT Fiddler's Creek
UT Fiddler's Creek
Wetland BD H
Wetland BD G
Fiddler's Creek
Wetland HR F
South Fork Muddy Creek
Pond DW 3
Pond DJ N
Pond DW 1-2
Pond DW 1
UT Soakas Creek
UT Soakas Creek
Wetland HR E
UT Soakas Creek
Future
See Figure 4-1B
See Figure 4-1D
Forsyth County
Davidson County
Legend
Corridor 1
Corridor 3
Corridor 4
Corridor 5
Corridor 6
Study Area Boundary
Perennial Streams
Intermittent Streams
Delineated Wetlands
0 375 750 1,500 2,250 Feet
Note: Corridors shown are 1,000 feet wide.
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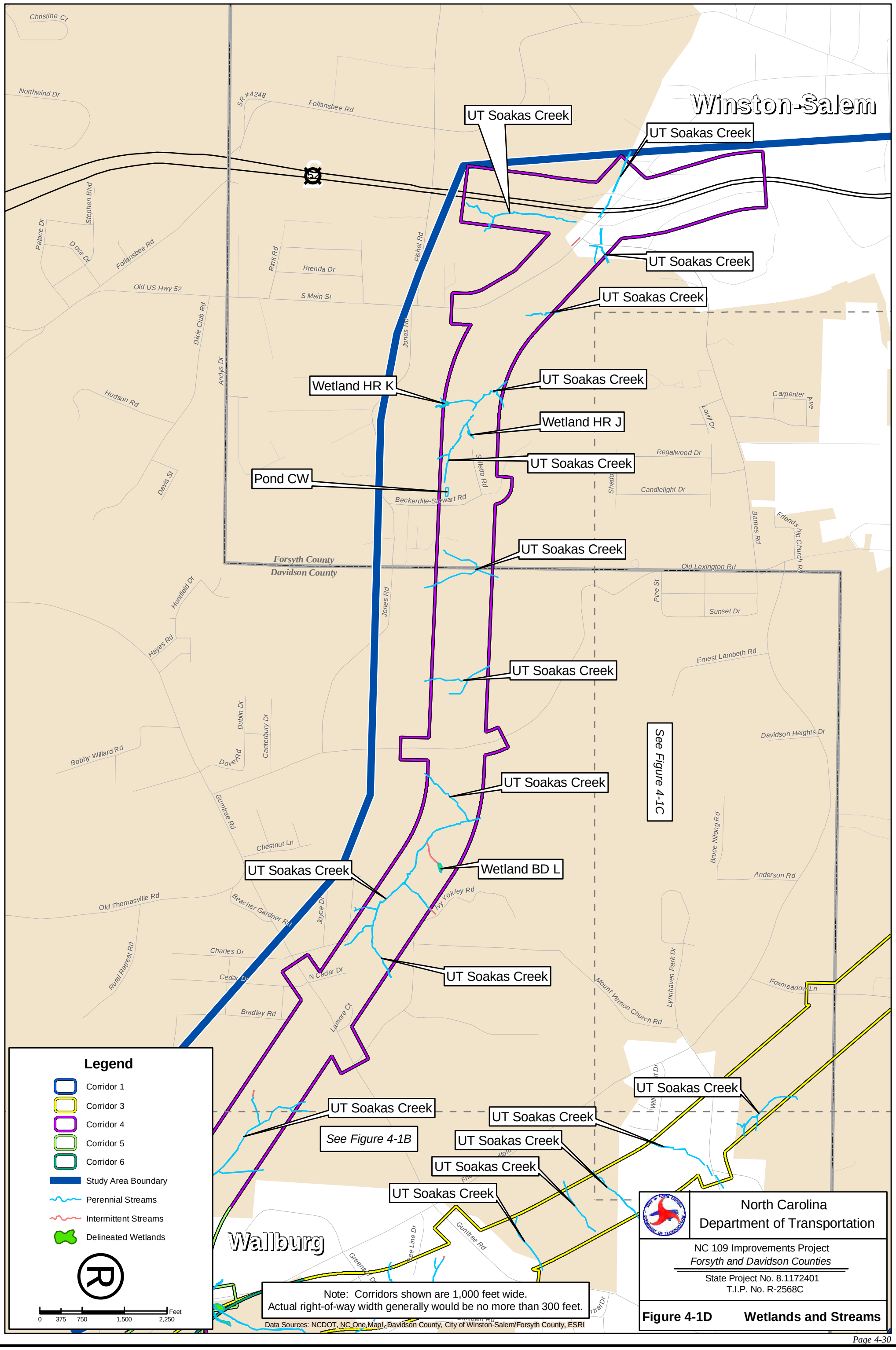
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 4-1C Wetlands and Streams


Winston-Salem
Walburg
Forsyth County
Davidson County
UT Soakas Creek
Wetland HR K
Wetland HR J
Wetland BD L
Pond CW
See Figure 4-1C
See Figure 4-1B
Christine Ct
Northwind Dr
SR #4248
Follansbee Rd
Stephen Blvd
Palace Dr
Dove Dr
Old US Hwy 52
S Main St
Brenda Dr
Rhyk Rd
Fishel Rd
Jones Rd
Dixie Club Rd
Andys Dr
Hudson Rd
Davis St
Beckerdite-Stewart Rd
Regalwood Dr
Candlelight Dr
Carpenter Ave
Lovill Dr
Barnes Rd
Friendship Church Rd
Old Lexington Rd
Pine St
Sunset Dr
Ernest Lambeth Rd
Davidson Heights Dr
Huntfield Dr
Hayes Rd
Dublin Dr
Canterbury Dr
Dove Rd
Bobby Willard Rd
Gumtree Rd
Chestnut Ln
Old Thomasville Rd
Beacher Gardner Rd
Joyce Dr
Ivy Yokley Rd
Rural Retreat Rd
Charles Dr
Cedar Dr
N Cedar Dr
Bradley Rd
Lamore Ct
Mount Vermon Church Rd
Lynnhaven Park Dr
Foxmeadow Ln
Anderson Rd
Bruce Nifong Rd
Greenwood Dr
Tree Line Dr
Legend
Corridor 1
Corridor 3
Corridor 4
Corridor 5
Corridor 6
Study Area Boundary
Perennial Streams
Intermittent Streams
Delineated Wetlands
0 375 750 1,500 2,250 Feet
Note: Corridors shown are 1,000 feet wide.
Actual right-of-way width generally would be no more than 300 feet.
Data Sources: NCDOT, NC One Map!, Davidson County, City of Winston-Salem/Forsyth County, ESRI
North Carolina
Department of Transportation
NC 109 Improvements Project
Forsyth and Davidson Counties
State Project No. 8.1172401
T.I.P. No. R-2568C
Figure 4-1D Wetlands and Streams

2007c) prepared for this project; tables summarizing this information are presented in Appendix E. 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 jurisdictional resources that are to be bridged can be found in Section 4.1.3.7. The impacts were calculated using slope stakes plus 25 feet.

