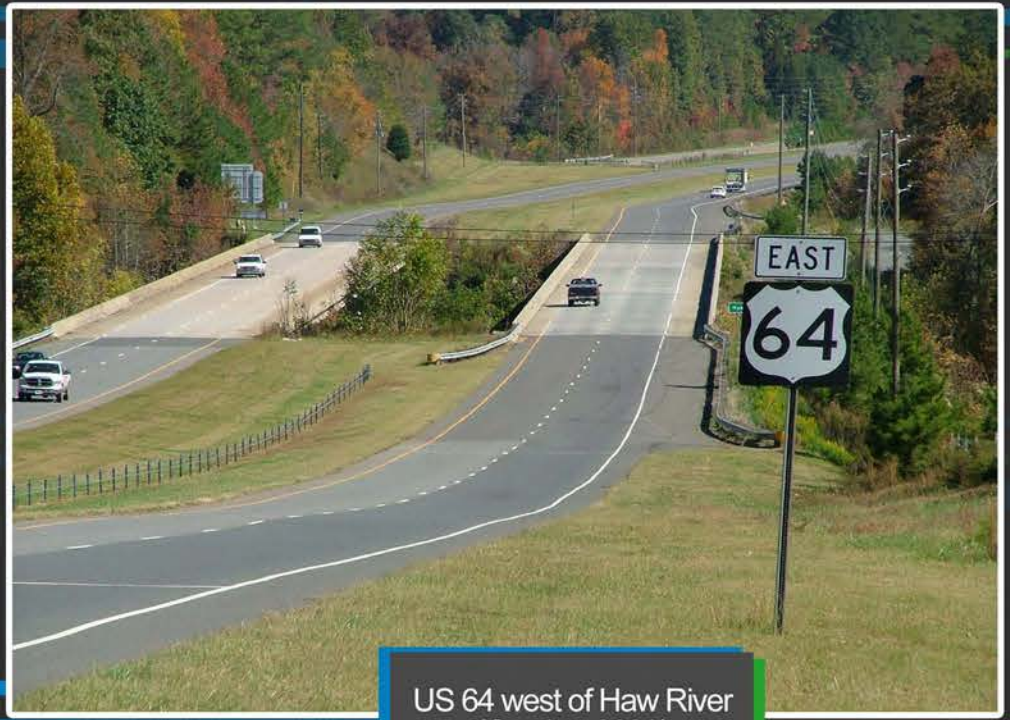
US 64 Corridor Study
Wake and Chatham Counties
Corridor Study Report

January 2011

US 64 at Laura Duncan Road (October 2009)

US 64 at Fern Valley Lane (October 2009)



US 64 west of Haw River (October 2009)

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PREFACE

The Triangle is consistently ranked as one of the fastest growing metropolitan areas in the United States. It is estimated that the population of the Raleigh-Cary Metropolitan Statistical Area has increased from 797,000 in 2000 to 1,125,000 in 2009. The proposed extension of NC 540 (Raleigh Outer Loop) is expected to further enhance the desirability of the western Wake and eastern Chatham County area, as motorists traveling to the Research Triangle Park (RTP), one of the major employment centers in the region, will experience shorter travel times. Roadways connecting to the proposed extension of NC 540, such as US 64, are anticipated to see an increase of traffic resulting from motorists using the new highway to travel to and from RTP. Many examples of the increased traffic on roadways connecting to the I-540/NC 540 Raleigh Outer Loop can be found throughout the region.

In 2004, the North Carolina Department of Transportation adopted the Strategic Highway Corridor initiative which strives to improve, protect and maximize the capacity of existing corridors deemed critical to statewide mobility and regional connectivity. US 64 is a Strategic Highway Corridor. At the same time the Capital Area Metropolitan Planning Organization (CAMPO) began identifying corridors that currently or in the future would experience unacceptable congestion, which includes US 64. It was determined that corridor studies should be conducted in order to devise mitigation strategies that would allow the corridors to operate at an acceptable level. Corridor Studies of this magnitude are rare due to the extensive resources needed to complete them; however, the benefits that result from the study are extremely valuable for decision makers along the corridor.

The US 64 Corridor Study establishes a vision for the corridor between the US 64 Business interchange east of Pittsboro to US 1 in Cary of preserved and enhanced mobility and safety balanced with community access and interests. The study sets forth a short-term and long-term master plan for the corridor that will allow the roadway to accommodate the substantial growth projected for western Wake and eastern Chatham County over the next 25 years.

One of the most important benefits of this study is the establishment of a framework and collaborative process for making decisions about land use and transportation along the corridor. Numerous agencies and groups are responsible for overseeing elements of the corridor, including environmental agencies, NCDOT, CAMPO, counties and local municipalities. This study establishes a comprehensive vision for the corridor and a plan that provides the decision makers with the tools to collaborate and make decisions that are consistent with the vision. The completion of the study will not be the end of the efforts to keep US 64 a viable corridor, but the beginning of the stage where the partners along the corridor work together to implement solutions that enhance the corridor for users, residents and businesses along the corridor.

Just as important as defining the purpose of the study, is establishing what the study is not expected to accomplish. The results of this study and the recommended solutions will not directly result in the construction of any of the solutions identified, but will act as a basis for developing additional studies to implement solutions that are consistent with the vision for the corridor.

The study is a guide for making decisions that affect the corridor into the future, and is based on existing data and projections of how the corridor is expected to evolve. The results of the study are meant to be flexible and allow for innovation and enhancement of the solutions in the event that the future trends change or better solutions are developed. With a collaborative effort by the stakeholders along the corridor, it is likely that elements of this study may be improved upon and changes made that will better balance the community's needs while maintaining the overall vision for the corridor.

One of the key aspects of this study was to involve the public and communities that live and work along the corridor and engaging them in an active role in the development of this study. Community insight and opinion has substantially shaped the recommendations and vision for the corridor. Throughout the different chapters of the report, the ongoing community involvement is described and details are provided around how the communities' input has shaped the outcome of this study. Moving forward, the community will continue to play a major role as further studies are developed for the individual projects along the corridor.

Numerous individuals have spent countless hours helping to establish the unique vision for the US 64 Corridor and have been invaluable throughout the development of this study. The Corridor Study Team would like to sincerely thank these individuals and groups for the time and effort they dedicated to creating a plan that benefits the communities along US 64 while meeting the goals for increased mobility and safety along this vital corridor.

ACKNOWLEDGEMENTS

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Executive Summary

US 64 west of
Jordan Lake
(October 2009)

EXECUTIVE SUMMARY

This summary provides an overview of the materials included in this Corridor Study Report and present the findings and recommendations of the study. For more detailed information please consult the individual chapters of this report.

S.1. INTRODUCTION (CHAPTER 1)

The US 64 corridor has been identified in the state's Strategic Highway Corridors (SHC) initiative. The Strategic Highway Corridors initiative seeks to identify, protect and maximize the use of highway corridors that play a critical role in regional or statewide mobility in an ongoing effort to enhance transportation, economic development and environmental stewardship throughout North Carolina.

The study is being conducted as a joint effort between the North Carolina Department of Transportation (NCDOT), the Capital Area Metropolitan Planning Organization (CAMPO), Town of Apex, Town of Cary, Town Of Pittsboro, Wake County and Chatham County for the segment of US 64 from the US 64/US 64 Business split on the east side of Pittsboro to the US 1/US 64 interchange in Cary.

The report is organized as follows:

- Chapter 1 provides an introduction to the study, presents the purpose and goals for the study and the context of the study in relation to the overall planning process;
- Chapter 2 provides an overview of the existing and anticipated future conditions along the corridor;
- Chapter 3 describes the alternatives considered for the short-term and long-term solutions for the corridor and presents the master plan for the corridor;
- Chapter 4 describes how the master plan for the corridor will be implemented and presents the steps required before the recommended improvements are constructed;
- Chapter 5 describes the integration of alternate travel modes such as transit, bicycle and pedestrian into the recommended short-term and long-term solutions;
- Chapter 6 provides an analysis of the effects on the human and natural environments for the short-term and long-term solutions;
- Chapter 7 provides an evaluation of the land use along the corridor and provides recommendations for future zoning along the corridor; and
- Chapter 8 describes the efforts made to engage the public in the development of this study as well as the coordination with regulatory agencies and the Corridor Study Team (CST).

S.1.1. DESIGNATION OF US 64 AS A STRATEGIC HIGHWAY CORRIDOR

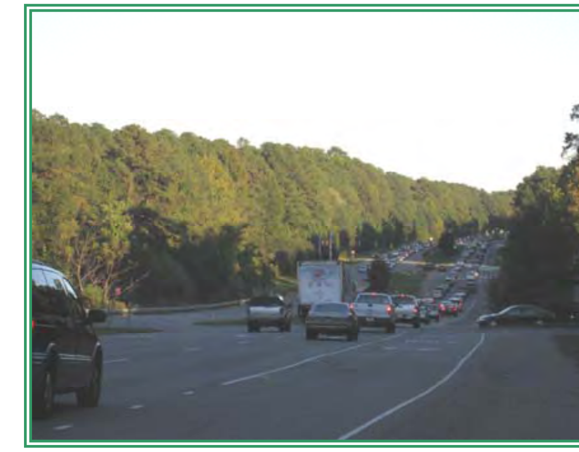
The Strategic Highway Corridors initiative was adopted by the North Carolina Board of Transportation on September 2, 2004, as a part of North Carolina's Long-Range, Multimodal Statewide Transportation Plan. Following adoption, a formal policy statement on the initiative was endorsed by the Departments of Commerce, Environment and Natural Resources, Transportation, and the Governor's Office. The NCDOT Board of Transportation approved revisions to the SHC Vision Plan in March 2007 and July 2008.

The North Carolina SHC initiative represents the first major implementation step to be advanced under the state's Long-Range Multimodal Statewide Transportation Plan. The concept defines a new focus for NCDOT to improve, protect, and maximize the capacity of existing highway corridors deemed critical to statewide mobility and regional connectivity. The SHC initiative represents an opportunity for NCDOT in partnership with corridor stakeholders to create a long-range corridor vision. This vision encompasses decision-making consistency, land use and transportation relationships, and roadway design and operational elements.

NCDOT has identified the US 64 corridor as a Strategic Highway Corridor. The US 64 corridor is considered to possess the following characteristics consistent with Strategic Highway Corridors criteria:

- Potential to carry significant traffic;
- Connect existing major activity centers;
- Connect existing and planned Interstate facilities;
- Potential to serve as an Interstate reliever route; and
- Part of the National Highway System (NHS).

S.1.2. NEED FOR THE STUDY



Increasing traffic volumes over the past several years have substantially reduced the traffic flow and increased congestion along US 64. This congestion is expected to worsen as the Raleigh-Durham metropolitan area continues to experience rapid growth. An estimated 1.2 million new residents are expected to move within 30 miles of downtown Raleigh by the year 2035.

The proposed extension of NC 540 (Raleigh Outer Loop) is expected to enhance the desirability of the western Wake and eastern Chatham County area further, as motorists traveling to the Research Triangle Park (RTP), one of the major employment centers in the region, will experience shorter travel times. Roadways connecting to the proposed extension of NC 540, such as US 64, are anticipated to see an increase of traffic resulting from motorists using the new highway to travel to and from RTP. Without additional improvements to US 64, congestion and travel times are expected to substantially worsen.

S.1.3. PURPOSE OF THE STUDY

The goal of the study is to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests. This plan will be used to guide development and improvements along the corridor from US 64 Business in Pittsboro to US 1 in Cary.

The master plan includes two distinct components, a short-term plan and a long-term plan:

- The short-term plan consists of interim strategies to improve mobility, safety and pedestrian accessibility at major intersections; and
- The long-term plan consists of improvements needed to serve the anticipated amount of traffic in the year 2035 and later. It proposes to convert many of the major intersections to interchanges or overpasses.

One of the most important elements of this study is to establish a framework and collaborative process for the decision making for land use and transportation along the corridor. Numerous agencies and groups are responsible for overseeing elements of the corridor, including environmental agencies, NCDOT, counties and local municipalities. This study will provide a comprehensive plan for the corridor that will provide the decision makers with the tools to collaborate and make decisions that are consistent with the vision for the corridor. Once the study is completed, it is anticipated that it will not be the end of the process, but the beginning of the stage where the partners along the corridor work together to implement solutions that enhance the corridor for users, residents and businesses along the corridor.

Just as important as defining what is the purpose of the study, it is important to define what the purpose of the study is not. The results of this study and the recommended solutions will not directly result in the construction of any of the solutions identified, but will act as a basis for developing additional studies to implement solutions that are consistent with the vision for the corridor.

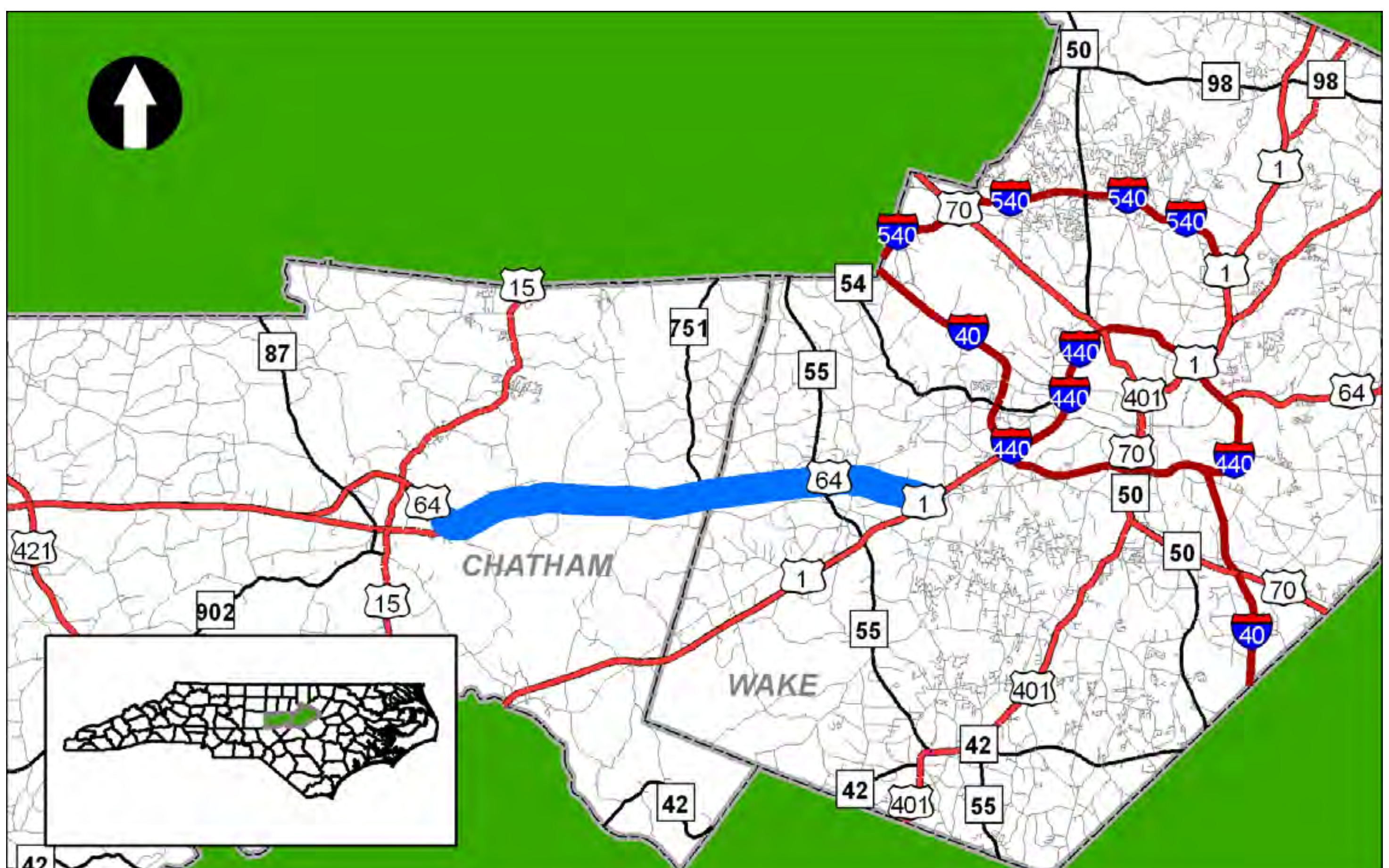
The study will establish a guide for the corridor, and is based on existing data and projections of how the corridor is expected to evolve in the future. The results of the study are meant to be flexible and allow for innovation and enhancement of the solutions in the event that the future trends change or better solutions are developed. With a collaborative effort by the stakeholders along the corridor, it is likely that elements of this study may be improved upon and changes made that will better balance the community's needs while maintaining the overall vision for the corridor.