Based on the information in Table 4-9, Alternative 5 would have the greatest total stream impacts (10,729 linear feet) and the greatest perennial stream impacts. Alternative 4 would have slightly higher intermittent stream impacts. Alternatives 4 and 5 would have the greatest number of stream crossings (34). Alternative 1 would have the lowest total stream impacts (4,432 linear feet and the lowest number of stream crossings (20). Alternative 1 would affect the most wetlands and ponds, impacting 0.58 wetland acres in six wetlands and 0.61 pond acres. Alternative 6 would impact the least wetlands, impacting 0.14 acres and two wetlands. Alternatives 4 and 6 would not impact any ponds.

TABLE 4-9: IMPACTS TO JURISDICTIONAL WATERS

Alternative	Perennial Stream Impacts (linear ft)	Total Stream Impacts (linear ft)	Total Number of Stream Crossings	Wetland Impact Area (acres)	Total Number of Wetlands Impacted	Pond Impact Area (acres)
1	4,067	4,432	20	0.58	6	0.61
3	7,203	7,757	24	0.15	2	0.46
4	7,862	9,259	34	0.21	3	0
5	9,368	10,729	34	0.16	4	0.46
6	5,910	6,500	24	0.14	2	0

Source: Data in table were calculated using GIS with data from the *Natural Resources Technical Report* prepared for this project (Lochner, 2007c) and preliminary engineering designs dated July 21, 2009.

4.1.5.4.2 Buffer Areas

The Yadkin-Pee Dee River basin is not subject to vegetated riparian buffer requirements by the State of North Carolina.

4.1.5.4.3 Mitigation Evaluation

Mitigation has been defined in NEPA regulations to include efforts which: a) avoid; b) minimize; c) rectify; d) reduce or eliminate; or e) compensate for adverse impacts to the environment [40 CFR 1508.20 (a-e)]. Mitigation of wetland impacts is recommended in accordance with Section 404(b)(1) Guidelines of the CWA (40 CFR 230), FHWA step-down procedures (23 CFR 777.1 et seq.), mitigation policy mandates articulated in the USACE/EPA Memorandum of Agreement (MOA), Executive Order 11990 (42 FR 26961) (1977), and USFWS mitigation policy directives (46 FR 7644-7663) (1981).

Section 404(b)(1) Guidelines, the USACE/EPA MOA, and Executive Order 11990 stress avoidance and minimization as primary considerations for protection of wetlands. Practicable alternatives analysis must be fully evaluated before compensatory mitigation can be discussed.

Federal Highway Administration policy stresses that all practicable measures should be taken to avoid or minimize harm to wetlands which will be affected by federally funded highway construction. A sequencing (step-down) procedure is recommended in the event that avoidance is impossible. Mitigation employed outside of the highway right-of-way must be reviewed and approved on a case-by-case basis.

Avoidance and Minimization

During development of preliminary designs for the proposed project, efforts were taken to avoid and minimize impacts to wetlands, streams, and buffers where possible. Impacts can be avoided to streams, wetlands, and federally protected species with the use of environmentally sensitive design. Impacts to the jurisdictional surface waters were minimized by crossing streams at a perpendicular angle, and can be further minimized by avoiding construction activities in the stream channels, and avoiding deposition into the stream channel during roadway construction. Adjustment to the roadway alignment was made to avoid these sensitive areas.

Other Avoidance and Minimization Measures

Best Management Practices (BMPs) will be implemented in an effort to further minimize impacts. Reduction of fill slopes at stream and wetland crossings will reduce necessary wetland impacts. Conservative use of culverts and sensitive placement of drainage structures will minimize further degradation of water quality and reduce adverse impacts on aquatic habitat viability in streams and tributaries.

Compensatory Mitigation

The USACE may require compensation under an Individual Permit if the discharge causes the loss of greater than 0.1 acres of Waters of United States or if the activity causes more than 150 linear feet of perennial streambed impacts or intermittent streambed impacts if the intermittent stream has important aquatic function(s) as denoted on USACE's "Intermittent Channel Evaluation Form." In accordance with 15A NCAC 2H .0506(h), NCDWQ may require compensation for impacts to 150 linear feet or more of jurisdictional streams and/or one acre or more of wetlands.

The USACE may require compensation for all cumulative jurisdictional impacts to wetlands and perennial streambed or important intermittent streambed that result from activities authorized under an Individual Permit. The NCDWQ may require compensation for all cumulative jurisdictional stream and wetland impacts for activities authorized under a Major Water Quality Certification (WQC).

Impacts incurred during project construction may require mitigation. Final compensation requirements for stream and wetland impacts are left to the discretion of USACE and NCDWQ.

Appropriate compensatory mitigation requirements for wetland and stream impacts from the preferred alternative would be determined in consultation with these agencies. A conceptual mitigation plan would be developed for the preferred alternative and presented in the Final Environmental Impact Statement. A final mitigation plan would be completed prior to issuance of a Section 404 permit and Section 401 Water Quality Certification.

4.1.5.4.4 Protected Species

Complete surveys for all federally protected species were conducted along all build alternatives for the project. Prior to conducting field surveys suitable habitat was defined for each species. Suitable habitat for each species is defined in Section 3.5.4.3. Once the habitat requirements and life history information for each species were compiled, areas of likely suitable habitat were identified. These areas were established through review of project aerial photography, field notes from project wetlands delineation and determination efforts, and data from previous natural systems surveys done in the study area.

Literature searches regarding natural resources in the project area were initiated in the summer of 2006. Subsequent field work began in the fall of 2006 and was completed by fall 2007. The areas of likely suitable habitat were visited and surveyed for the particular species. The field surveys first consisted of an assessment of the area's likelihood of being suitable habitat as identified in the research material and element occurrence records. Each area was visually inspected by a team of experienced biologists. If the field visit determined that the area was suitable habitat, then intensive searches for the particular species were conducted. Prior to conducting field surveys, North Carolina Natural Heritage Program (NCNHP) element occurrence records were reviewed to determine the status of known element occurrences in the area.