S.2. EXISTING AND ANTICIPATED CONDITIONS (CHAPTER 2)

S.2.1. Study Area Description

The US 64 corridor study area begins at the US 64 Business/US 64 Bypass Interchange, east of Pittsboro (Chatham County) and extends east to the US 1/US 64 interchange in Cary (Wake County). The study area is approximately 19 miles in length, which includes two miles across Jordan Lake. The study area includes approximately 1500 feet on each side of existing US 64. The study area also includes a segment of US 1 at the east end of the corridor for potential modifications to the US 1/US 64 interchange. The study area for the corridor is shown in Figure S.1. The corridor includes ten miles in Chatham County and nine miles in Wake County and passes through the towns of Apex and Cary.

Figure S.1: Study Area



S.2.2. Population and Development

The Triangle area is one of the fastest growing areas in the nation and has been identified on numerous "Best Places" lists. According to the US Census Bureau in March 2009, Raleigh-Cary was the fastest growing metropolitan area in the nation. In 2009 alone, according to the Greater Raleigh Chamber of Commerce, the Triangle area received over 35 accolades and based on the strong growth in the past and the continued strong outlook for growth in the future, the Triangle region is poised for a substantial amount of growth in the coming years.

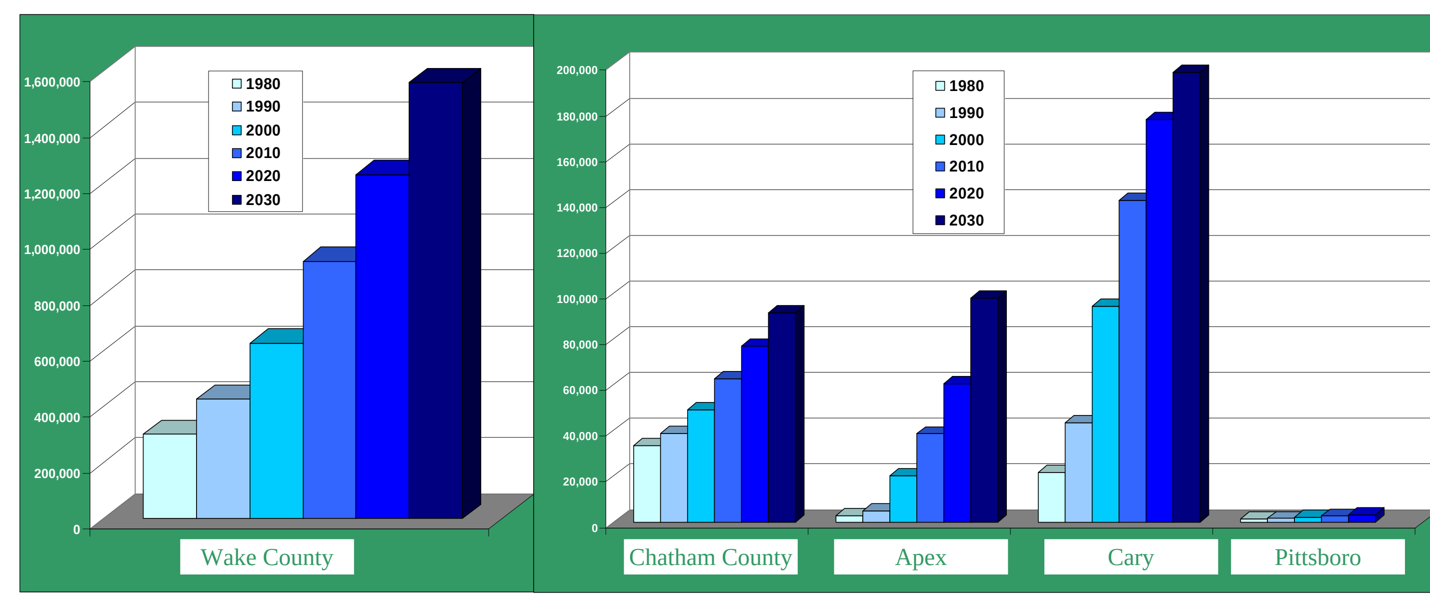
S.2.3. Population Projections

The current population and the projected population for the next 20 years are summarized in Table S.1

Table S.1: Population Projections

Area	Population				Growth % Change		
	2000	2010	2020	2030	2000-2010	2010-2020	2020-2030
North Carolina	8,046,813	9,502,904	10,966,956	12,465,478	18.1	15.4	13.7
Wake County	627,846	920,298	1,230,382	1,560,026	51.4	33.7	26.8
Chatham County	49,326	62,887	77,008	91,491	27.5	22.5	18.8
Town of Apex	20,212	38,659	60,614	98,091	91.3	56.8	61.8
Town of Cary	94,536	140,871	176,072	196,806	49.0	25.0	11.8
Town of Pittsboro	2,226	2,678	3,120	n/a	20.3	16.5	n/a

Figure S.2: Current and Projected Population



S.2.4. Existing and Future No-Build Traffic Capacity Analysis

The methodology used to determine the traffic operations for the US 64 corridor are based on the procedures defined in the *Highway Capacity Manual* (HCM) published by the Transportation Research Board. The HCM includes procedures to define the operational qualities of roadways based on the concept of capacity and Level of Service (LOS) and is based on the peak one hour period of the day. The LOS is defined with letter designations from A to F where LOS A represents the best operating conditions along a road or at an intersection, while LOS F represents the worst conditions.

S.2.5. Existing and Future No-Build Level of Service

The LOS for the major intersections along the corridor was evaluated based on the 2007 existing traffic volumes and the projected 2035 traffic volumes along US 64 without any major upgrades to the corridor.

The analysis indicates that 4 of the 11 signalized intersections and 6 of the 7 unsignalized intersections (with a total of 17 individual movements) are currently operating at an unacceptable LOS E or F. If no improvements are made to the corridor, 10 of 11 intersections and all 5 unsignalized intersections (with a total of 22 individual movements) will be operating at LOS E or F in 2035.

S.3. ALTERNATIVE ANALYSIS (CHAPTER 3)

The alternatives considered for the study are described in this section. Each alternative is evaluated with respect to its ability to the meet the needs of the study. A number of alternatives were considered during the early phases of the project studies, including the following:

- No-Build Alternative;
- Transportation System Management Alternatives;
- Transportation Demand Management Alternatives;
- Mass Transit Alternatives; and
- Build Alternatives.

Based on the evaluation, only the build alternatives would meet the goals of the study. For the Build alternatives, three types of facilities were considered, freeway alternatives, expressway alternative and signalized intersection alternatives. The three types of alternatives are summarized as follows:

Freeway Alternative

Freeways are characterized by a divided roadway with full control of access and include grade separations or interchanges at cross streets. Freeways provide the highest level of mobility of all types of roadways and the lowest level of access, which is allowed only at interchanges. Based on the evaluation of a freeway alternative in previous studies and by the CST it was determined that a freeway alternative would meet the goals of the study and would be most appropriate for the portion of the corridor between the US 64 Pittsboro Bypass and NC 540 with the exception of the portion across Jordan Lake.

Expressway Alternative

Expressways are characterized by a divided roadway with limited or partial control of access. Access is provided only at interchanges for major cross streets and at-grade intersections for minor cross streets. Expressways do not allow traffic signals and strongly discourage direct driveway connections. Based on the evaluation of an expressway alternative in previous studies and by the CST it was initially determined that an expressway alternative would meet the goals of the study and be appropriate for the portion of the corridor across Jordan Lake and from NC 540 to US 1.

Signalized Intersection Alternative

Signalized Intersections are roadways with traffic signals. A corridor of signalized intersections is commonly referred to as an arterial or boulevard and is the existing classification for a majority of the US 64 corridor within the study area. Based on the evaluation of a Signalized Intersection alternative by the CST it was determined that a Signalized Intersection alternative was not likely to meet most of the goals of the study; however, based on the potential impacts associated with freeway and expressway facilities it was decided that signalized intersection alternatives could be considered, where appropriate, as a means to minimize the effects on the local communities. The CST determined that the only portion of the corridor where a signalized intersection alternative may be appropriate is the section of US 64 from east of Lake Pine Drive to the US 1 interchange.

S.3.1. Short-term Solution

Due to the likely expense and timeframe for implementing the Build Alternatives, it was decided by the CST that Short-term Concepts or Transportation System Management (TSM) Alternatives would also be developed that would enhance mobility, safety and pedestrian accessibility along the corridor with minimal capital expenditures, extending the lifespan of the corridor until a time when the long-term Build Alternative needed to be implemented.

S.3.1.1. Initial Evaluation of Short-term Concepts

The initial evaluation of short-term concepts was geared toward evaluating the potential signalized intersection concepts and selecting a short-term solution that would best meet the short-term goals established for the corridor. The following intersection types were considered for the initial evaluation of the short-term solution:

- Traditional Intersection Treatments
- Superstreet
- Median U-turn Crossover
- Quadrant Roadway
- Quadrant Roadway with Grade Separation
- Jughandle
- Split Intersection
- Continuous Flow Intersection

S.3.1.2. Initial Selection of Short-term Solutions

Based on the initial evaluation of short-term solutions, it was determined that the Superstreet with Direct Major Street Left-turns would be the initial preferred solution for each of the intersections along the US 64 corridor and was presented to the public at a workshop on April 27-28, 2009. Based on comments received at the workshop and during the comment period following the workshop, a community meeting was held on July 16, 2009 to further discuss the long-term and short-term solutions for the corridor.

S.3.1.3. Further Detailed Evaluation of Short-term Concepts

Due to the public's concerns, the CST decided to re-evaluate the corridor for both the short-term and long-term solutions. The CST decided that the corridor, while it functions as a system, has unique circumstances at different intersections and that, for this reason, a single concept and configuration cannot be used as the short-term solution along the entire corridor. Additionally, it was determined that some of the concerns with pedestrians and bicyclists may not be able to be accommodated to an acceptable level by a signalized intersection concept, such as those considered for the short-term solution, and that expressway options may be the best way to address the concerns. The CST decided that, if a viable short-term solution was not available, the intersection would be prioritized for an upgrade to a long-term solution that could better address the needs without spending money on a short-term solution that would not provide adequate benefits.

Based on the re-evaluation of the signalized intersection concepts, three concepts emerged as strong candidates to address the public's concerns to the greatest extent possible and provide for a short-term solution that addresses the goals for the corridor. Additionally, long-term concepts such as interchanges would be evaluated if none of the three concepts were determined to be adequate. The three signalized intersection concepts that were re-evaluated were:

- Superstreet with Direct Major Street Left-turns
- Superstreet with Indirect Major Street Left-turns
- Median U-turn Crossover

S.3.1.4. Short-term Solution Corridor Evaluation

The CST evaluated the US 64 corridor on an intersection-by intersection basis to determine the most appropriate short-term solution at each location. For each location the unique circumstances and context of the intersection were evaluated and a preferred solution was selected.

S.3.1.5. Determination of Final Draft Short-term Solution Recommendations

The results of the short-term corridor evaluation for the intersections within Wake County were presented to a select group of stakeholders for review and comment at the stakeholder meeting held on October 22, 2009. Based on the comments and discussion at the stakeholder meeting, the CST met and developed the Draft Final Recommendations for the Short-term Solution.

Summary of Final Draft Short-term Solution Recommendations

A summary of the Final Draft Short-term Solution Recommendations is included in Table S.2.

Table S.2: Final Draft Short-term Solution Recommendations

Intersection/Interchange	Final Draft Short-term Solution
Firefox Trace	Superstreet with Direct Major Street Left Turn
Mt. Gilead Church/Pea Ridge Road	Superstreet with Direct Major Street Left Turn
Big Woods/Seaforth Road	Superstreet with Direct Major Street Left Turn
Farrington/Beaver Creek Road	Superstreet with Direct Major Street Left Turn
NC 751/New Hill Road	Superstreet with Direct Major Street Left Turn
Jenks Road	Superstreet with Direct Major Street Left Turn
Kellyridge Road	Left-in/Right-in/Right-out
Kelly Road	No change from configuration constructed as part of NC 540 project
NC 540	No change from configuration constructed as part of NC 540 project
Green Level Church Road	No change from configuration constructed as part of NC 540 project
NC 55	No change from existing configuration
Fern Valley Lane	No change from existing configuration
Davis Drive	No change from existing configuration
Laura Duncan Road	Tight Interchange (Modern Roundabout Configuration Preferred) Note: Interim solution may include Median U-turn Crossover if privately funded
Knollwood Drive	Left-in/Right-in/Right-out
Lake Pine Drive	Median U-turn Crossover
Autopark Boulevard	Left-in/Right-in/Right-out
Mackenan/Chalon	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Gregson Drive	Superstreet with Direct Major Street Left Turn
Edinburgh Drive	Superstreet with Direct Major Street Left Turn Note: Town of Cary plans to add additional eastbound lane on US 64
US 1 Interchange	No change from existing configuration

S.3.1.6. Short-term Solution Traffic Volumes and Traffic Operations

The goal of the Short-term Solution is to improve traffic operations along the corridor and extend the lifespan of the existing corridor until the long-term solutions are needed and can be implemented. Based on this, the goal of the short-term solutions is to provide for adequate traffic operations until the year 2025.

Short-term Solution Level of Service

The LOS for the major intersections along the corridor was evaluated based on the 2025 traffic volumes for the Short-term Solution design. The analysis indicates that 11 of the 32 signalized intersections and 5 of the 7 unsignalized are projected to be operating at an unacceptable LOS E or F in 2025. For those intersections operating at LOS E or F, upgrading to the long-term solutions should be considered. An additional measure to show the traffic operations along the corridor is through the use of travel time.

S.3.2. Long-term Solution

The goal of the long-term solution for the corridor is to enhance mobility, safety and pedestrian accessibility along US 64 for the design year 2035. The process used to select a recommended long-term solution is described in this section.

S.3.2.1. Evaluation of Initial Long-term Concepts

The first step in developing the long-term solution was to develop general concepts for the corridor. These general concepts were evaluated for their potential to meet the goals for the corridor and did not include an evaluation of detailed design elements, such as the interchange configuration or detailed location of service roads. The initial evaluation included five long-term scenarios, labeled as Long-term Scenarios A-E.

S.3.2.2. Development of Preliminary Long-term Solution (Alternatives 1, 2 and 3)

Following the evaluation of the initial five concepts, three of the scenarios were carried forward for additional detailed study. The three scenarios were labeled as Preliminary Long-term Solutions, given the names Alternative 1, 2 and 3, and detailed design layouts were developed for presentation to the public at Workshop #1 on May 19-20, 2008.

S.3.2.3. Development of Preliminary Recommended Long-term Solution (Alternative 4)

Following Workshop #1 the CST met and discussed the public comments and developed a Preliminary Recommendation for the Long-term Solution, which was a combination of elements from all three of the Preliminary Long-terms Solution Alternatives as well as a variation of Alternative 3 that reduced the magnitude of the design in the residential areas through Cary and Apex. Because the Preliminary Recommended Alternative was a hybrid of the previous alternatives, it was named Alternative 4. Following discussions with the CST and the determination of the Preliminary Recommended Long-term Solution, the design plans and traffic capacity analysis were completed for Alternative 4 and the results were presented to the public at Workshop #2 on April 27-28, 2009. A Community Meeting was held on July 16, 2009 to further discuss the long-term and short-term solutions for the corridor.

S.3.2.4. Recommended Draft Long-term Solution Evaluation

Following the Community Meeting, the CST decided to reevaluate the corridor for both the short-term and long-term solution based on the community input. The CST evaluated the US 64 corridor on an intersection by intersection basis to determine the most appropriate long-term solution. For each location, the unique circumstances and context of the intersection were evaluated and a preferred method selected. The CST determined that, based on the potential impacts associated with freeway and expressway facilities, signalized intersection alternatives could be considered, where appropriate, as a means to minimize the effects on the adjacent areas. The CST determined that the only location where a signalized intersection alternative may be appropriate is the section of US 64 from east of Lake Pine Drive to the US 1 interchange.

S.3.2.5. Determination of Final Draft Long-term Solution Recommendations

The results of the long-term corridor evaluation for the intersections within Wake County were presented to a select group of stakeholders at the Stakeholder Meeting held on October 22, 2009 for review and comment. Based on the comments and discussion at the Stakeholders Workshop, the CST met and developed the Draft Final Recommendations for the Long-term Solution

Summary of Final Draft Long-term Solution Recommendations

A summary of the Final Draft Long-term Solution Recommendations is included in Table S.3.