Bog turtle (*Clemmys muhelbergii*)

BIOLOGICAL CONCLUSION: Not Applicable

The southern population of the bog turtle is listed as Threatened due to Similarity of Appearance to the northern population; therefore, the southern population is not afforded protection under ESA §7. No known occurrence of the bog turtle has been reported by the NCNHP within the project vicinity (0.5 mile on all sides of the project study area). While suitable habitat for the bog turtle is present in the project area, no evidence of this species was observed during field surveys within the study area or project vicinity.

Bald eagle (*Haliaeetus leucocephalus*)

BIOLOGICAL CONCLUSION: No Effect

NCNHP records (reviewed October 16, 2006) did not indicate any occurrences of bald eagles or their nests within the project vicinity. Field inspection for suitable nesting and foraging habitat was conducted within the study area and within another one mile radius beyond the study area. No suitable nesting or foraging habitat for this species was observed within the study area or project vicinity. The surface waters are either too small, impacted by development or agriculture,

or have a closed canopy, all of which would impair nesting and foraging activity. Given these circumstances, the proposed project will have No Effect on this species.

Red-cockaded woodpecker (*Picoides borealis*)
BIOLOGICAL CONCLUSION: No Effect
The project area and project vicinity are dominated by habitats lacking a prevalence of pine. The pine habitats which are present are generally less than 30 years old, have large components of hardwoods, occupy small areas, or have no other contiguous pine habitats.

A review of available NCNHP records, aerial mapping, and a site reconnaissance indicate that no areas of potentially contiguous nesting, roosting, or foraging habitats occur within a 0.5 mile radius surrounding the project study area. This 0.5 mile radius assessment area is required for a red-cockaded woodpecker survey. It can therefore be concluded that no suitable habitat for the red-cockaded woodpecker exists within the project study area; therefore, a Biological Conclusion of No Effect is rendered for this species.

Small-anthered bittercress (*Cardamine micranthera*)
BIOLOGICAL CONCLUSION: No Effect
Suitable habitat for this species exists within the study area in the form of seeps and wet rock crevices of stream banks, adjoining sandbars, moist woods near small streams fully to partially shaded by trees and shrubs. NCNHP records did not reveal any occurrences of this species within one mile of the study area. A Biological conclusion of "No Effect" was rendered per NCDOT Memorandum from Karen M. Lynch on September 11, 2006, which only requires surveys for small-anthered bittercress in the Dan River drainage (subbasin 03-02-01).

Schweinitz's sunflower (*Helianthus schweinitzii*)
BIOLOGICAL CONCLUSION: No Effect
A review of the NCNHP elemental occurrence database records indicate that no recorded occurrences of Schweinitz's sunflower are found within one mile of the project study area. A known population of the species is documented several miles south of the study area along NC109.

Suitable habitat for Schweinitz's sunflower exists within the project study area in the form of disturbed-maintained areas, including clearings, field edges, and roadsides. During the field reconnaissance (October-December 2006) several *Helianthus* plants were found within the study area, some with flowers still present, however none were *Helianthus schweinitzii*. Frost had already browned many perennial plants in the study area, and hard frosts continued throughout the field reconnaissance period. A second field study was conducted in September 2007, which falls within the flowering time for this species. No Schweinitz's sunflower individuals were observed during the survey. A Biological Conclusion of No Effect is rendered for this species.

4.1.5.4.5 Essential Fish Habitat
No essential fish habitat will be impacted by any of the project alternatives.

4.1.5.4.6 Areas of Environmental Concern

No AECs will be impacted by any of the project alternatives.

4.1.5.4.7 Anadromous Fish Habitat

No anadromous fish habitat will be impacted by any of the project alternatives.

4.1.6 Construction Impacts

All of the build alternatives under consideration would have similar construction impacts. All of the construction impacts listed below would be temporary in nature and can be controlled, minimized, or mitigated through conformance with Best Management Practices (BMPs) and standard NCDOT procedures. For detailed information concerning BMPs, refer to the NCDOT guide, *Best Management Practices for Construction and Maintenance Activities* (2006). This section of the DEIS describes the potential construction impacts of the project.

4.1.6.1 Energy

Construction of any of the alternatives is expected to result in less total energy utilization than the No-Build Alternative. Construction of the facility would initially require the consumption of energy and resources that would not be used if the project were not built. Operation of the facility, however, would compensate for the energy lost during construction by increasing the efficiency of the regional roadway system.

Increased energy efficiency on the new facility would be attributed to its improving capacity and traffic flow, resulting in decreased vehicle delays, more efficient vehicle operating speeds, and diversion of traffic away from less convenient and less efficient roadways.

4.1.6.2 Lighting

Temporary impacts due to lighting used during construction are expected to occur. Properties near the construction area may experience these impacts. Impacts due to lighting can be minimized by regulating the hours of construction activities in sensitive areas.

4.1.6.3 Visual

Short term visual impacts are expected to occur due to construction activities and equipment. To reduce the potential for visual impacts, construction activities would be contained within as minimal an area as practical. Construction easements on parcels outside the alignment, where required, would be managed to minimize potential visual impact. Following construction, ground cover, landscaping, or related materials may be used to restore or enhance areas to preconstruction conditions or better.

4.1.6.4 Noise

Construction of the project will result in temporary increases in noise levels within the vicinity of the project. Noise and vibration impacts would be from the heavy equipment movement and construction activities such as pile driving. Sensitive receivers located close to the construction activities may temporarily experience increased noise levels.

Construction noise can be controlled by regulating the hours of construction and equipping machinery with noise reduction devices. Storage and staging areas would be located as far from noise sensitive areas as practicable. NCDOT specifications require the contractor to limit noise levels to 80 dBA Leq in noise-sensitive areas adjacent to the project. The NCDOT also reserves the right to monitor construction noise and to require noise abatement where limits are exceeded. NCDOT can also limit work that produces objectionable noise during normal sleeping hours.

4.1.6.5 Air Quality

Construction activities could have a short-term impact on air quality, primarily during site preparation. Particulate matter (dust) is the pollutant of primary concern during the construction period. Dust would be generated during earth moving activities, handling of cement, asphalt, or aggregate, and equipment travel over unpaved haul roads. Wind erosion of exposed areas and material stockpiles would also generate particulate matter.