Table S.3: Final Draft Long-term Solution Recommendations

Intersection/Interchange	Final Draft Short-term Solution
Firefox Trace	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business
Mt. Gilead Church/Pea Ridge Road	Compact Diamond Interchange
Big Woods/Seaforth Road	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
Farrington/Beaver Creek Road	Compact Diamond Interchange
NC 751/New Hill Road	Tight Diamond Interchange with US 64 relocated to the north
Jenks Road	Partial Cloverleaf Interchange with loop in southwest quadrant
Kellyridge Road	Right-in/Right-out connecting to eastbound collector-distributor road
Kelly Road	Configuration constructed as part of NC 540 project with revised connections to collector-distributor roads in both directions along US 64
NC 540	Configuration constructed as part of NC 540 project with revised connections to collector-distributor roads in both directions along US 64
Green Level Church Road	Configuration constructed as part of NC 540 project with revised connections to westbound collector-distributor road
NC 55	Improvements to NC 55, new bridge over US 64, improvements to US 64 ramps and connects to westbound collector-distributor road
Fern Valley Lane	Right-in/Right-out connecting to westbound collector-distributor road and new connection to Old Jenks Road by extending Sandy Hill Court
Davis Drive	Improvements to Davis Drive and US 64 Ramps
Laura Duncan Road	No change from Short-term (Tight Interchange)
Knollwood Drive	Right-in/Right-out subject to interchange design at Laura Duncan Road and Lake Pine Drive
Lake Pine Drive	Tight Interchange with modern roundabout configuration preferred
Autopark Boulevard	6-lane US 64 and Left-in/Right-in/Right-out
Mackenan/Chalon	6-lane US 64 and Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Gregson Drive	6-lane US 64 and Superstreet with Direct Major Street Left Turn
Edinburgh Drive	6-lane US 64 and Superstreet with Direct Major Street Left Turn
US 1 Interchange	No change from existing configuration except for additional lane on ramp from US 1/64 Southbound

S.3.2.6. Long-term Solution Traffic Volumes and Traffic Operations

The goal of the long-term solution is to improve traffic operations along the corridor and enhance the safety and mobility of US 64 until the year 2035. The analysis indicates that all basic freeway segments, ramp junctions, and multi-lane segments, as well as a majority of the freeway weaving sections and signalized intersections are projected to operate at an acceptable LOS D or better in 2035. Three locations along the corridor were projected to operate at LOS E or F in 2035.

An additional measure to show the traffic operations along the corridor is through the use of travel time. Table S.4 shows the approximate travel time for the 19-mile US 64 corridor from the US 64 Bypass west of Pittsboro to the US 1 interchange in Cary for each direction of US 64 in the AM and PM peak periods for the 2007 existing timeframe, the 2035 No-Build scenario, the 2025 Short-term scenario and the 2035 Long-term scenario.

Table S.4: Travel Time Summary

Roadway	2007 Existing AM/PM Travel Time	2035 No-Build AM/PM Travel Time	2025 Short-term AM/PM Travel Time	2035 Long-term AM/PM Travel Time
US 64 Eastbound	29 /26 minutes	54 /40 minutes	39/31 minutes	21/21 minutes
US 64 Westbound	27 /27 minutes	39 /51 minutes	28/36 minutes	20/22 minutes

Based on Table S.4, it is shown that the Short-term and Long-term Solutions improve the mobility of the US 64 to a substantial degree. The implementation of the Short-term solution will provide immediate benefits by reducing the delay along the US 64 corridor. The 2025 travel time for the corridor is slightly longer than the 2007 existing conditions, but shows an improvement over the 2035 No-Build conditions. For the 2035 Long-term Solution, the implementation of the recommendations is projected to reduce the travel time along US 64 by as much as 33 minutes over the 2035 No-Build scenario.

S.4. IMPLEMENTATION PLAN (CHAPTER 4)

This section of the study includes developing a plan for implementing the recommended short-term and long-term solutions for the corridor.

S.4.1. DEVELOPING CORRIDOR INTERSECTIONS AND SEGMENTS

For the purposes of determining how the recommended solutions will be implemented it was determined that a measured approach would be taken and the corridor would be evaluated on an intersection by intersection basis for the short-term solution. The recommended Short-term solution includes revisions to 14 intersections along the corridor. Because the recommended improvements are individual solutions at each of the intersection locations, they can be implemented either individually or as a part of a larger corridor project to upgrade multiple locations. Due to public concerns with the Short-term solutions it is recommended that initially the improvements be taken incrementally and only when needed. If following the implementation of several of the recommendations a consensus emerges that the improvements are beneficial then the combination of multiple intersections into a single project may be beneficial from a cost standpoint.

The partitioning of the corridor for the Long-term solution is a less straight forward endeavor than for the Short-term solution as several of the recommended improvements would require multiple portions of the corridor be upgraded as a part of a single project. This is because some segments of the corridor are tied together with a common improvement that would need to be constructed as a single project in order to be effective. In general, many of the intersections that are recommended as future interchanges can be implemented individually if necessary, or as a part of a larger project to upgrade a longer section of the corridor. Each segment could be developed as a stand alone project and provide benefits to the overall US 64 Corridor. The segments were developed in a manner such that they would eliminate bottlenecks along the corridor and address any potential safety issues of converting the corridor while maintaining driver's expectations. The evaluation of the corridor resulted in the development of 12 segments.

S.4.2. DEVELOPING IMPLEMENTATION TIMEFRAME AND PRIORITY OF IMPROVEMENTS

For planning purposes it is important to anticipate when projects will likely be needed. Therefore, based on the current information known along the corridor, the projected timeframe and priorities will be developed to aid in the planning process. The first step in the development of the implementation plan is to determine when the existing intersections along US 64 are no longer functioning in an acceptable manner and need to be upgraded to the short-term improvements. The second step is to determine when each of the short-term solutions will no longer be functioning in an acceptable manner and require upgrading to the long-term improvements. The timeframes being considered for the implementation plan coincide with the timeframes used in the CAMPO Long Range Transportation Plan and include 2015, 2025 and 2035. 2015 projects are projects already underway that will occur between 2010 and 2015 with an expected completion date by 2015. The 2025 projects are programmed to occur between 2015 and 2025 while the 2035 projects are for programmed for the time period between 2025 and 2035 and include sections of roads forecasted to be beyond capacity by 2025 or 2035 and that can potentially be funded with existing revenue streams or reasonably foreseeable new revenue streams. A fourth timeframe (post 2035) will also be included for those improvements that will not be over capacity in 2035 but will eventually need to be upgraded to fulfill the Strategic Highway Corridor vision and accommodate traffic volumes beyond 2035.

The implementation plan for the US 64 corridor includes recommendations based on what is currently known along the corridor and what is expected to occur in the future. If a substantial safety or traffic operations problem develops along the corridor, NCDOT may implement solutions to improve safety and mobility along the corridor outside of what is included in this study.

One item that was clear from the public involvement efforts of the study was that the public wanted to see what effect the construction of NC 540 would have on the corridor, prior to implementing any of the improvements. The assumption is that once completed, NC 540 would allow some regional and statewide traffic to bypass the section of US 64 through Cary and Apex and allow the existing configuration to operate at an acceptable level. The CST considered this effect and agreed that the implementation of any of the Short-term solutions for the US 64 Corridor, from NC 540 to the US 1 interchange should be delayed until the time that NC 540 is open to traffic and the effects of the change in travel patterns can be evaluated. Therefore, none of the Short-term solutions for Intersections 8 through 14 will be recommended prior to the 2015 timeframe.

S.4.3. IMPLEMENTATION TIMEFRAME

The traffic operations analysis for the corridor was used to determine when each of the improvements would need to be implemented. Once it was determined when each of the improvements would be needed, the timeframe for implementation was developed. The selected timeframe for each of the improvements also includes other more qualitative considerations, such as the availability of funding and includes the consideration of the concerns from the public. For example, the highest priority along the corridor would be to upgrade Laura Duncan Road to an interchange; however due to the cost and the need to develop an environmental document for the improvement, it was moved to the 2015-2025 timeframe. Conversely, the intersection improvement at Jenks Road may not have the highest volumes along the corridor, but as an unsignalized intersection it became a higher priority because it will need to become a signalized intersection soon. Additionally, due to development in the area of Jenks Road, the recommended improvements may be included in the development plans and constructed by private entities.

The recommendations included in this section are based on the best available data and assumptions about the future growth in this area, are in no way to be seen as definitive measures for when the improvements should be implemented. Ongoing review of the safety and mobility along the corridor is essential to ultimately meeting the goals of the study. It is recommended that the Agreements signed as a part of this study include a working group that meets periodically to coordinate planning efforts along the corridor and monitor the changes along the corridor compared to the assumption made as a part of this study. It is likely that through ongoing coordination that the plans included in this study may be refined and improved as new data becomes available.

Prior to implementing any project along the corridor, the following two conditions need to be met: (1) a well defined need for the improvement based on empirical analysis including, traffic studies and/or crash analysis and safety studies; (2) an identified funding source.

The results of the analysis for when improvements should be implemented are shown in Table S.5.

Table S.5: Implementation Timeframe

Short-term Solution Intersections	Implementation Timeframe	Final Draft Short-term Solution
Intersection 1 – Firefox Trace	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 2– Mt. Gilead Church/North Pea Ridge Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 3 – Big Woods Road/Seaforth Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 4 – Farrington Road/Beaver Creek Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 5 – NC 751/New Hill Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 6 – Jenks Road	2010-2015	Superstreet with Direct Major Street Left Turn
Intersection 7 – Kellyridge Road	2015-2025	Left-in/Right-in/Right-out
Intersection 8 – Knollwood Road	2015-2025	Left-in/Right-in/Right-out
Intersection 9 – Shepherds Vineyard Drive	2015-2025	Included in Median U-turn Crossover at Lake Pine Drive
Intersection 10 – Lake Pine Drive	2015-2025	Median U-turn Crossover
Intersection 11 – Autopark Boulevard	2015-2025	Left-in/Right-in/Right-out
Intersection 12 – Mackenan Drive/Chalon Drive	2015-2025	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Intersection 13 – Gregson Drive	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 14 – Edinburgh Drive	2015-2025	Superstreet with Direct Major Street Left Turn
Long-term Solution Segments	**Implementation Timeframe**	**Final Draft Long-term Solution**
Segment A – West of Haw River	Post 2035	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business
Segment B – Mt. Gilead Church/North Pea Ridge Interchange	Post 2035	Compact Diamond Interchange
Segment C – Big Woods Road/Seaforth Road Interchange	Post 2035	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
Segment D – Jordan Lake Area	2025-2035	Convert to right-in/right-out access
Segment E – Farrington Road/Beaver Creek Road Interchange	Post 2035	Compact Diamond Interchange
Segment F – NC 751/New Hill Road Interchange	2025-2035	Tight Diamond Interchange with US 64 relocated to the north
Segment G – Jenks Road Interchange	2025-2035	Partial Cloverleaf Interchange with loop in southwest quadrant
Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area	2025-2035	Kellyridge Road -Right-in/Right-out connecting to eastbound collector-distributor road. US 64 with collector-distributor roads in both directions along US 64.
Segment I – Davis Drive Interchange Area	2025-2035	Improvements to Davis Drive and US 64 Ramps
Segment J – Laura Duncan Road/CSX Railroad Crossing Area	2015-2025	Tight Interchange with modern roundabout configuration preferred
Segment K – Lake Pine Drive Interchange	2025-2035	Tight Interchange with modern roundabout configuration preferred
Segment L – East of Lake Pine Drive to US 1 Interchange	2025-2035	Upgrade short-term solution to 6-lane roadway along US 64 and add additional ramp lane to US 1 SB to US 64 WB ramp

S.4.4. Prioritization of Improvements

The priority of the projects was developed for the 2010-2015, 2015-2025, 2025-2035 and post 2035 timeframes using a similar process to the one used to determine the implementation timeframe. The prioritization is based on both the projected traffic operations and more qualitative measures such as community input and projected growth trends. The project priority for each implementation timeframes is included in Table S.6.

Table S.6: Prioritization of Improvements Summary

2010-2015 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Intersection 6 – Jenks Road Intersection	Superstreet with Direct Major Street Left Turn
2015-2025 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment J – Laura Duncan Road/CSX Railroad Crossing Area	Tight Interchange with modern roundabout configuration preferred
2	Intersection 10 – Lake Pine Drive Intersection 9 – Shepherds Vineyard Drive	Median U-turn Crossover
3	Intersection 5 – NC 751/New Hill Road	Superstreet with Direct Major Street Left Turn
4	Intersection 3 – Big Woods Road/Seaforth Road	Superstreet with Direct Major Street Left Turn
5	Intersection 14 – Edinburgh Drive	Superstreet with Direct Major Street Left Turn
6	Intersection 13 – Gregson Drive	Superstreet with Direct Major Street Left Turn
7	Intersection 11 – Autopark Boulevard Intersection 12 – Mackenan Drive/Chalon Drive	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
8	Intersection 7 – Kellyridge Road	Left-in/Right-in/Right-out
9	Intersection 4 – Farrington Road/Beaver Creek Road	Superstreet with Direct Major Street Left Turn
10	Intersection 2– Mt. Gilead Church/North Pea Ridge Road	Superstreet with Direct Major Street Left Turn
11	Intersection 8 – Knollwood Road	Left-in/Right-in/Right-out
12	Intersection 1 – Firefox Trace	Superstreet with Direct Major Street Left Turn
2025-2035 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment K – Lake Pine Drive Interchange	Tight Interchange with modern roundabout configuration preferred
2	Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area	Kellyridge Road -Right-in/Right-out connecting to eastbound collector-distributor road. US 64 with collector-distributor roads in both directions along US 64.
3	Segment L – East of Lake Pine Drive to US 1 Interchange	Upgrade short-term solution to 6-lane roadway along US 64 and add additional ramp lane to US 1 SB to US 64 WB ramp
4	Segment I – Davis Drive Interchange Area	Improvements to Davis Drive and US 64 Ramps
5	Segment F – NC 751/New Hill Road Interchange	Tight Diamond Interchange with US 64 relocated to the north
6	Segment G – Jenks Road Interchange	Partial Cloverleaf Interchange with loop in southwest quadrant
7	Segment D – Jordan Lake Area	Convert to right-in/right-out access

Post 2035 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment E – Farrington Road/Beaver Creek Road Interchange	Compact Diamond Interchange
2	Segment C – Big Woods Road/Seaforth Road Interchange	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
3	Segment B – Mt. Gilead Church/North Pea Ridge Interchange	Compact Diamond Interchange
4	Segment A – West of Haw River	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business

S.4.5. Funding

The ability to fund any of the improvements along the corridor is subject to the availability of funds. Currently, transportation funding is not able to keep pace with growing need for improvements and the rapid inflation in construction costs. North Carolina's Long-Range Statewide Multimodal Transportation Plan, completed in 2004 identified the need for over $84 billion over the next 25 years with a projected $55 billion in revenues, generating a $29 billion shortfall. A 2006 update to this report showed that the gap had expanded to $65 billion over the next 25 years. Locally, the CAMPO Long Range Transportation Plan identifies $13.6 billion in needs over the next 25 years with only $8.2 billion in expected revenue, generating a $5.4 billion shortfall.

As shown above, the competition for the limited amount of project funding is very high and it is likely that the timeframes shown in this plan may be optimistic with the actual implementation lagging behind due to a growing number of unmet needs. The current CAMPO Long Range Transportation Plan allocates approximately $11 million of the nearly $430 Million estimated to upgrade the entire corridor included in this plan to the long-term solution in the next 25 years. The priorities in the Long Range Transportation Plan are updated every four years, but it is unlikely that, due to the competitive nature of funding situation, any major improvements needed to improve mobility along US 64 will be undertaken without strong community support. It should be noted that any safety needs that arise along the corridor will be undertaken by NCDOT in order to provide a safe roadway for the traveling public.

S.4.6. Study Recommendations

In addition to the detailed recommendations on the design of the short-term and long-term solutions, several additional recommendations are being made for the corridor by the Corridor Study Team, including the following:

- Conduct a speed study for the purpose of setting an appropriate speed limit along US 64 from Kellyridge Road to US 1 before NC 540 opens and after NC 540 opens.
- Place landscaping in the median and fencing along US 64 to encourage students to use the crosswalk at the Laura Duncan Road intersection.
- Make any improvements as aesthetically pleasing as possible (keep the green/boulevard feel along the corridor).
- Consider lowering the speed limit between Laura Duncan Road and US 1 when short-term solutions are implemented.
- Recommend the towns of Cary and Apex consider developing a no compression braking ordinance to reduce noise concerns.
- The Corridor Study Team recommends that NCDOT pursue the signing of US 64 along NC 540.

- This recommendation would request that NCDOT consider a formal recommendation to designate the NC 540/US 1 roadways as US 64 Bypass and re-designate existing US 64 as US 64 Business by submitting an application to the American Association of State Highway and Transportation Officials (AASHTO) for approval. If approved by both NCDOT and AASHTO there may also be some legislative issues that would need to occur to allow the signing of a US route along a toll road.

- Recommend Town of Cary study extending Mackenan Drive to Regency Parkway over US 1 via a new bridge as part of next Comprehensive Transportation Plan.

- Recommend that the Long-term Solution be coordinated with the CAMPO Triangle Regional Intelligent Transportation System (ITS) Strategic Deployment Plan. The plan includes recommendations for the use of network surveillance through detectors and cameras and Dynamic Message Signs along US 64. The plan also recommends Emergency Management including a roadway service patrol vehicle for the portion of the corridor between NC 540 and US 1.

- Recommend that Chatham County review their land use policies and develop land use controls that would not allow the portion of the corridor within Chatham County to develop with strip mall type developments. Additionally, Chatham County and the Town of Pittsboro should consider the recommendations in this report as they evaluate emergency response times and provide additional fire stations as needed to accommodate the population growth.

- Recommend that the study partners take an active role in the development of local and regional transit efforts and take a proactive role in identifying park and ride facilities to enhance transit operations.

S.5. SYSTEMS LINKAGE EVALUATION (CHAPTER 5)

An evaluation of the multi-modal systems along the US 64 corridor is the focus of this chapter. The primary means of transportation along US 64 is by motor vehicle; however, there is a substantial need to provide for improved connectivity for all modes of transportation, including transit, bicycles and pedestrians. Please refer to Chapter 5 of the CSR for the detailed systems linkage evaluation.

S.6. ENVIRONMENTAL ANALYSIS (CHAPTER 6)

The human, cultural and natural environments are analyzed in Chapter 6 of the Corridor Study Report. The evaluation determines what the effects on environmental features will be as a result of the implementation of the Short-term and Long-term Solutions for the Study. Please refer to Chapter 6 of the CSR for the detailed environmental analysis.

S.7. LAND USE EVALUATION (CHAPTER 7)

The purpose of the land use evaluation presented in this report is to define a specific land use study area along the proposed corridor, analyze development trends, potential growth areas, and existing and future land use within the US 64 corridor. This evaluation includes the evaluation of land use compatibility with the proposed design concepts, and will identify long-term and short-term transportation and land development strategies for transitioning the corridor from its current state to the long-term solution. Please refer to Chapter 7 of the CSR for the detailed land use evaluation.

S.8. PUBLIC, CORRIDOR STUDY TEAM AND AGENCY INVOLVEMENT (CHAPTER 8)

The US 64 Corridor Study was conducted with extensive input from the public, agencies and local leaders. The Corridor Study Team (CST) guided the study and had substantial influence over its direction. The public was engaged through two large workshops, one large community meeting, smaller group meetings and through other outreach activities and materials. Early coordination with environmental regulatory agencies was initiated through two agency meetings. A summary of the collaboration and involvement that took place throughout the study is provided in this section. Detailed information is available in the appendices referenced.

S.8.1. PUBLIC INVOLVEMENT

The US 64 Corridor Study garnered substantial attention from the communities surrounding the US 64 corridor. The methods and involvement opportunities used to reach out to the public are summarized as follows:

- Mailing List
- Newsletters
- Telephone Hotline
- Project Website
- Visualizations
- Public Notices

S.8.1.1. Summary of Public Involvement Opportunities and Major Comments

Two workshops, one community meeting and two stakeholder meetings were held during the course of the study. The workshops were announced through public notices, newsletters and on the US 64 Corridor Study website.

Workshop #1

Two public workshops were held on May 19 and 20, 2008.

Workshop #2

Two public workshops were held on April 27 and 28, 2009.

Community Meeting

A Community Meeting was held on July 16, 2009.

Small Group Meetings

Throughout the study meetings were held with small groups of stakeholders who had an interest in the study.

Local Officials Meeting

Prior to the Workshop #1 meetings a special meeting for local elected officials was held to allow elected officials the opportunity to preview the materials that would be presented, ask questions and provide input.

Stakeholder Meetings

A Stakeholder Meeting was held at the Apex Town Hall on October 22, 2009 from 8:00 AM to 4:00 PM. Stakeholders requested a follow-up meeting be held to review the decisions made by the CST, which was held on December 16, 2009.

S.8.2. CORRIDOR STUDY TEAM INVOLVEMENT

A CST was created to provide guidance to and oversight of the study. A total of eight meeting were held with the CST.

S.8.3. AGENCY INVOLVEMENT

A team made up of the different permitting agencies with an interest in a project met jointly two times throughout the corridor study in order to facilitate early agency coordination.

S.9. ADDRESSING PUBLIC CONCERNS FROM THE DRAFT CORRIDOR STUDY REPORT

The Draft US 64 Corridor Study Report was made available to the public on May 5, 2010 with comments on the plan being accepted until June 30, 2010. Chatham County requested an extension to provide comments and was provided additional time to review the draft study. Chatham County provided comments on August 30, 2010. A total of 83 comments were provided by individuals, groups, local governments or elected officials. The most substantial comments related to a desire to provide a facility that met what some local stakeholders envisioned for the corridor. Further, stakeholders stated their desire to maintain the existing aspects of the corridor that they perceived to be the positive. In general, a majority of the comments received on the study felt that the recommended solutions were too large and disruptive to the communities along US 64 as well as did not fit the unique context of the US 64 Corridor.

In response to comments received, this section presents the background information on how the study was developed, what assumptions were made in developing the solutions for the study and how the public concerns can best be addressed.

The goals of the study were developed based on a set of assumptions of what will occur within the study area in the future. The primary goal of the Corridor Study was to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests. The need for the study was based on the projected growth along the corridor and the corresponding increase in traffic along the corridor. The current population projections show that the population of Wake County will increase by nearly 70% in the next two decades, while Chatham County's population will increase by 45%. The study area surrounding the US 64 corridor is anticipated to grow by nearly 41,000 persons, or an increase of 66% by 2030.

The result of this rapid growth is a substantial increase in traffic volume along US 64. Future traffic volumes for the corridor were projected based on the population projections mentioned above and the land use plans developed by each of the local governments along the corridor. As stated, the goal of the study was to develop plans that would enhance mobility by providing for adequate traffic operations along the corridor. The recommended short-term and long-term solutions were developed to provide for mobility and safety while considering the community access and interests.

A majority of the comments received on the Draft Corridor Study Report concluded that the benefits of the plan would be outweighed by the negative effects that they perceived would occur as a result of the implementation of the plan. This corridor study was completed based on the assumptions for future land use and population growth and the resulting increased traffic volumes with the goal of finding a solution that satisfied those assumptions. One of the benefits to developing long range plans is that it allows one to envision what will happen in the future based on a set of reasonable assumptions. This study has been very effective in showing how this corridor will emerge in the future if the underlying land use and population projections are accurate. Based on the lack of support for the recommended solutions for the corridor, it would be prudent to look at the underlying assumptions and determine if changing these assumptions would allow for the corridor to better match the community's vision for the corridor.

S.9.1. LINK BETWEEN LAND USE AND TRANSPORTATION

The development of transportation systems and the land use along the transportation systems are both interrelated and interdependent. Transportation systems stimulate growth and development due to improved access and reduced travel times. Over time, the improved transportation system results in increased development pressure along the corridor and eventually the growth exceeds the capacity of the transportation system, which must be improved to accommodate the development pressure. This is what has been occurring along US 64 since it was widened from two-lanes to four-lanes in the mid-1990's. The study shows that portions of US 64 are currently experiencing operational problems; however, the construction of NC 540 as an alternate route will likely reduce the traffic volumes along US 64, east of NC 540. Growth along a corridor necessitating additional improvements to the transportation system has been identified as a cycle known as the transportation-land use cycle (Figure ES-1). The transportation-land use cycle can continue indefinitely until an inability to further expand either the land use or the transportation facility occurs. Alternatively, the cycle can be broken by creating a better balance between the transportation system and the adjacent land uses.

Based on the comments received on the Draft Corridor Study Report it appears as though the stakeholders along the corridor do not desire to move forward with another expansion of the transportation system and there is a strong desire to break the cycle. As stated, the only way to break the cycle is to create a balanced environment where the magnitude of the development along the corridor matches the abilities of the transportation network to carry the associated traffic. The primary means of accomplishing this balance is through an exercise of visioning and scenario planning.

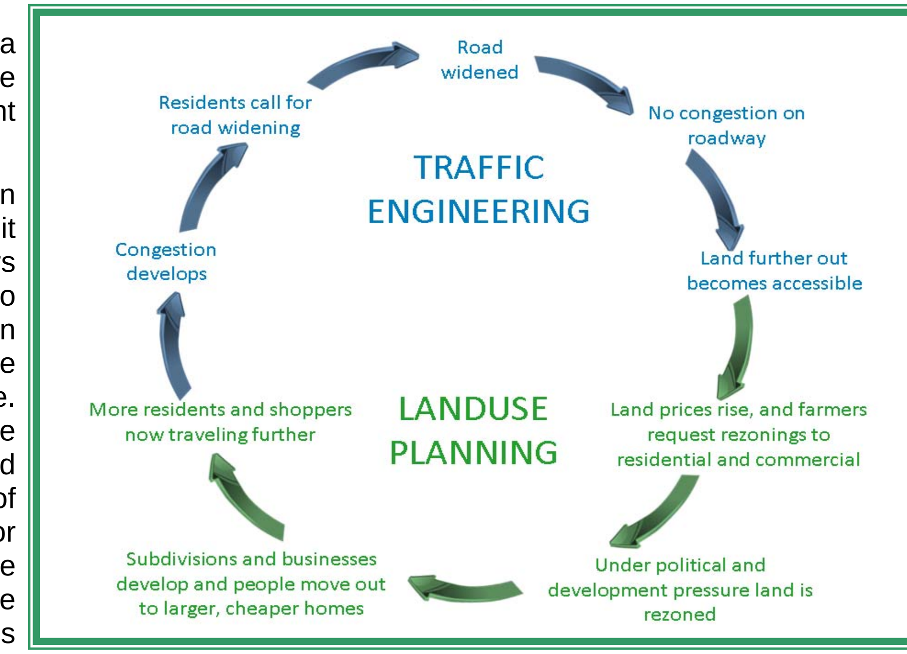


Figure ES-1: Transportation-Land Use Cycle

S.9.2. VISIONING AND SCENARIO PLANNING

The first step in the process of balancing the transportation and land use along US 64 would be to establish a vision for the corridor. Throughout the community involvement process the notion of maintaining the sense of community along the corridor emerged as a key desire along with maintaining the green boulevard feel through Wake County and the rural character through Chatham County. Scenario planning is an analytical tool that can help planning professionals prepare for what lies ahead. Scenario planning provides a framework for developing a shared vision for the future by analyzing various forces that affect growth (e.g., health, transportation, economic, environmental, land use, etc.). Scenario planning tests various future alternatives that meet state and community needs. A defining characteristic of successful public sector scenario planning is that it actively involves the public, the business community, and elected officials on a broad scale, educating them about growth trends and trade-offs, and incorporating their values and feedback into future plans.

S.9.3. RECOMMENDATION FOR THE US 64 CORRIDOR

One of the objectives of this study was to be proactive in identifying transportation solutions that would accommodate the growth anticipated by the local governments along the corridor. Upon further consideration, what has been made clear over the past three years as this study has been developed is that the stakeholders along the corridor do not support the further expansion of the roadway, thus do not support the future growth plans established by the local governments along the corridor. The study has shown that a majority of the traffic along US 64 is projected to be local traffic. For example, 90% of the traffic passing Apex High School on US 64 has an origin or destination within 15 miles of the school.

In retrospect, the objectives of this study may serve a different role than originally intended. This report should be seen as a glimpse into the future of what will be needed from a transportation perspective if the growth plans that are currently in place are allowed to come to fruition. The land use and development along the corridor is under the jurisdiction of the Towns of Cary, Apex and Pittsboro as well as Wake and Chatham Counties. It is recommended that the local governments determine if the outcome of this study is consistent with the goals and objectives of the towns. If the plan is not consistent, then it is recommended that the local governments undertake an effort to determine the community vision for the corridor and through scenario planning develop a solution that meets the vision for the corridor by balancing the interaction of land use and transportation.

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Chapter 1: Introduction

US 64 at
Patriot Way
(October 2009)

CHAPTER 1. INTRODUCTION

The US 64 corridor has been identified in the state's Strategic Highway Corridors (SHC) initiative. The Strategic Highway Corridors initiative seeks to identify, protect and maximize the use of highway corridors that play a critical role in regional or statewide mobility in an ongoing effort to enhance transportation, economic development and environmental stewardship throughout North Carolina.

The goal of the US 64 Corridor Study is to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests. The evaluation of the US 64 corridor is being done in phases. This study is the second phase of the comprehensive *US 64-NC 49 Corridor Study Phase 1 Report* completed in May 2005 that included US 64 and NC 49 from Statesville and Charlotte to Raleigh. Phase 1 of the study included a regional assessment of transportation needs, the evaluation of broad alternative roadway investment strategies to meet those needs and the selection of a vision for the entire US 64 and NC 49 corridors. Phase 2 of this study, the subject of this report, consists of a more detailed evaluation of the corridor from Pittsboro to Cary (identified as the highest priority segment in Phase 1); including developing recommended designs for both short-term and long-term solutions.

This plan will be used to guide development and improvements along the corridor from US 64 Business in Pittsboro to US 1 in Cary. The study is being conducted as a joint effort between the North Carolina Department of Transportation (NCDOT), the Capital Area Metropolitan Planning Organization (CAMPO), Town of Apex, Town of Cary, Town Of Pittsboro, Wake County and Chatham County for the segment of US 64 from the US 64/US 64 Business split on the east side of Pittsboro to the US 1/US 64 interchange in Cary.

The report is organized as follows:

- Chapter 1 provides an introduction to the study, presents the purpose and goals for the study and the context of the study in relation to the overall planning process.
- Chapter 2 provides an overview of the existing and anticipated future conditions along the corridor.
- Chapter 3 describes the alternatives considered for the short-term and long-term solutions for the corridor and presents the master plan for the corridor.
- Chapter 4 describes how the master plan for the corridor will be implemented and presents the steps required before the recommended improvements are constructed.
- Chapter 5 describes the integration of alternate travel modes such as transit, bicycle and pedestrian into the recommended short-term and long-term solutions.
- Chapter 6 provides an analysis of the effects on the human and natural environments for the short-term and long-term solutions.
- Chapter 7 provides an evaluation of the land use along the corridor and provides recommendations for future zoning along the corridor.
- Chapter 8 describes the efforts made to engage the public in the development of this study as well as the coordination with regulatory agencies and the Corridor Study Team.

1.1 DESIGNATION OF US 64 AS A STRATEGIC HIGHWAY CORRIDOR

The Strategic Highway Corridors initiative was adopted by the North Carolina Board of Transportation on September 2, 2004, as a part of North Carolina's Long-Range, Multimodal Statewide Transportation Plan. Following adoption, a formal policy statement on the initiative was endorsed by the Departments of Commerce, Environment and Natural Resources, Transportation, and the Governor's Office. The NCDOT Board of Transportation approved revisions to the SHC Vision Plan in March 2007 and July 2008 and the currently approved SHC Vision Plan is shown in Figure 1.1.

The North Carolina SHC initiative represents the first major implementation step to be advanced under the state's Long-Range Multimodal Statewide Transportation Plan. The concept defines a new focus for NCDOT to improve, protect, and maximize the capacity of existing highway corridors deemed critical to statewide mobility and regional connectivity. The SHC initiative represents an opportunity for NCDOT in partnership with corridor stakeholders to create a long-range corridor vision. This vision encompasses decision-making consistency, land use and transportation relationships, and roadway design and operational elements.