The amount of dust generated would vary, depending on the construction activity and local weather conditions. Where excess dust is anticipated to be a problem, effective dust control measures would be implemented in accordance with standard NCDOT procedures. Dust control would be the responsibility of the contractor and could include:

- Minimizing exposed earth surface;
- Temporary and permanent seeding and mulching;
- Watering working and haul areas during dry periods;
- Covering, shielding, or stabilizing material stockpiles; and
- Using covered haul trucks.

Emissions from construction equipment are regulated by federal standards. Any burning of cleared materials would be conducted in accordance with applicable State and local laws, regulations, and ordinances. Specifically, a Burning Permit from the North Carolina Division of Forest Resources must be obtained for burning within woodlands or 500 feet of woodlands under the protection of the Division of Forest Resources.

4.1.6.6 Utilities

Construction of the proposed project would require some adjustment, relocation or modification to existing public utilities such as natural gas pipelines, power transmission/distribution lines, water and sewer lines, and telephone and cable lines. Impacts to these utilities are described in Section 4.1.3.4. Any disruption to utility service during construction would be minimized by

phased adjustments to the utility lines and close coordination with utility providers and property owners in affected areas.

4.1.6.7 Water Quality

Runoff from the project construction site could impact water quality by the transport of sediment, nutrients, or hazardous materials. In accordance with the North Carolina Sedimentation and Pollution Control Act (15A NCAC 4B.0001.0027), 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 (see Section 4.1.6.8). BMPs to minimize water quality impacts during construction include, but are not limited to:

- Scheduling construction activities to minimize exposed area and duration of exposure;
- Clearing only minimal distances ahead of grading;
- Temporary seeding, sodding, and/or mulching of disturbed areas;
- Use of gravel or straw on exposed surfaces prior to revegetation;
- Revegetating as soon as possible after construction;
- Use of energy dissipaters at outfalls;
- Construction of temporary sediment traps;
- Use of silt fences;
- Covering stockpiled materials; and
- Wetting exposed areas during windy conditions.

Additionally, NCDOT's standard practices will be employed during construction of the project. The standard practices require the proper use and handling of construction materials. Every precaution should be taken by the contractor to avoid erosion and discharge of waste water, bitumens, or hazardous materials, including fuel, lubricants, solvents or other chemicals, to ground or surface waters.

4.1.6.8 Erosion Control

As described above, an erosion and sedimentation control plan in accordance with the North Carolina Sedimentation and Pollution Control Act must be prepared for this project. Thus, prior to the start of project construction activities, an erosion and sedimentation control plan will be prepared in accordance with the NCDENR publication *North Carolina Erosion and Sediment Control Planning and Design Manual* (2006a) and the NCDOT sediment and erosion control program. The plan will identify BMPs to be used to reduce erosion and sedimentation. BMPs would include but are not limited to:

- Minimizing exposed earth surface;
- Installation of silt fencing;
- Temporary and permanent seeding and mulching;
- Watering working and haul areas during dry periods; and
- Covering, shielding, or stabilizing material stockpiles.

4.1.6.9 Geodetic Markers

The National Geodetic Survey (NGS) geodetic monuments are located across the country to provide a physical marker that is primarily used for land survey controls. There are 39 monuments that fall within the project limits. Of these, 8 would be impacted by construction of one or more of the project alternatives and the remaining 31 would not be impacted by any project alternative. Mitigation for the impacted monuments will be replacement at a nearby location to maintain the network of survey controls in the project area.

4.1.6.10 Borrow and Disposal Sites

All construction waste material generated during clearing, grubbing, and other construction phases would be removed from the project site and burned or disposed of by the contractor in accordance with State and local regulations. Litter and other general trash would be collected and disposed of at local landfill locations. Construction waste and borrow with regard to wetlands will not be allowed unless properly permitted by USACE. Specific locations of borrow and disposal sites will be determined during the final design phase of the project.

4.1.6.11 Traffic Maintenance and Detour Accessibility

Maintenance of traffic and sequence of construction would be planned and scheduled so as to minimize traffic delays throughout the project. A traffic control plan will be developed during the final engineering design phase. The traffic control plan will address any disturbances to existing traffic patterns, road closures or realignments, as well as define designated truck routes and parking areas for construction vehicles.

Signs would be used where appropriate to provide notice of road closures and other pertinent information to the traveling public. The local news media would be notified in advance of road closings and other construction related activities which could excessively inconvenience the community so motorists, residents, and businesses could plan their day and travel routes in advance.

Access to all businesses and residences would be maintained to the extent practical through controlled construction scheduling. Traffic delays would be controlled to the extent possible where many construction operations are in progress at the same time.

4.1.7 Irreversible and Irretrievable Commitments of Resources

Implementation of the proposed project involves a commitment of the range of natural, physical, human, and fiscal resources. Land used in the construction of the proposed facility is considered an irreversible commitment during the time period that the land is used for highway facility. However, if a greater need arises for use of the land or if the highway facility is no longer needed, the land can be converted to another use. At present there is no reason to believe such a conversion will be necessary or desirable.

Considerable amounts of fossil fuels, labor, and highway construction materials such as cement, aggregate, and bituminous material would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not in short supply and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of state funds which are not retrievable.

4.1.8 Relationship Between Short-term Impacts and Long-term Benefits

In general, the alternatives would have similar impacts on the local short-term uses of resources and the maintenance and enhancement of long-term productivity. Completion of the project would, over the long term, be consistent with local, county, regional, and State plans.

The construction phase of the project would cause limited adverse effects on the human environment which are deemed to be of a short-term nature. Existing homes and businesses would be displaced. However, adequate replacement housing, land, and space are available for homeowners, tenants, and business owners within the project area. Improved mobility and access to and from the study area could stimulate economic and business growth and viability as well as long-term residential interest.

Construction activities could create short-term air quality, noise and visual impacts for nearby residents and businesses. Normal traffic patterns would also be disrupted. Implementation of BMPs and NCDOT standard construction procedures would help minimize these impacts. Increased turbidity levels in creeks and streams adjacent to construction activities could temporarily affect localized water quality. BMPs, as described in Section 4.1.6.6, would minimize potential water quality impacts. In addition, NCDOT will consult with the USACE in order to determine measures that will minimize impact to waterways and wetlands.

The proposed project would be classified as a long-term productive facility. This project, with its desirable design characteristics, would provide for safe and efficient vehicle operation. The benefits, such as reduced operating costs, reduced travel time, and general economic enhancement of the area offered by the long-term productivity of this project, should more than offset the short-term inconvenience and adverse effects on the human environment.