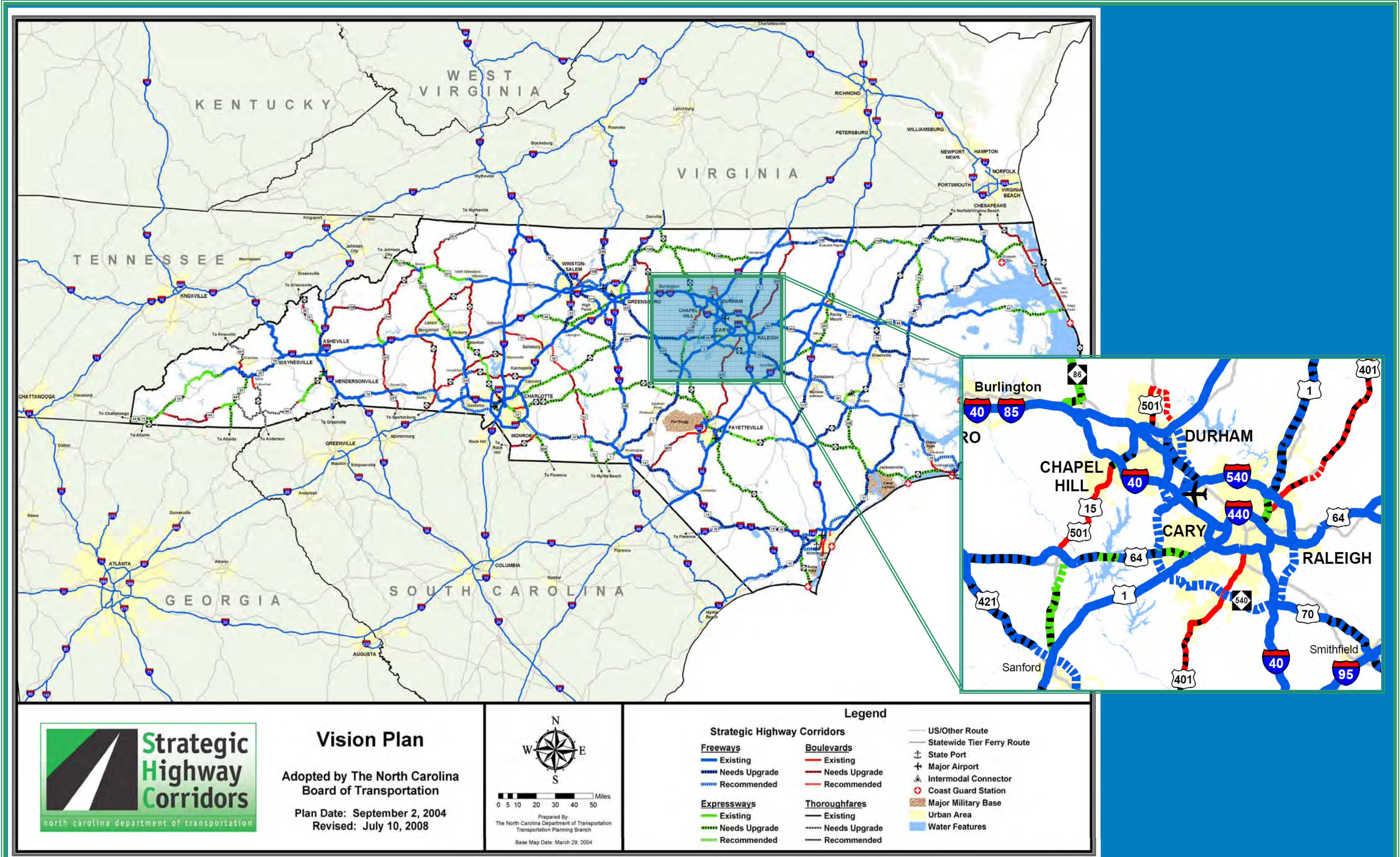
NCDOT has identified the US 64 corridor as a Strategic Highway Corridor. The US 64 corridor is considered to possess the following characteristics consistent with Strategic Highway Corridors criteria:

- Potential to carry significant traffic
- Connect existing major activity centers
- Connect existing and planned Interstate facilities
- Potential to serve as an Interstate reliever route
- Part of the National Highway System (NHS)

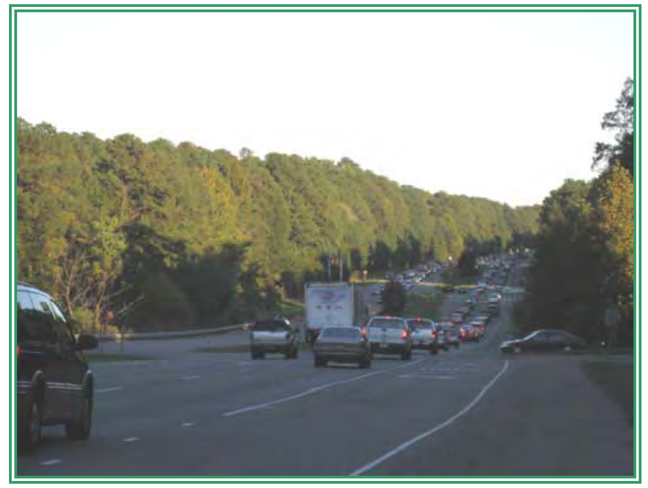
US 64 is an important highway in North Carolina. The route being studied serves three major functions:

- Statewide Travel - US 64 is used to travel between the Raleigh area, Greensboro area (via US 421), and Charlotte area (via NC 49), as the highway serves as an alternate route to the often-congested Interstate 40/85 corridor. As traffic volumes continue to increase along these interstate routes, US 64 will become an even more important highway to facilitate the efficient and safe movement of people and goods across the state. US 64 is an important route at both the state and national level. The designation of US 64 as a Strategic Highway Corridor demonstrates that it is one of the key highways in the state. US 64 is also part of the North Carolina Intrastate System and the National Highway System and is signed as a United States route.
- Regional Travel - US 64 is the only major east-west route in the Raleigh-Durham metropolitan area between Wake and Chatham Counties. Many commuters use this route to travel between Pittsboro, Apex, Cary, and Raleigh for work, shopping, and/or dining.
- Local Travel - Many neighborhoods are located along the US 64 corridor. Residents use the highway to travel to local shopping centers, community parks, area schools, and the Eva Perry Regional Library.

Figure 1.1: Strategic Highway Corridor Vision Plan



1.2 NEED FOR THE STUDY



Increasing traffic volumes over the past several years have substantially reduced the traffic flow and increased congestion along US 64. This congestion is expected to worsen as the Raleigh-Durham metropolitan area continues to experience rapid growth. An estimated 1.2 million new residents are expected to move within 30 miles of downtown Raleigh by the year 2035.

The proposed extension of NC 540 (Raleigh Outer Loop) is expected to enhance the desirability of the western Wake and eastern Chatham County area further, as motorists traveling to the Research Triangle Park (RTP), one of the major employment centers in the region, will experience shorter travel times. Roadways connecting to the proposed extension of NC 540, such as US 64, are anticipated to see an increase of traffic resulting from motorists using the new highway to travel to and from RTP. Many examples of the increased traffic on roadways connecting to the Raleigh Outer Loop (also known as I-540 and NC 540) can be found throughout the region. One notable example is along US 1 between I-540 and Wake Forest. Traffic along US 1 near the Neuse River has increased from 39,000 vehicles per day in 1998 to 63,000 vehicles per day in 2007 (I-540 was completed between RTP and US 1 in 2003). Travel times and congestion along US 1 have substantially increased as a result of the additional vehicles using the highway.

The need exists to develop a plan to preserve and enhance mobility and safety along US 64 as a result of the anticipated increase in motorists using the highway. Traffic volumes in 2007 ranged from 16,000 vehicles per day near Jordan Lake to 54,000 vehicles per day near US 1. The existing traffic volumes are causing several of the traffic signals in Cary and Apex to fail in rush hours, meaning there are more motorists who want to go through the signals than the signals can allow. In 2035 traffic volumes are projected to range from 44,000 vehicles per day near Jordan Lake to 70,000 vehicles per day near US 1, with an estimated 68,000 vehicles per day just west of the proposed NC 540 extension. Without additional improvements to US 64, congestion and travel times are expected to substantially worsen, in a manner similar to US 1.

1.3 PURPOSE OF THE STUDY

The goal of the study is to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests. This plan will be used to guide development and improvements along the corridor from US 64 Business in Pittsboro to US 1 in Cary.

The master plan includes two distinct components, a short-term plan and a long-term plan:

- The short-term plan consists of interim strategies to improve mobility, safety and pedestrian accessibility at major intersections.
- The long-term plan consists of improvements needed to serve the anticipated amount of traffic in the year 2035 and later. It proposes to convert many of the major intersections to interchanges or overpasses.

The primary purpose of the master plan is to develop a vision for the corridor and establish a framework for collaborative decision making along the corridor. The goal of the study is to establish how the corridor will transition to accommodate the increased growth in traffic volumes that are anticipated in the next 30 years.

The desired outcome is to establish solutions that can be implemented in the short-term, within the next 5 to 10 years, and in the long-term horizon of the next 30 years. These solutions will help guide the planning and development along the corridor such that there is a transportation system that can support the projected growth in a manner that balances the interests and desires of many users who live or travel along US 64.

One of the most important elements of this study is to establish a framework and collaborative process for the decision making for land use and transportation along the corridor. Numerous agencies and groups are responsible for overseeing elements of the corridor, including environmental agencies, NCDOT, counties and local municipalities. This study will provide a comprehensive plan for the corridor that will provide the decision makers with the tools to collaborate and make decisions that are consistent with the vision for the corridor. Once the study is completed, it is anticipated that it will not be the end of the process, but the beginning of the stage where the partners along the corridor work together to implement solutions that enhance the corridor for users, residents and businesses along the corridor.

Just as important as defining what is the purpose of the study, it is important to define what the purpose of the study is not. The results of this study and the recommended solutions will not directly result in the construction of any of the solutions identified, but will act as a basis for developing additional studies to implement solutions that are consistent with the vision for the corridor. As these additional studies are undertaken there will typically be opportunities for public input prior to any solution being implemented.

The study will establish a guide for the corridor, and is based on existing data and projections of how the corridor is expected to evolve in the future. The results of the study are meant to be flexible and allow for innovation and enhancement of the solutions in the event that the future trends change or better solutions are developed. With a collaborative effort by the stakeholders along the corridor, it is likely that elements of this study may be improved upon and changes made that will better balance the community's needs while maintaining the overall vision for the corridor.

1.4 CORRIDOR STUDY PROCESS

A brief description of the steps included in the corridor study process is included in this section. The entire evaluation process for the US 64 Corridor Study is shown in Figure 1.2. Throughout this report, the steps of the study process will be highlighted in each of the pertinent sections by using the graphic shown at right, with the text in the box showing which step is being described in that section.

Evaluate Existing and Projected Conditions – The first step undertaken was to collect existing data along the corridor and project what the corridor will be like in the future if no improvements are made. This step included evaluating accident data and traffic data for the existing and future conditions, as well as collecting pertinent land use and environmental data for the corridor.

Determine the Need for the Study – The next step was to develop a list of needs based on the projected deficiencies along the corridor as a basis for developing goals for the study, and ultimately solutions for the corridor.

Determine Study Goals – The Corridor Study Team then developed the goals for the study based on the needs established. The goals were later used as a measure to determine whether a solution was viable and should be considered as a part of the study.

Figure 1.2: Corridor Study Process

1. Evaluate Existing and Projected Conditions
2. Determine the Need for the Study
3. Determine Study Goals
4. Develop Initial Long-term Solutions
5. Evaluate Initial Long-term Solutions
6. Present Initial Long-term Solutions to Public
7. Determine Preliminary Recommendation for Long-term Solution
8. Develop Initial Short-term Solutions
9. Evaluate Initial Short-term Solutions
10. Develop Initial Recommendations for Implementation
11. Present Preliminary Recommendations to Public
12. Refine Preliminary Recommendations and Make Final Recommendations
13. Refine Evaluation of Final Recommendations
14. Develop Draft Corridor Study Report
15. Present Draft Corridor Study Report to Public
16. Revise/Finalize Corridor Study Report
17. Seek Approvals and Develop Agreements

Develop Initial Long-term Solutions – Initial Long-term Solutions were then developed to determine the range of solutions along the corridor that would meet the established needs and goals for the study. From this step, approximately three potential solutions were developed for the corridor.

Evaluate Initial Long-term Solutions – The design for the potential Long-term Solutions was then developed along with a preliminary cost estimate. Projected traffic volumes were determined and the effects on the human and natural environments along the corridor were evaluated.

Present Initial Long-term Solutions to Public – The three initial Long-term Solutions were then presented to the public at a workshop in order to help the public to understand the study process and give the public the opportunity to comment on the solutions presented.

Determine Preliminary Recommendation for Long-term Solution – The comments from the public were collected and summarized and the Corridor Study Team met to evaluate the comments and select a preliminary recommendation for the Long-term Solution. The Preliminary Recommended Long-term Solution was then developed into a detailed design plan.

Develop Initial Short-term Solutions – The Corridor Study Team then evaluated potential Short-term Solutions that can be implemented along the corridor as it transitions from the existing condition to the Long-term Solution. From this step, a single Short-term Solution for the corridor was carried forward for additional evaluation.

Evaluate initial Short term Solutions – The next step was to develop the design for the potential Short-term Solution, determine the projected traffic volumes, develop a preliminary cost estimate and evaluate the effects on the human and natural environments along the corridor.

Develop Initial Recommendations for Implementation – Based on the Preliminary Recommendations for the Long-term and Short-term Solutions, the Corridor Study Team developed initial recommendations for how the improvements along the corridor will be prioritized and determined the timeframe that each improvement will likely be implemented.

Present Preliminary Recommendations to Public – The Preliminary Recommendations for the Short-term and Long-term Solutions and the Initial Recommendations for the Implementation were presented to the public at a second workshop. The Workshop was an opportunity for the public to ask questions and make comments on the preliminary recommendations and provide feedback to the Corridor Study Team.

Refine Preliminary Recommendations and Make Final Recommendations - The comments from the public were collected and summarized and the Corridor Study Team met to evaluate the comments and make a recommendation for the Short-term and Long-term Solutions.

Refine Evaluation of Final Recommendations – The Long-term and Short-term Solutions were refined and the Final Recommendations were evaluated in greater depth, including a detailed evaluation of the traffic operations, environmental effects, construction costs and land use effects.

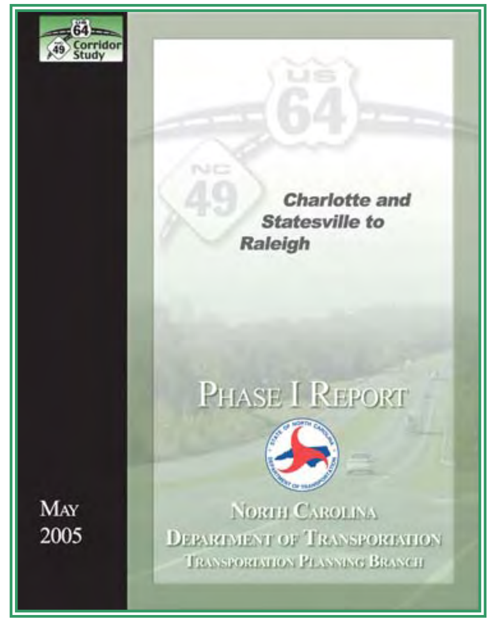
Develop Draft Corridor Study Report – The Draft of the Corridor Study Report was developed and reviewed by the Corridor Study Team.

Present Draft Corridor Study Report to Public – The Draft Corridor Study Report is currently being made available for public comment for a minimum of 30 days.

Revise/Finalize Corridor Study Report – Following the public comment period, the Corridor Study Team will meet to discuss the comments from the public, make any final revisions to the study and develop the Final Corridor Study Report.

<u>Seek Approvals and Develop Agreements</u> – The Final Corridor Study Report will be submitted to CAMPO for approval and the Corridor Study Team will develop an agreement to continue periodic coordination on the elements of the corridor in the future.

1.5 RELATIONSHIP TO THE PHASE I STUDY



The US 64 Corridor Study included in this report is the second phase of a larger analysis of the US 64 and NC 49 corridor that was completed in May 2005, known as the Phase 1 study. The Phase 1 study included evaluating US 64 and NC 49 from Charlotte and Statesville to Raleigh and is included in the *US 64-NC 49 Corridor Study Phase 1 Report*. Phase I of the study consisted of a regional assessment of transportation needs and the evaluation of a broad range of alternative roadway investment strategies to meet those needs. The product of Phase I was a corridor vision that defines the improvement design concept (major features and characteristics) and scope (range or extent of the proposed action). The Phase 1 study also prioritized segments of the corridor and recommended further detailed evaluation to address location specific improvements. The segment of US 64 from Pittsboro to the US 1 interchange was determined to be the highest priority due to the exiting traffic conditions and area growth and this study further evaluates this segment to determine the specific improvements along this segment.

1.6 MAKEUP, ROLE AND PURPOSE OF THE CORRIDOR STUDY TEAM

The US 64 Corridor Study is being overseen by a committee made up of representatives of the entities that are responsible for decision making along the corridor, known as the Corridor Study Team (CST). The Corridor Study Team is made up of representatives from the following organizations:

- NCDOT Strategic Planning Office
- NCDOT Transportation Planning Branch
- NCDOT Roadway Design Unit
- NCDOT Project Development and Environmental Analysis Branch
- NCDOT Mobility and Safety Division
- NCDOT Bicycle and Pedestrian Division
- NCDOT Division 5
- NCDOT Division 8
- CAMPO
- Triangle Area Rural Planning Organization
- Chatham County
- Wake County
- Town of Pittsboro
- Town of Apex
- Town of Cary
- North Carolina Turnpike Authority
- Federal Highway Administration

- US Army Corp of Engineers
- North Carolina State Park Service

The role of the CST is to oversee both technical and non-technical matters, provide input on meeting the goals of the study and develop consensus for the solutions presented in this study. CST members were critical to the study process in assisting with the following items:

- Developing the goals and objectives for the study
- Providing in-depth knowledge of the study area
- Developing potential solutions for the corridor
- Evaluating solutions and providing input into the recommendation of solutions
- Raising and discussing issues of concern
- Providing support in the public involvement process
- Representing the range of interests along the corridor
- Communicating project information and findings to their respective organizations

The CST operates on a consensus basis, with each member having the ability to discuss concerns and request additional detail in the development of this study. Consensus was defined as each member of the team being able to live with the results of the study. Each step in the study was discussed with the CST, with consensus being reached on each element before it was moved forward in the study. For more information on the meetings held by the CST refer to Chapter 8 of this report.

The purpose of the CST also extends beyond the development of this report, as it is envisioned that the CST or a subset of the group will continue to meet in the future as the results of this study are implemented. The establishment of an ongoing effort is critical to ensure that goals of the study are realized in the most effective manner possible.