4.1.9 Permits and Certifications

The design and construction of the proposed project will dictate the magnitude of the impacts to surface waters. If impacts occur, permits and certifications will be required from various regulatory agencies in charge of protecting the water quality of public water resources. Surface water systems and wetlands receive similar protection and consideration from the regulatory agencies. These permits are authorized under the Clean Water Act (CWA) and are under separate state laws regarding significant water resources.

Section 401 and 404 Permits

In accordance with provisions of the CWA §404 (33 USC 1344), a permit will be required from the USACE for the discharge of dredged or fill material into "Waters of the United States." If the total impacts exceed 300 linear feet or 0.5 acres, or multiple crossings of the same stream are incurred, an Individual Permit is necessary. Due to the extensive nature of jurisdictional streams and wetlands associated with this project, it is likely that an Individual Permit may become necessary. If an Individual Permit is required, a corresponding Major 401 Water Quality Certification will be required by NCDWQ. The USACE will determine final permit requirements.

This project will require a 401 Water Quality General Certification from the NCDWQ prior to the issuance of any Section 404 Nationwide Permit or an Individual Permit. Section 401 of the CWA requires that the state issue or deny water quality certifications for any federally permitted or licensed activity that may result in a discharge into "Waters of the United States." Section 401 Certification allows surface waters to be temporarily impacted for the duration of the construction or other land manipulation. Issuance of a 401 Certification from the DWQ is a prerequisite to the issuance of a Section 404 Permit.

During construction activities, NCDOT's BMPs will be utilized, including erosion control measures.

4.2 INDIRECT AND CUMULATIVE EFFECTS

An assessment of potential indirect and cumulative effects that may result from the proposed NC 109 Improvements project as well as other past, present, and reasonably foreseeable development activities within the vicinity of the project was completed using NCDOT's *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (2001). The results of this assessment are detailed in the *Indirect and Cumulative Effects Report* prepared for the project (Lochner, 2007b) and are summarized below.

4.2.1 Existing Conditions

In recent years the project area has experienced modest growth at a similar rate to overall growth in Davidson and Forsyth Counties, and at a slower rate than in North Carolina overall. However, some areas on the fringes of the project area, such as the Kernersville area in southeastern Forsyth County and the portion of High Point within Davidson County, have grown faster than the area as a whole. The study area, along with Davidson and Forsyth Counties, are expected to continue to experience modest population growth. With the continued decline in the manufacturing sector, this once manufacturing-centered area has lost large numbers of manufacturing jobs over the last decade and will likely continue to lose these jobs. Growth in the health care, educational, and retail sectors has partially offset the loss of manufacturing jobs in the area, but the area as a whole is not expected to experience significant job growth.

Land uses throughout the project area are largely rural, consisting mainly of large-lot residential and agricultural development. Nearby areas within incorporated High Point and Thomasville are more suburban in nature, consisting of larger residential subdivisions. At the northwestern corner of the study area, land uses are more urban in nature, consisting of higher-density residential uses, retail commercial uses, and industrial uses. While still fairly rural, the northeastern corner of the study area includes a number of large business parks, featuring light industrial, commercial and office uses. Most of the project area is not currently served by water and sewer infrastructure and there are no immediate plans to extend these services into areas without service. Adjacent areas in western High Point and northern Thomasville are, however, expected to receive water and sewer service as growth continues in these areas. In addition to the NC 109 Improvements project, there are a number of other NCDOT and local MPO transportation improvements planned for the project area. These are listed in Section 1.8. Each of these improvements will increase capacity and build linkages in the regional transportation system, facilitating travel movement and improving access.

The study area includes several notable natural and cultural features. Three historic properties are within the APE for the project and several more are in the surrounding areas. Rich Fork Creek and Hunts Fork Creek, which lie just south of the project area, are on the §303(d) Impaired Waters List. The Abbotts Creek Water Supply Watershed III (WS-III) and Leonard Creek WS-III, part of the larger Lake Thom-a-Lex Water Supply Watershed, extend across the study area. State and local regulations limit development densities and intensities in these areas. The study area contains habitat for five federally-protected species. No occurrences of any of these species have been reported in the study area.

Direct natural environmental impacts by NCDOT projects would be addressed by programmatic agreements with resource agencies, and will be further evaluated by the NCDOT Natural Environment Unit during project permitting. Because few indirect impacts are anticipated, the cumulative effect of this project, when considered in the context of other past, present and future actions, and the resulting impact on notable human and natural features should be minimal. Therefore, any contribution of the project to cumulative impacts resulting from current and planned development patterns is expected to be minimal.

4.2.2 Potential for Indirect Impacts

The construction of the NC 109 Improvements project will improve overall mobility in northeastern Davidson County and southeastern Winston-Salem by providing either additional capacity on existing NC 109 or an additional transportation corridor. The project will also improve accessibility for adjacent properties gaining new roadway frontage.

While the project will have a moderate impact on improving areawide mobility and accessibility to the area road network, several other factors will influence the magnitude of the project's indirect effects. The anticipated growth rate in the project area is approximately one percent per

year, a modest rate that should moderate the demand for new residential and commercial development and limit rapid land use change in the area. In addition, the abundant supply of developable land will limit the development pressures on most parcels. The lack of existing or planned water and sewer service through much of the area will also limit the magnitude of induced land use change in the area.

Specific areas closer to the project alternatives are more likely to experience development influenced by the project. Parcels along the new location alternatives and near the alternatives on intersecting roadways will likely become attractive for development of large-lot rural residential subdivisions. Proposed directional crossover intersections, particularly the Gum Tree Road and Rex Road/Devoe Road intersections on Alternative 1, the Teague Road intersection on Alternatives 3 and 6, and the Beckerdite-Stewart Road intersection and terminus at US 52 on Alternatives 4 and 5, are likely to experience new highway commercial development. Again, the modest annual growth rate predicted for the area will moderate the pace of this development. The area of older urban development near the northern terminus of existing NC 109 is unlikely to experience significant redevelopment as a result of this project. The NC 109 Improvements project alone will not have a major effect on land use change in areas more than a few miles from the project alternatives, although the project may contribute to cumulative effects in these areas (see below).

Most of the notable features in the project area will not receive indirect effects as a result of land use change stimulated by the project. The NRHP-eligible Mark Parker House and D. Austin Parker House are located on Teague Road near the proposed intersection with Alternatives 3 and 6. It is possible that induced development near this intersection or along Teague Road may have an indirect effect on the scenic character of these properties. The scenic character of the proposed Friedland Lower Tier Historic District, east of Alternative 1 in Forsyth County, may also be affected by new residential development in this area. While areas at the northern end of Alternatives 1, 3 and 6 have relatively high concentrations of minority and low-income residents, it is unlikely that the project will lead to land use change in these neighborhoods.

While induced residential development in the area could affect water quality in the area, most water resources are located away from the project alternatives. None of the project alternatives cross any of the §303(d) streams in the project area and critical areas for the Abbotts Creek and Leonard Creek watersheds are located several miles away from the project alternatives. In addition, the drainage areas for Rich Fork Creek and Hunts Fork Creek, located southeast of the southern terminus of the project alternatives, are less likely to experience project-induced development than areas closer to the alternatives. While a small portion of the Salem Creek drainage area is located within the project area, this area already contains significant urban development; the project is unlikely to induce higher development densities or intensities in this already developed area. Local land use policies and regulations and state regulations are also in place to limit densities and development impacts near the §303(d) streams and in the water supply watersheds.

4.2.3 Potential for Cumulative Impacts

The construction of the NC 109 Improvements project and any resultant induced development and complementary land development, coupled with the completion of recent transportation and development projects along with the construction of planned transportation projects and private development projects, could constitute a cumulative effect on the study area. Improvements to the southern section of NC 109, from Business I-85 to just north of Old Greensboro Road (STIP Projects R-2568A and B) were completed in 2006. Together with R-2568C, these projects will improve mobility between Thomasville and Winston-Salem and could stimulate land use change between these two areas. The widening of Union Cross Road and the proposed North-South Connector, along with the development of major job generators in southeastern Forsyth and southwestern Guilford Counties will accelerate land use change in the northeastern part of the study area. This is particularly true in High Point's annexation area in northeastern Davidson County, where local policies ensure that municipal water and sewer will be extended to any properties annexing into the city. These projects will also stimulate land use change in southeastern Forsyth County, particularly west of Wallburg Road and Union Cross Road, where water and sewer are currently available. Development pressures may lead to water and sewer eventually being extended east of Wallburg Road, where extensive developable land is available in close proximity to major employment centers such as the Union Cross Business Park. By improving mobility in the region, the NC 109 project may also play a cumulative role in this induced land use change. Together, recent and planned transportation projects and private development projects, and the NC 109 Improvements project, will also cause cumulative increases in traffic volumes in the project area.

South of the project area, cumulative effects of the project are not likely to negatively impact notable features. This area is largely outside of area water supply watersheds. Development along Rich Fork Creek, a §303(d) stream in this area, is strictly limited by Davidson County land use policies as a Preferred Conservation Area. Wetlands are somewhat prevalent along streams in the southern part of the study area; federal wetlands regulations should limit impacts to these resources. East of the study area, Rich Fork Creek is designated by the City of High Point as Recreation/Open Space, which also strictly limits development. The High Point annexation area within Davidson County does not extend into the Abbotts Creek Water Supply Watershed. The watershed does extend into southeastern Forsyth County—local policies and regulations and State regulations are in place to limit densities and development impacts in this area. The scenic character of the proposed Friedland Lower Tier Historic District could also be cumulatively affected by induced residential development in this area.

4.3 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Estimated environmental impacts and costs associated with each of the build alternatives are summarized in Table 4-10.

TABLE 4-10: SUMMARY OF ENVIRONMENTAL IMPACTS						
		Build Alternative				
		Alternative 1	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Length of Corridor (Miles)	Length on Existing	7.74	1.80	0.81	1.29	1.33
	Length on New Location	1.80	7.61	8.39	7.21	8.72
	Total Length	9.54	9.41	9.20	8.50	10.05
Relocations	Residential	165	87	75	70	97
	Business	39	5	3	4	5
	Total	204	92	78	74	102
Minority Populations Impacted		0	0	0	0	0
Schools		0	0	0	0	0
Parks		0	0	0	0	0
Churches		3	2	1	1	2
Cemeteries		0	0	0	0	0
Number of New Directional Crossover Intersections		13	6	8	8	6
New Indirect Left Turns (No Directional Crossover)		9	2	2	0	3
Railroad Crossings		0	0	1 (Grade Sep.)	1 (Grade Sep.)	0
Major Utility Conflicts		3	4	3	3	4
Historic Sites with Adverse Effects		0	0	0	0	0
Section 4(f) Sites		0	0	0	0	0
Federally Protected Species		0	0	0	0	0
Prime Farmland (acres)		230.13	124.81	137.41	129.13	124.98
Hazardous Materials Sites		25	9	3	4	3
Noise Impacted Receptors		97	61	33	31	61
100-Year Floodplain (acres)		10.44	9.94	5.87	10.46	5.35
Wetlands (acres)		0.58	0.15	0.21	0.16	0.14
Streams	Stream Crossings	20	24	34	34	24
	Stream Impacts (linear feet)	4,432	7,757	9,259	10,729	6,500
Cost	Construction	$70,000,000	$78,500,000	$85,600,000	$78,400,000	$81,500,000
	Right-of-Way	$69,975,000	$49,425,000	$34,975,000	$39,950,000	$46,710,000
	Utilities	$4,758,169	$628,221	$657,572	$657,572	$618,841
	Total	$144,733,169	$128,553,221	$121,232,572	$119,007,572	$128,828,841

SECTION 5
LIST OF PREPARERS

This document was prepared by the Federal Highway Administration and the North Carolina Department of Transportation with assistance from H.W. Lochner, Inc.

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North Carolina Department of Transportation

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H.W. Lochner, Inc.

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SECTION 6

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

Federal Agencies

US Environmental Protection Agency
US Department of Transportation
US Department of Interior
US Department of Commerce
US Department of Agriculture
US Department of Energy
US Department of Health and Human Services, Office of Environmental Affairs
Federal Rail Administration
Federal Emergency Management Agency
Office of Management and Budget

Regional Offices

Regional Representative of the Secretary of Transportation
Environmental Protection Agency
Department of Housing and Urban Development
US Army Corps of Engineers
US Fish and Wildlife Service
Federal Emergency Management Agency
General Services Administration
Federal Transit Authority

State Agencies

NC Department of Human Resources
NC Department of Environment and Natural Resources
NC Wildlife Resources Commission
NC Department of Cultural Resources
NC Department of Public Instruction
NC Department of Commerce
NC Department of Economic and Community Development
State Clearinghouse

Local Governments and Agencies

Chairman, Wallburg Town Council
Chairman, Winston-Salem City Council
Chairman, Forsyth Council Board of Commissioners
Chairman, Davidson County Board of Commissioners
High Point Urban Area Metropolitan Planning Organization
Winston-Salem Urban Area Metropolitan Planning Organization
Davidson County Department of Planning and Zoning
Winston-Salem/Forsyth County City-County Planning Board

SECTION 7
COORDINATION AND PUBLIC INVOLVEMENT

7.1 AGENCY COORDINATION

7.1.1 Early Coordination

To begin early coordination for the project, a Start of Study letter was distributed on October 17, 2003 to the appropriate federal and state regulatory agencies, local officials, NCDOT staff, and other stakeholders. The letter introduced the project, provided preliminary information on the range of alternatives to be considered and solicited comments for use in evaluating the environmental impacts of the project. Pertinent comments received from these agencies and officials are included in Appendix A.