1.7 RELATIONSHIP OF THE STUDY TO THE OVERALL PROJECT DEVELOPMENT PROCESS

It is important to note that this study is an initial step toward the implementation of the solutions recommended for the US 64 corridor. The overall process for construction of transportation projects includes numerous steps to complete. The development of transportation projects, Shown in Figure 1.3, generally follows a four step process including the following steps:

- Long Range Planning – Typically done on a regional level and involves developing strategies for the overall transportation network. Steps in the process include: determine transportation deficiencies, develop scenarios to eliminate deficiencies, determine priority of projects based on funding, and develop a Long Range Plan. Improvements at this stage are typically identified by the number of lanes and facility type required and very little detailed analysis at the corridor level is undertaken. Examples of Long Range Plans are CAMPO Long Range Transportation Plan and the Town of Cary Comprehensive Transportation Plan.
- Corridor Planning – Typically done for major corridors once the Long Range Plan for the corridor has been established. This is the level of planning included in this Corridor Study Report. In corridor planning, more

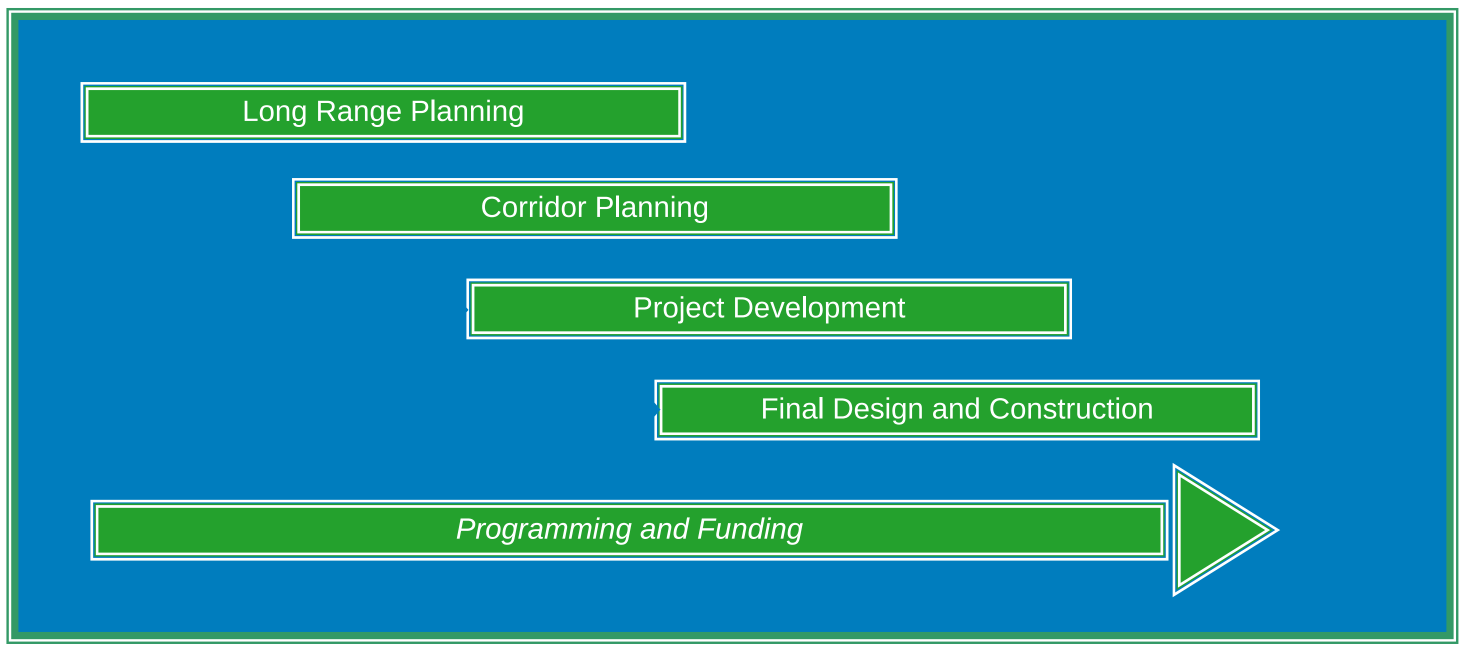
detailed concepts for specific locations along the corridor are evaluated. This level of planning typically includes the conceptual design of the corridor, detailed evaluation of traffic operations, prioritization of corridor segments and analysis of the effects on the human and natural environments.

- Project Development – This step in the process includes developing detailed preliminary designs of the corridor and completion of an environmental document. The Project Development process requires public involvement and can be a lengthy process, depending on the size of the project and the magnitude of impacts that it would create.

- Final Design and Construction – Once the Project Development process is completed, projects enter a stage where detailed construction drawings are developed including all elements necessary for the construction of the project.

In addition to these four steps, a fifth step is often included in the process that overlaps with the four-step process. The fifth step is the programming of the project in a funding plan and includes determining the construction cost and priority of the project. The typical funding plan for projects paid for with state or federal funds is the State Transportation Improvement Program (STIP) which allocates the available funding throughout the state to individual projects. For locally funded projects, the programming of the project is typically included in a Capital Improvement Program developed by each local government.

Figure 1.3: General Planning Process



The planning process will vary slightly for the Project Development phase depending on the funding source for the project. The following three general funding sources are typically used for construction projects:

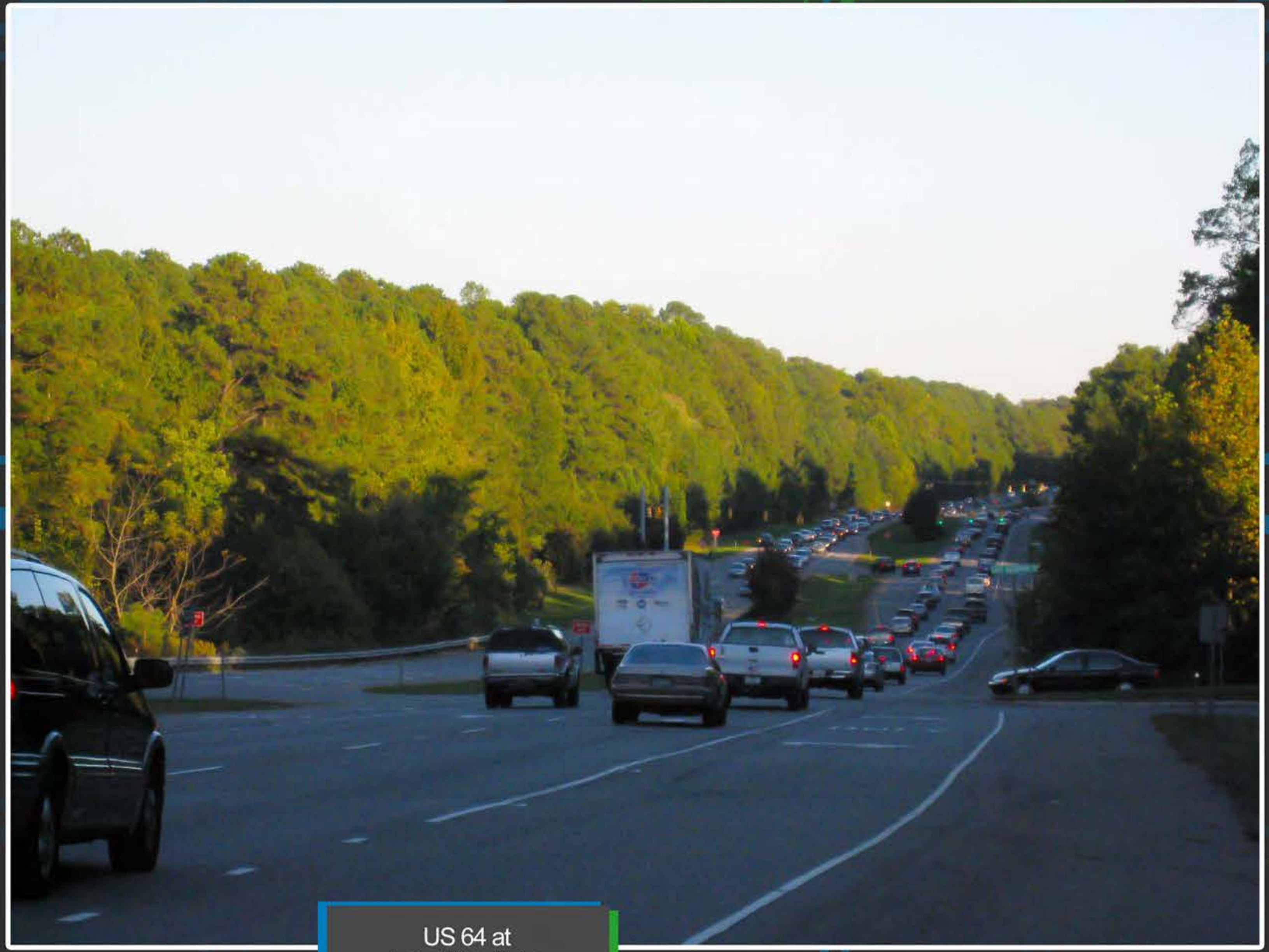
- State or Federal Funds – for projects paid for with state or federal funds, a longer and more complex Project Development phase is undertaken that must satisfy the requirements for the National Environmental Policy Act (NEPA) for federal projects and the State Environmental Policy Act (SEPA) for state funded projects. Depending on the magnitude of the project either a Categorical Exclusion (CE), Environmental Assessment (EA) or Environmental Impact Statement (EIS) will be required, with a CE taking as little as 6 months to prepare to an EIS typically taking 5-10 years to complete. All projects with state or federal funding require public involvement.

- Local Funds – for projects paid for by local municipalities or regional agencies, a less detailed process is typically undertaken. The process includes evaluation of alternatives and includes public involvement opportunities.

- Private Funds – for projects that are constructed by private entities, typically by developers, the process is not as well defined. Most municipalities require public involvement as a part of the development process and the Project Development phase is typically short in duration.

A more detailed description of the planning process is included in Chapter 4.

Chapter 2: Existing and Anticipated Conditions



US 64 at
Lake Pine Drive
(October 2009)

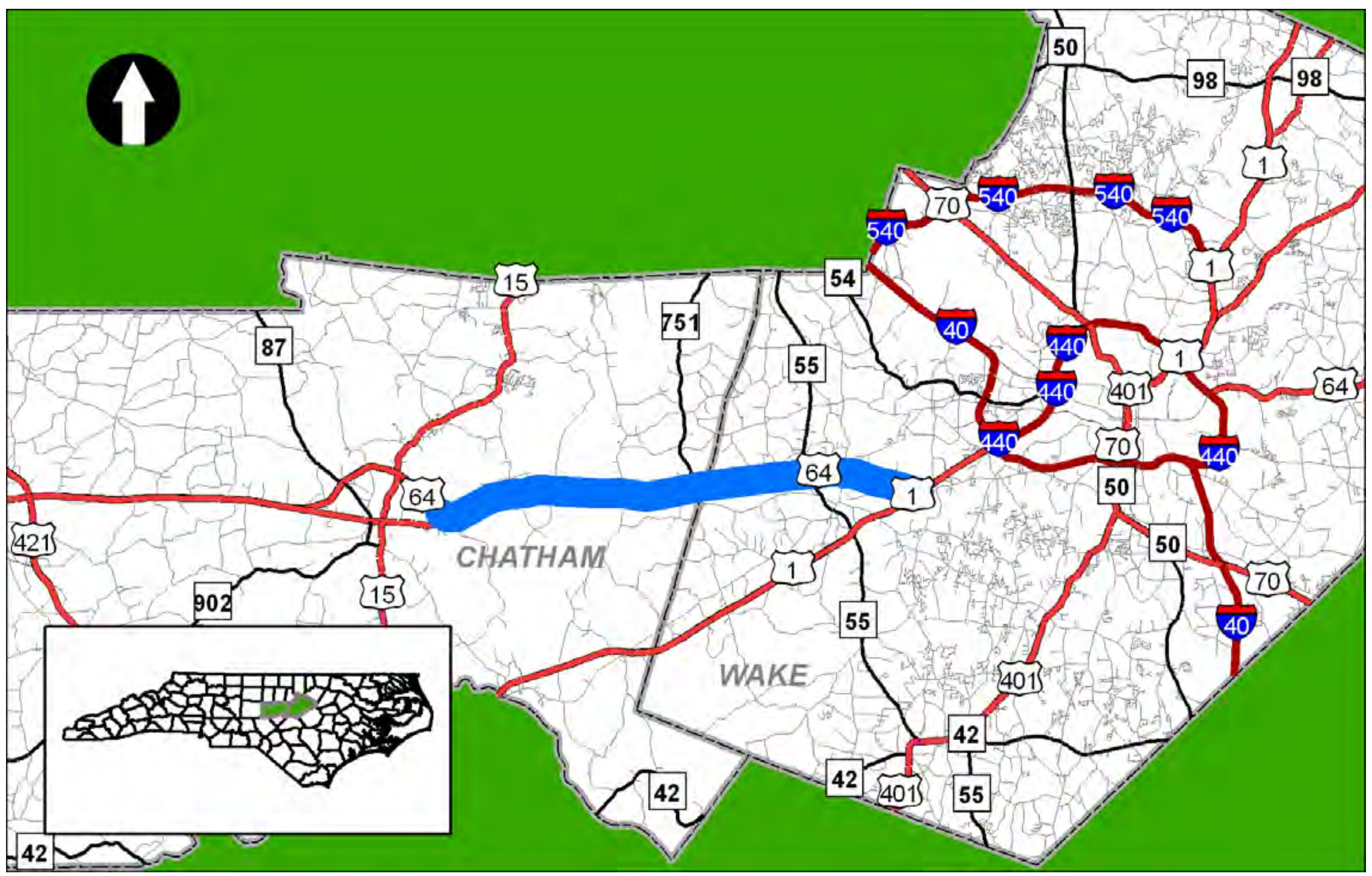
CHAPTER 2. EXISTING AND ANTICIPATED CONDITIONS

This chapter includes an evaluation of the existing conditions along the corridor and an analysis of what the corridor will look like in the future if no major improvements are made to US 64.

2.1 STUDY AREA DESCRIPTION

The US 64 corridor study area begins at the US 64 Business/US 64 Bypass Interchange, east of Pittsboro (Chatham County) and extends east to the US 1/US 64 interchange in Cary (Wake County). The study area is approximately 19 miles in length, which includes two miles across Jordan Lake. The study area includes approximately 1500 feet on each side of existing US 64. The study area also includes a segment of US 1 at the east end of the corridor for potential modifications to the US 1/US 64 interchange. The study area for the corridor is shown in Figure 2.1. The corridor includes ten miles in Chatham County and nine miles in Wake County and passes through the towns of Apex and Cary.

Figure 2.1: Study Area



2.2 POPULATION AND DEVELOPMENT

The Triangle area is one of the fastest growing areas in the nation and has been identified on numerous "Best Places" lists. According to the US Census Bureau in March 2009, Raleigh-Cary was the fastest growing metropolitan area in the nation. In 2009 alone, according to the Greater Raleigh Chamber of Commerce, the Triangle area received over 35 accolades including the following:

- #1 City with Best Economic Potential (*fDi Magazine)*
- #1 City where Americans are Relocating (Forbes.com)
- #1 Best Place for Business and Careers (Forbes.com)
- #1 Top City for Small Business (*Bizjournals)*
- #1 America's Smartest Cities (The Daily Beast)
- #3 Best Places to Launch a Small Business (CNNMoney.com)
- #5 Metro for Best Quality of Life (*Business Facilities*)
- #6 Healthiest Housing Market (Builderonline.com)
- #8 Best Big City for Jobs (Forbes.com)
- #10 Best City (*Kiplinger's)*
- #10 High-tech Centers in the U.S. (*American City Business Journals)*

Based on the strong growth in the past and the continued strong outlook for growth in the future, the Triangle region is poised for a substantial amount of growth in the coming years.

2.2.1 CURRENT POPULATION AND TRENDS

The current population and growth trends for the past 20 years are discussed in this section and summarized in Table 2.1. Chatham County had a slightly higher growth rate than the state and a slower growth than Wake County from 1980 to 1990 and 1990 to 2000. The Town of Pittsboro had a higher growth than both the state and Chatham County during these decades. According to North Carolina State Demographics, the Town of Pittsboro had a projected average increase of 1.5% per year from 2000 to 2008.

The Town of Apex has had a substantial amount of growth in the last two decades compared to Wake County and North Carolina. As shown in Table 2.1, Apex had an estimated 306.8% increase in population from 1990 to 2000. According to the Town of Apex Development Report (Town of Apex, October 2008), population increased in Apex 72% from 2000 to 2008, with an average growth rate of 6.4% per year. The estimated average number of residents added per day in 2008 was 2.97.

According to the Town of Cary's Population Report (Town of Cary, July 2007), the Town has had an annual growth rate averaging 7.6% from 1980 to 2000, and has grown an average of 4.2% per year from 2000 to 2007. Like the Town of Apex, the Town of Cary has had a substantial amount of growth in the last two decades compared to Wake County and the state. As shown in Table 2.1, Cary had an estimated 117.5% increase in population from 1990 to 2000.

Table 2.1: Population Trends

	1980	1990	2000	% Change	
				1980-1990	1990-2000
North Carolina	5,880,095	6,632,448	8,049,313	12.8	21.4
Wake County	301,429	426,301	627,846	41.4	47.3
Chatham County	33,415	38,759	49,326	16.0	27.3
Apex	2,847	4,968	20,212	74.5	306.8
Cary	21,763	43,457	94,536	99.7	117.5
Pittsboro	1,332	1,621	2,226	21.7	37.3

Source: http://data.osbm.state.nc.us/pls/linc/dyn_linc_main.show

2.2.2 POPULATION PROJECTIONS

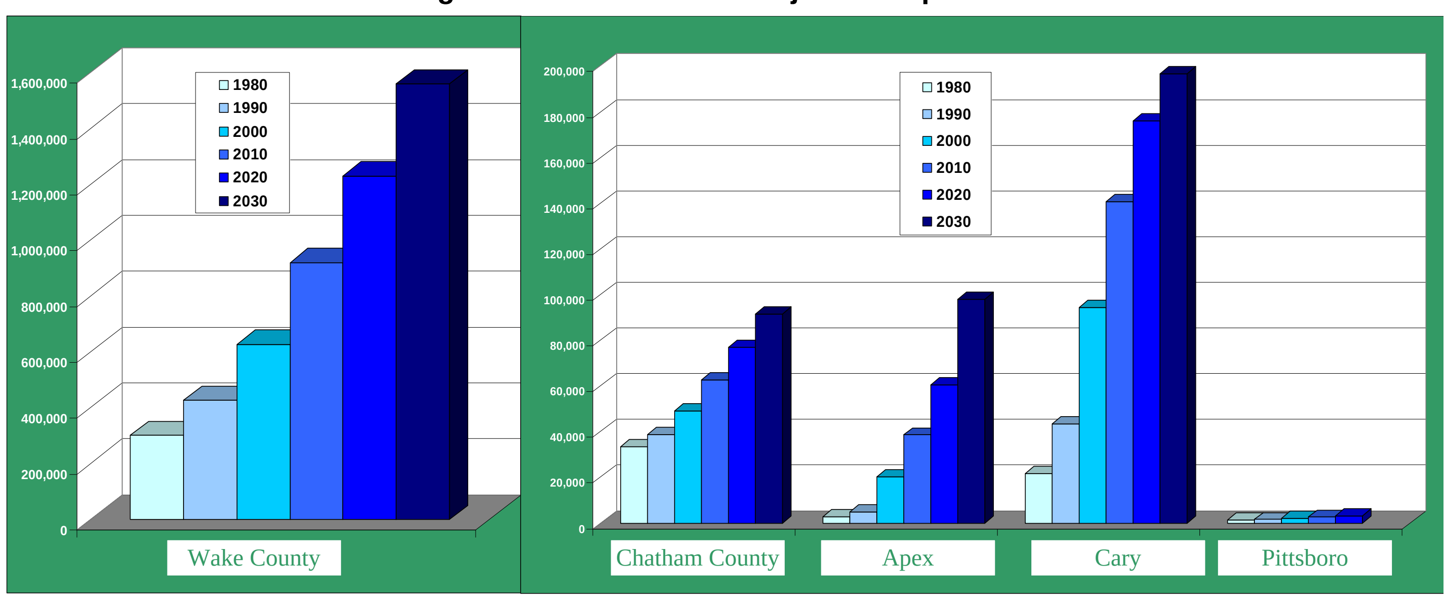
According to the North Carolina Department of Commerce's Economic Development Intelligence System, Chatham County is expected to have an annual growth rate of 2.6% from 2008 to 2013, with an estimated 2013 population of 69,498. This is comparable to its growth rate from 1990 to 2000. As shown in Table 2.2 and Figure 2.2, population estimates show an estimated increase of 27.5% from 2000 to 2010, 22.5% from 2010 to 2020, and 18.8% increase from 2020 to 2030. All estimates for Chatham County are slightly higher than growth rates for the state.

Table 2.2: Population Projections

Area	Population				Growth % Change		
	2000	2010	2020	2030	2000-2010	2010-2020	2020-2030
North Carolina	8,046,813	9,502,904	10,966,956	12,465,478	18.1	15.4	13.7
Wake County	627,846	920,298	1,230,382	1,560,026	51.4	33.7	26.8
Chatham County	49,326	62,887	77,008	91,491	27.5	22.5	18.8
Town of Apex	20,212	38,659	60,614	98,091	91.3	56.8	61.8
Town of Cary	94,536	140,871	176,072	196,806	49.0	25.0	11.8
Town of Pittsboro	2,226	2,678	3,120	n/a	20.3	16.5	n/a

Source: CAMPO, Population summary.; Log Into North Carolina (LINC) Census Lookup. Available: http://linc.state.nc.us/.; North Carolina State Demographics. Available : http://osbm.state.nc.us.; Town of Apex, Development Report, October 8, 2008.; Town of Pittsboro, Land Use Plan, June 27, 2002.; U.S. Census Bureau, 2000 U.S. Census.

Figure 2.2: Current and Projected Population



The Town of Pittsboro's Land Use Plan estimates an increase in growth of 20.3% from 2000 to 2010 and an increase of 16.5% from 2010 to 2020. These estimates are comparable to the state and lower than the estimates for Chatham County.

Wake County has a projected increase in growth of 51.4% from 2000 to 2010, an increase of 33.7% from 2010 to 2020 and an increase of 26.8% from 2020 to 2030. These estimates are substantially higher (nearly double) than the percent increase for the state and the estimates for Chatham County.

According to the Town of Apex Development Report, it is estimated that the Town's population will be approximately 48,408 in 2015. As shown in Table 2.2 and Figure 2.2, the projected population for the Town of Apex in 2010 is 38,659, a 91.3% increase from 2000. It is also projected that the town will have a 56.8% increase from 2010 to 2020 and a 61.8% increase from 2020 to 2030. These projections are substantially higher than Wake County and the state.

The Town of Cary has a projected increase in growth of 49.0% from 2000 to 2010, an increase of 25.0% from 2010 to 2020 and an increase of 11.8% from 2020 to 2030. These estimates are higher than the percent increase for the state between 2000 and 2020 but lower than the percent increase between 2020 and 2030.

A summary of the growth along the US 64 corridor is shown in Figure 2.3 for Population and Figure 2.4 for Employment. Each dot in Figure 2.3 denotes 100 people and is shown for 2005 and 2035, while each dot in Figure 2.4 denotes 50 jobs and is shown for 2005 and 2035. The information is based on the population and employment projections developed by CAMPO in support of their 2009 Long Range Transportation Plan. The data was developed in 2008 and may not include several large developments that have been approved recently. The graphics show large growth in western Wake County with the growth in Chatham County being somewhat limited by the watershed restrictions for Jordan Lake.

As can be seen from Table 2.2 and Figure 2.2, Figure 2.3, and Figure 2.4; the US 64 corridor and the surrounding areas are projected to have strong growth in the future.

Figure 2.3: 2005 and 2035 Population Data

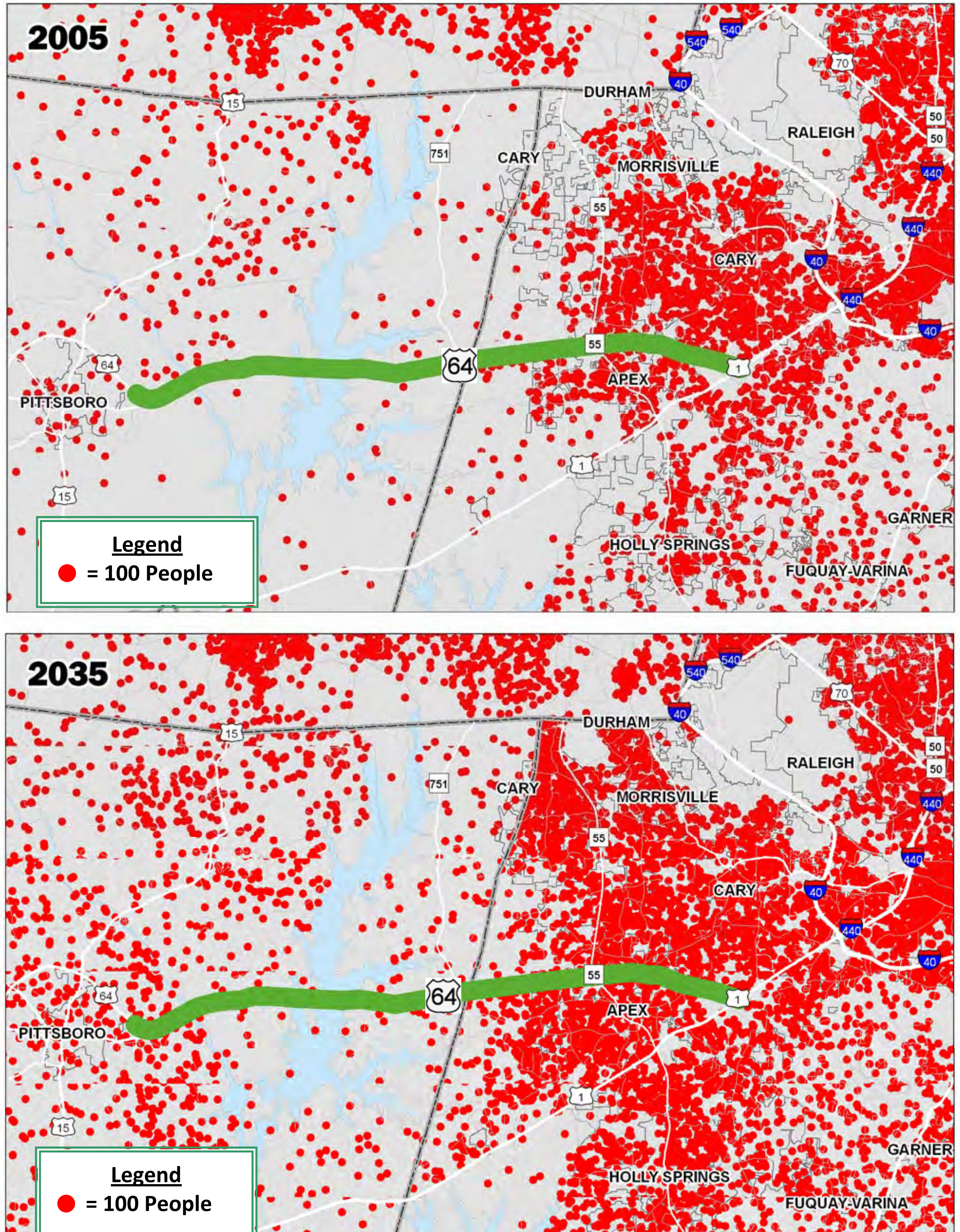
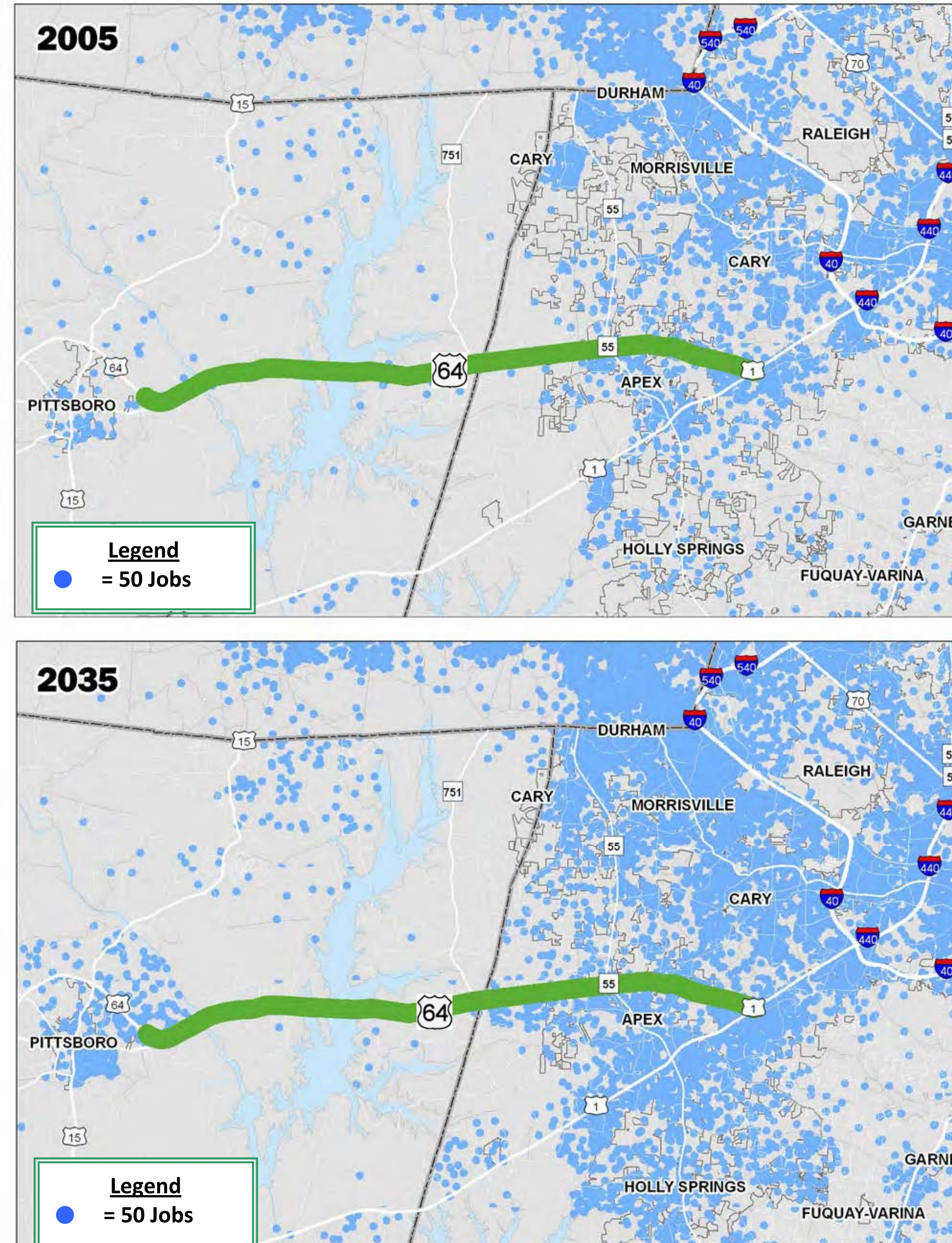


Figure 2.4: 2005 and 2035 Employment Data



2.3 EXISTING AND FUTURE NO-BUILD TRAFFIC FORECAST

This section includes determining the existing traffic volumes along the corridor and determining what the likely future volumes along the corridor will be in the future. The determination of the existing and future traffic volumes is an important step in evaluating how the corridor is currently operating and how it will operate in the future. The detailed evaluations of the traffic capacity along the corridor are included in Section 2.4.

2.3.1 DATA COLLECTION SUMMARY

In order to determine the existing traffic volumes, traffic counts were collected in September and October 2007 along the US 64 corridor at intersections, on the roadway between intersections, and on ramps. Intersection counts were collected for at least 16 hours at a total of 26 locations along the corridor and included the collection of turning volumes and the percentage of trucks. Tube counts, collected by laying a pneumatic tube across the roadway, were taken at 22 locations along the corridor for a minimum of 48 hours each and included the traffic volume and percentage of trucks at each location. As standard procedure, the data collected was then converted to the Average Annual Daily Traffic (AADT) by accounting for factors such as the time of year and day of week that the data was collected. A summary of the 2007 AADT for each of the major roadways along the corridor is shown in Figure 2.5.

2.3.2 TRAVEL DEMAND MODEL AND FUTURE TRAFFIC VOLUME PROJECTIONS

The most common tool used for projecting future traffic volumes for large and complex planning studies is travel demand models. For projects located within the Triangle Region, the Triangle Regional Travel Demand Model (Triangle TDM) is utilized. The Triangle TDM is developed and maintained by the Triangle Regional Model Service Bureau at NC State University's Institute for Transportation Research and Education (ITRE).

The Triangle TDM was utilized to determine the traffic volumes along US 64 in 2007 and the projected traffic volumes along US 64 in 2035 assuming no major improvements will be made to the US 64 corridor. The 2035 scenario where no major improvements are made to the US 64 corridor is known as the Future No-Build Scenario and allows for a basis of comparison for any alternatives developed. The No-Build scenario assumes that all planned and programmed projects outside of this study, such as NC 540 and I-40 widening, will be built but that the improvements being evaluated in this study will not be built. The No-Build traffic volumes and associated capacity analysis will show what the corridor will look like in 2035 if the recommendations of this study are not constructed. In Chapter 3, the effect of the potential solutions for the corridor on projected traffic volumes are compared to the No-Build traffic projections in order to determine whether the solutions meet the goals for the corridor.

The results of the Triangle TDM reveal several trends for the corridor when 2007 traffic volumes are compared to the 2035 No-Build projections:

- US 64 between US 1 and NC 55 showed a relatively low rate of growth in volume with an increase of approximately 1% per year between 2007 and 2035.
- The traffic volumes along US 64 from NC 55 to NC 540 increased from 1% per year at NC 55 to approximately 3% per year as you approach NC 540 for the period between 2007 and 2035.
- The traffic volumes along US 64 from Kelly Road to Farrington Road increased by approximately 3% per year for the period between 2007 and 2035.
- The traffic volumes along US 64 from Farrington Road to the US 64 Business interchange increased by approximately 4% per year for the period between 2007 and 2035.