The formal scoping process was initiated through the distribution of a scoping letter on December 15, 2003, to representatives from various NCDOT departments and agency staff. The scoping letter included preliminary project information and a project location map. It also served as an invitation to a formal scoping meeting held on January 14, 2004. At the scoping meeting, attendees discussed the history and purpose of the project, the study process, and known environmental constraints in the project area. Project limits were also discussed.

FHWA issued a Notice of Intent to prepare a Draft Environmental Impact Statement for the project on March 18, 2009 (see Appendix B).

7.1.2 Combined NEPA/Section 404 Merger Process

In a May 1, 1992 agreement, the US Department of Transportation, the Office of the Assistant of the Army (Civil Works), and the US Environmental Protection Agency (EPA), developed policy that (a) would improve interagency coordination and (b) would integrate NEPA and Section 404 procedures. On May 14, 1997, the Wilmington District of the US Army Corps of Engineers (USACE), the North Carolina Division of the Federal Highway Administration (FHWA), and the North Carolina Department of Transportation (NCDOT) signed an Interagency Agreement that provided procedures to integrate NEPA and Section 404 for transportation projects in North Carolina.

In 1997, NCDOT, FHWA, and USACE agreed that “these procedures apply to all projects needing Federal Highway Administration action under the National Environmental Policy Act and a US Army Corps of Engineers Individual Permit under Section 404 of the Clean Water Act. These procedures are limited to those projects determined by Federal Highway Administration and North Carolina Department of Transportation to be processed with an Environmental Impact

Statement to comply with NEPA, and/or those projects that require an Individual Section 404 Permit."

The NEPA/Section 404 Merger Process is based on concurrence from Merger Team Members at four major milestones (concurrence points) during project studies. For the NC 109 Improvements project, the Merger Team includes representatives from federal, state, and local agencies, including FHWA, USACE, EPA, US Fish and Wildlife Service (USFWS), North Carolina Department of Environment and Natural Resources - Division of Water Quality (NCDWQ), North Carolina Wildlife Resources Commission (NCWRC), North Carolina State Historic Preservation Office (HPO), High Point Urban Area Metropolitan Planning Organization (MPO), Winston-Salem Urban Area MPO and NCDOT. The four points for concurrence are (1) project purpose and need, (2) alternatives selected for detailed study, (3) least environmentally damaging practicable alternative (LEDPA), and (4) avoidance and minimization.

The NEPA/404 Merger Process was amended in 2001 and is referred to as the "Merger Process." The amended procedures for the Merger Process were implemented in March 2003. The Concurrence Points amendments in the Merger Process include the addition of Concurrence Point 2A and the separation of Concurrence Point 4 into three items: A, B, and C. Concurrence Point 2A includes coordinating the bridge locations, lengths, and cost with the Merger Team, and the three items for Concurrence Point 4 (A, B, and C) include Avoidance and Minimization, a Hydraulic Design Review, and a Permit Drawing Review, respectively.

The project has proceeded through Concurrence Points 1, 2, and 2A as described below. After further public involvement and distribution of this DEIS, it is expected that the Merger Process will continue with Concurrence Point 3. Copies of the signed Concurrence Forms can be found in Appendix C.

7.1.2.1 Concurrence Point 1 -- Purpose and Need

Members of the Merger Team concurred with the purpose and need for the project on September 15, 2004. The agreed upon needs for the project include capacity deficiencies, above-average accident rates, and deficient roadway geometry on NC 109. In order to address the stated needs, the agreed upon purpose of the project is to improve safety, traffic flow, and level of service along the NC 109 corridor in the project study area.

7.1.2.2 Concurrence Point 2 – Alternatives for Detailed Study

The Merger Team met on August 15, 2006, to review the five preliminary corridors under consideration and their potential impacts in order to select alternatives to be carried forward for detailed study. The Merger Team agreed that all five corridors should be carried on for further study and these five are examined in detail in this DEIS. There was extensive discussion at this meeting about the use of directional crossovers with indirect lefts.

7.1.2.3 Concurrence Point 2A – Bridge Locations and Lengths

The Merger Team met on April 28, 2009, to review the stream and wetland crossings along the five alternatives selected for detail study and to achieve concurrence on bridging decisions. The Merger Team viewed several stream crossing sites in the field to determine if the hydraulic structure recommended following preliminary analysis was appropriate. It was agreed that bridges would be included at the seven sites identified in preliminary hydraulic analysis. No additional bridges were proposed, although it was agreed that NCDOT would consider design modifications at certain sites later in the study process to avoid and/or minimize jurisdictional impacts.

7.1.3 HPO Coordination

Representatives of NCDOT, FHWA, and HPO met on March 24, 2009, to review project alternatives for effects to historic properties. The following conclusions were reached:

- Mark Parker House – No Adverse Effect (Alternatives 3 and 6); No Effect (Alternatives 1, 4 and 5)
- D. Austin Parker House – No Adverse Effect (Alternatives 3 and 6); No Effect (Alternatives 1, 4 and 5)
- George Wall House – No Adverse Effect (Alternative 1); No Effect (Alternatives 3, 4, 5 and 6)
- Dempsey Clinard House – No Effect (All alternatives)
- John Hiatt Farm – determined to be outside the Area of Potential Effects (APE)

7.2 PUBLIC INVOLVEMENT

The early and continued involvement of citizens who may be affected by the study's outcome has been a vital part of the planning process for the NC 109 Improvements project. The public involvement program for this project included local officials meetings, citizens informational workshops, small group meetings, newsletters, and a toll-free project hotline.

7.2.1 Local Officials Meetings

7.2.1.1 First Public Officials Meeting

A public officials meeting was held on March 6, 2002, at the NCDOT Division 9 office in Winston-Salem. This meeting was held to give NCDOT personnel an opportunity to hear suggestions and concerns about the project and the project area. Three local officials attended this meeting.

7.2.1.2 Second Public Officials Meeting

The second Public Officials meeting was held on November 15, 2004, at the NCDOT Division 9 office in Winston-Salem. Nine local officials attended this meeting. This meeting was held to allow public officials to review the purpose and need for the project and to discuss preliminary

corridor concepts for the project. Based on discussion at this meeting, the group decided to remove a potential interchange at Ridgewood Road in Forsyth County due to geometric constraints and traffic demand considerations, and also decided to remove a potential interchange at West Clemmonsville Road/US 52 due to existing high traffic volumes and the need for extensive design improvements at this location. It was also agreed that an alternative affecting the Meadowlands development would be shifted to reduce impacts to the greatest extent possible.

7.2.1.3 Third Public Officials Meeting

A public officials meeting was held on October 13, 2005, at the NCDOT Division 9 office in Winston-Salem. Eight local officials attended this meeting. The purpose of this meeting was to update public officials about the current status of the project and to provide information for them to use when answering questions from the public in advance of the Citizens Informational Workshops held in November 2005. NCDOT received input on the five alternatives under consideration and provided information about the directional crossovers with indirect left turns that are proposed for project intersections.

7.2.2 Citizens Informational Workshops

7.2.2.1 First Citizens Informational Workshops

The first Citizens Informational Workshops were held by NCDOT on April 6, 2004, and April 15, 2004. The first meeting was held in the southern portion of the study area while the second meeting was held in the northern portion. The purpose of the meetings was to introduce the project and solicit comments or suggestions concerning the proposed improvements or areas of environmental concern. Approximately 350 people attended and approximately 50 written comments were received. Comments addressed the need for the project and its location. Copies of comments received are available from NCDOT by request.

7.2.2.2 Second Citizens Informational Workshops

The second Citizens Informational Workshops were held by NCDOT on November 10, 2005, and November 14, 2005. These meetings allowed the public to review the proposed study corridors. The public also had the opportunity to comment on the project purpose and need at these meetings; another opportunity to comment on purpose and need was provided in Newsletter 6, distributed in May 2009 (see Section 7.2.4). Approximately 500 people attended and over 270 written comments were received. Comments reflected area residents' desire to maintain the area's rural character, to protect natural resources, increase safety, and minimize residential impacts. Many respondents were in favor of upgrading existing NC 109. Copies of comments received are available from NCDOT by request.

7.2.3 Mailing List

A mailing list was developed in order to distribute project information to interested persons. The list was compiled from property owner data for the project study area and nearby communities. In

addition, any individual, group, or government official expressing an interest in the project was placed on the mailing list. The list contains approximately 7,000 names and addresses.

7.2.4 Newsletters

To date, six project newsletters have been published and mailed to citizens, groups, and officials on the mailing list (see Appendix F for copies of these newsletters). Newsletter 1 was distributed in March 2004, Newsletter 2 was distributed in October 2005, Newsletter 3 was distributed in April 2006, Newsletter 4 was distributed in October 2006, Newsletter 5 was distributed in September 2008, and Newsletter 6 was distributed in May 2009. These newsletters provided information on the study process and progress. Additional newsletters will be mailed at upcoming project milestones to announce the Corridor Public Hearing, the availability of the Draft Environmental Impact Statement, the selection of a preferred alternative, the publication of the Final Environmental Impact Statement/Record of Decision, and the Design Public Hearing.

7.2.5 Hotline

A toll-free hotline (1-800-554-7849) was available for public comments, suggestions, or questions. The hotline service is available Monday through Friday during regular business hours. More than 100 hotline calls have been received to date.

7.2.6 Project Website

NCDOT maintains a project website for the public to access information regarding the status of this project. The website is updated periodically at project milestones and to detail project progress. Included on the website are descriptions of the study process, maps of the study area and alternatives under detailed study, the project schedule, frequently asked questions, and contact information. In addition, the website contains links to copies of recent newsletters and meeting summaries. The website is located at http://www.ncdot.org/projects/NC109Improvements.

7.2.7 Small Group Meetings

Representatives from NCDOT, the local MPOs, the Piedmont Triad Regional Planning Organization (RPO) and the Davidson County Planning Department attended a small group meeting in the Winston-Salem City Hall Annex on August 3, 2004, to discuss the project. NCDOT displayed maps of the project area and discussed the purpose and need for the project. NCDOT received input on recent development in the project area and on existing conditions on NC 109.

On June 13, 2006, NCDOT gave a formal presentation on the project at the Wallburg Town Council meeting to update local representatives on the status or the project. The presentation included a brief update on the project history, the project development process and the project schedule. At the end of the presentation, the project representatives answered questions from the Town Council and the public in attendance.

7.2.8 Limited English Proficiency (LEP) Outreach

To provide project information to Spanish-speaking residents of the project area, the first project newsletter, distributed in March 2004, was translated into Spanish. Copies of the Spanish version of the newsletter were distributed in person at local Hispanic groceries and churches and local gas stations. A Spanish translator was present at the first Citizens Informational Workshops in April 2004, but no workshop attendees requested translation services.

7.2.9 Corridor Public Hearing

A corridor public hearing for the project will be held following the publication of this DEIS.

7.3 PUBLIC COMMENTS ON PURPOSE AND NEED AND ALTERNATIVES

In accordance with the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the public was provided an opportunity to review and comment on the project purpose and need and alternatives. The purpose and need statement was included in newsletters distributed to project area property owners in May 2009 and October 2005. The second Citizens Informational Workshops, in November 2005, also provided an opportunity for the public to comment on purpose and need. Project alternatives were included in the May 2009 newsletter and in a newsletter distributed in October 2006. Copies of these newsletters are in Appendix F. The project purpose and need and alternatives have also been available to the public via the project website. Six e-mail comments and three written comments letters were received following distribution of the May 2009 newsletters. Five of the e-mail comments and all of the written comments indicated concern about potential impacts on the Meadowlands community and a preference for alternatives with the least impacts on the Meadowlands. Two of these comments also expressed doubt about the need for the project. The sixth e-mail comment indicated a preference for Alternative 1 because it would disrupt existing development less than the other alternatives. NCDOT responded to each of these comments.

Public comments received to date and those received following publication of the DEIS and the corridor public hearing will be used in the corridor selection process to identify the least environmentally damaging practicable alternative (LEDPA) for the project.

SECTION 8

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