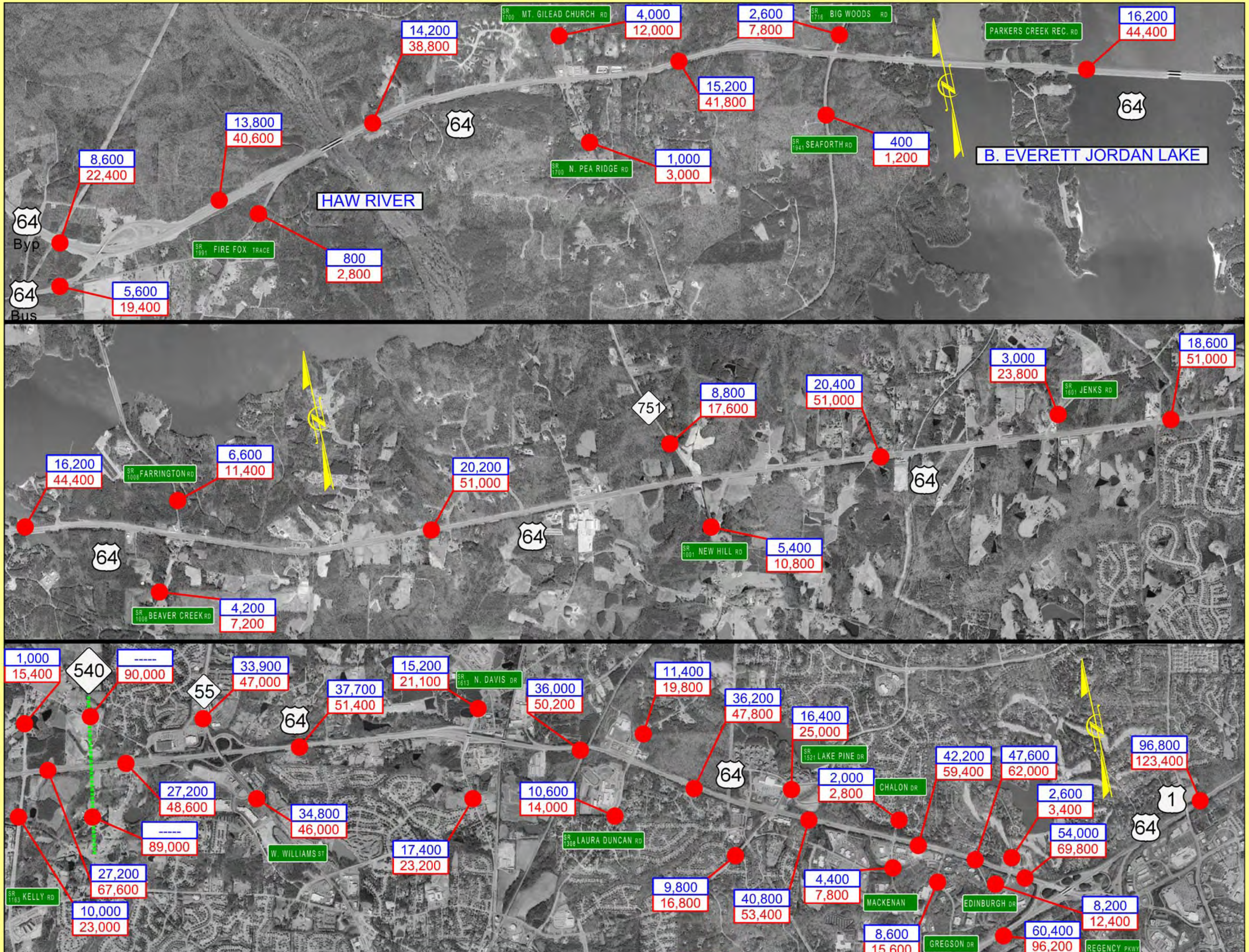
A summary of the 2035 No-Build AADT for the major roadways along the corridor is shown in Figure 2.5.

2.3.3 SUMMARY OF EXISTING AND FUTURE NO-BUILD TRAFFIC VOLUMES

Based on the traffic volume shown on Figure 2.5, the following observations can be made about the US 64 corridor:

- The traffic volume on US 64 west of the Haw River nearly triples between 2007 and 2035.
- The traffic volume on US 64 across Jordan Lake nearly triples between 2007 and 2035 to a volume of 44,400 vehicles per day.
- The traffic volume on US 64 continues to increase the further east you travel on US 64, until you reach the NC 540 (Triangle Expressway) interchange, where it reaches a daily volume of 67,600 vehicles per day. In 2035 the volume between Kelly Road and NC 540 is projected to increase by 40,400 vehicles per day beyond the existing volume of 27,200 vehicles per day.
- The NC 540 (Triangle Expressway) Toll Road is projected to have volumes of 89,000 vehicles per day south of US 64 and 90,000 vehicles per day north of US 64 by 2035. The NC 540 (Triangle Expressway) will provide relief to the NC 55 corridor and the US 64 corridor, east of NC 540.
- The portion of US 64 between NC 540 and NC 55 will nearly double between 2007 and 2035 as a result of the increased traffic to and from NC 540 and the intense retail development along this portion of the corridor.
- The traffic volumes on NC 55 in the vicinity of US 64 are projected to increase at a moderate level of about 40% from 2007 to 2035 with a 2035 volume of 47,000 vehicles per day north of US 64.
- The traffic volumes on US 64 between NC 55 and Davis Drive are projected to increase by 36% from a volume of 37,700 vehicles per day in 2007 to 51,400 vehicles per day in 2035.
- The traffic volumes on US 64 between Laura Duncan Road and US 1 are projected to increase by a moderate level of about 30% between 2007 and 2035. The 2035 volumes along US 64 for this section of roadway increase gradually the further east you travel with a projected traffic volume of 69,800 vehicles per day as you approach the US 1 interchange. The volumes for this section of US 64, and the corresponding moderate increase in traffic volumes, are a direct result of the construction of the NC 540 (Triangle Expressway). According to the Triangle TDM, NC 540 (Triangle Expressway) carries a majority of the statewide and regional trips that do not originate or terminate along US 64 between NC 540 and US 1. An evaluation by CAMPO of the portion of the corridor through Cary and Apex showed that 90% of the trips along this stretch of US 64 had an origin and/or a destination within 15 miles of this segment of US 64, meaning that a majority of the traffic on this portion of US 64 is locally generated.
- The traffic volume on US 1 south of US 64 is projected to increase by nearly 60% between 2007 and 2035, while the increase on US 1 north of US 64 is projected to be slightly less than 30%. The larger increase south of US 64 on US 1 shows that statewide and regional traffic is being diverted onto the NC 540 (Triangle Expressway). The traffic volume on US 1 north of US 64 is projected to be 123,400 in 2035.

Figure 2.5: 2007 Existing and 2035 No-Build Daily Traffic Volumes



LEGEND

2007 Existing Daily Traffic Volumes

2035 No-Build Daily Traffic Volumes

2007	2035

2007 Existing and 2035 No-Build

Daily Traffic Volumes

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2.4 EXISTING AND FUTURE NO-BUILD TRAFFIC CAPACITY ANALYSIS

This section includes the analysis of the traffic operations for the existing conditions and the future no-build scenario. The traffic volumes utilized in the analysis are based on the traffic forecasts included in Section 2.3.2.

2.4.1 ANALYSIS METHODOLOGY

The methodology used to determine the traffic operations for the US 64 corridor are based on the procedures defined in the *Highway Capacity Manual* (HCM) published by the Transportation Research Board. According to the Federal Highway Administration's publication *Traffic Analysis Toolbox:*

> HCM is the most widely used and accepted analysis technique in the United States. The HCM procedures are good for analyzing the performance of isolated facilities with moderate congestion problems. These procedures are quick and reliable for predicting whether or not a facility will be operating above or below capacity, and they have been tested through significant field-validated efforts.

The HCM includes procedures to define the operational qualities of roadways based on the concept of capacity and Level of Service (LOS) and is based on the peak one hour period of the day. The LOS is defined with letter designations from A to F as shown in Table 2.3. LOS A represents the best operating conditions along a road or at an intersection, while LOS F represents the worst conditions.

Table 2.3: Level of Service Definitions

Level of Service	Signalized Intersections	Unsignalized Intersections
A	Very low delay (<10.0 seconds per vehicle). Most vehicles do not have to stop at all.	Very low delay (<10.0 seconds per vehicle). Most vehicles do not have wait at the stop sign.
B	10.0-20.0 second delay. Good progression and short cycle length.	10.0-15.0 second delay. Good available gaps and short wait time.
C	20.1 to 35.0 second delay. Fair progression and/or longer cycles. The number of vehicles stopping is significant.	15.1 to 25.0 second delay. Less frequent gaps and the number of vehicles waiting to turn increases.
D	35.1 to 55.0 second delay. Many vehicles stop. Individual cycle failures are noticeable.	25.1 to 35.0 second delay. Gaps are becoming much less frequent and queuing along the roadway becomes more substantial.
E	55.1 to 80.0 second delay. Individual cycle failures are frequent.	35.1 to 50.0 second delay. Very few gaps exist and the wait time to make turn increases the length of traffic queuing at intersection
F	Delay in excess of 80.0 seconds. Considered unacceptable to most drivers.	Delay in excess of 50.0 seconds. Very few or no gaps. Considered unacceptable to most drivers.

Source: Transportation Research Board, 2000.

The LOS that is considered acceptable is based on guidance provided by the American Association of State Highway and Transportation Officials (AASHTO) in the *Policy on Geometric Design of Highways and Streets*. The AASHTO guidance for Urban and Suburban Arterials, as US 64 is classified, calls for LOS C as the appropriate LOS, but also states that in heavily developed sections of metropolitan areas, conditions may make the use of LOS D appropriate; however, this level should be used sparingly and LOS C should be sought. For this study, LOS D was considered to be the minimum acceptable LOS and the goal was to achieve LOS C or better.

2.4.2 EXISTING AND FUTURE NO-BUILD LEVEL OF SERVICE

The LOS for the major intersections along the corridor was evaluated based on the 2007 existing traffic volumes and the projected 2035 traffic volumes along US 64 without any major upgrades to the corridor. A summary of the LOS for each intersection is included in Table 2.4 and shown on Figure 2.6.

Table 2.4: 2007 Existing and 2035 No-Build Scenario Level of Service Analysis

Signalized Intersections	2007 Existing AM/PM Peak Hour LOS	2035 No-Build AM/PM Peak Hour LOS
US 64 at Mt. Gilead Church Road/N. Pea Ridge Road	B/B	E/D
US 64 at Big Woods Road/Seaforth Road	N/A[1]	D/D[5]
US 64 at Farrington Road	C/D	F/F
US 64 at NC 751/New Hill Road	C/C	F/F
US 64 at Jenks Road	N/A[1]	D/F[5]
US 64 at Kelly Road	C/B	N/A[2]
US 64 at Green Level Church Road	B/C	N/A[3]
US 64 at Laura Duncan Road	E/E	F/F
US 64 at Lake Pine Drive	F/E	F/F
US 64 at Mackenan Drive/Chalon Drive	C/C	F/F
US 64 at Gregson Drive	C/B	F/F
US 64 at Edinburgh Drive	E/D	F/F
US 64 at US 1 Southbound Ramps	C/D	F/F
Unsignalized Intersections	**2007 Existing AM/PM Peak Hour LOS[4]**	**2035 No-Build AM/PM Peak Hour LOS[4]**
US 64 at Firefox Trace	D/D (0/0)	F/F (6/7)
US 64 at Big Woods Road/Seaforth Road	F/F (2/4)	N/A[5]
US 64 at Jenks Road	F/F (2/2)	N/A[5]
US 64 at Kellyridge Road	F/F (1/1)	F/F (3/3)
US 64 at Knollwood Drive	F/F (2/2)	F/F (3/2)
US 64 at Shepherds Vineyard Drive	F/F (6/6)	F/F (7/7)
US 64 at Autopark Boulevard	F/F (2/2)	F/F (3/2)

Notes: 1 – Existing Unsignalized Intersection
2 – Upgraded to an interchange as part of NC 540 (Triangle Expressway) project
3 – Signalized intersection removed as part of NC 540 (Triangle Expressway) project
4 – LOS shown for unsignalized intersections is for the worst movement at the intersection and the number in parenthesis is the number of movements operating at LOS E or F.
5 – Intersection assumed to be signalized by 2035

The analysis indicates that 3 of the 11 signalized intersections and 6 of the 7 unsignalized intersections (with a total of 17 individual movements) are currently operating at an unacceptable LOS E or F. If no improvements are made to the corridor, 10 of 11 intersections and all 5 unsignalized intersections (with a total of 22 individual movements) will be operating at LOS E or F in 2035.

Figure 2.6: 2007 Existing and 2035 No-Build Level of Service Summary

LEGEND

2007 Existing Level of Service (AM/PM)

2035 No-Build Level of Service (AM/PM)

Signalized Intersection

Unsignalized Intersection

2007 Existing and 2035 No-Build

Level of Service

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An additional measure that is used to show the traffic operations along a corridor is through the use of travel time. Table 2.5 shows the approximate travel time for the 19-mile US 64 corridor from the US 64 Bypass west of Pittsboro to the US 1 interchange in Cary for each direction of US 64 in the AM and PM peak periods.

Table 2.5: 2007 Existing and 2035 No-Build Scenario Travel Time Summary

Roadway	2007 Existing AM/PM Travel Time	2035 No-Build AM/PM Travel Time
US 64 Eastbound	29 minutes/26 minutes	54 minutes/40 minutes
US 64 Westbound	27 minutes/27 minutes	39 minutes/51 minutes

As shown in Table 2.5, the travel time along the corridor is substantially higher in 2035 with an average speed as low as 21 miles per hour for the US 64 eastbound traffic during the AM Peak period and shows that significant delays to traffic will occur unless measures are taken to address the congestion along the corridor.

2.5 TRAFFIC SAFETY ANALYSIS

This section presents a summary of the traffic safety analysis for the US 64 corridor.

2.5.1 SEGMENT ANALYSIS

As part of the traffic safety analysis, the accident rates on roadway segments in the study area were compared to statewide average accident rates for similar roadway types. The purpose of the study is to determine if the accident rates on the roadway segments in the study area exceed statewide averages.

The segments analyzed along US 64 included a total of 522 crashes, of which 3 resulted in fatalities and 3 involved pedestrians during the analysis period from August 2004 through July 2007. The segments analyzed along US 1/US 64 and US 1 included a total of 246 crashes, of which 1 resulted in a fatality. The simple comparison of the roadway crash rate versus the statewide average crash rate identifies nearly one half of all locations as having a potential highway safety concern. A more appropriate method is the critical crash rate method. The critical crash rate is a statistically derived number, which is greater than the average crash rate, that can be used to identify locations where crash occurrence is higher than expected for a given facility type. Safety measures could be considered for locations identified in this manner. For planning purposes the confidence level used to calculate the critical crash rate is 95% for rural areas and 99.95% for urban areas. The critical crash rate is beneficial as it accounts for differing traffic volumes and varying segment lengths. If a segment has an actual crash rate higher than the critical rate, the location may have a potential highway safety deficiency and should receive additional analysis. Table 2.6 and Figure 2.7 show each segment along the corridor that was analyzed and whether it exceeds the statewide average crash rate and the critical crash rate for a similar roadway type and configuration.

Table 2.6: Crash Rate Segment Analysis

Roadway	Segment Limits	Crash Rate[1]	Statewide Average	Critical Rate	Crash Rate Exceeded
US 64	US 64 Business to Big Woods Road/Seaforth Road	57.3	96.84	119.40	None
US 64	Big Woods Road/Seaforth Road to Farrington Road/Beaver Creek Road	68.79	96.84	118.38	None
US 64	Farrington Road/Beaver Creek Road to NC 751/New Hill Road	99.01	96.84	119.68	Statewide Average
US 64	NC 751/New Hill Road to Kelly Road	117.6	250.45	318.80	None
US 64	Kelly Road to NC 55	141.01	250.45	340.24	None
US 64	NC 55 to Davis Drive/Salem Street	55.52	250.45	322.22	None
US 64	Davis Drive/Salem Street to Lake Pine Drive	240.13	250.45	318.78	None
US 64	Lake Pine Drive to US 1/US 64/Tryon Road	255.46	250.45	313.38	Statewide Average
US 1/ US 64	Cary Parkway to US 64/Tryon Road	223.16	142.59	188.41	Statewide Average and Critical Rate
US 1	US 64/Tryon Road to Ten-Ten Road	74.37	142.59	181.69	None

1 – Crash rate is in crashes per 100 million vehicle mile traveled from August 2004 through July 2007.

Only one segment analyzed resulted in the crash rate exceeding both the statewide average crash rate for similar facilities and the critical crash rate. This segment is not within the limits of the study; however was included in the analysis due to the proximity to the study and because the US 64 corridor shares a common alignment with US 1 east of the project.

The one segment was along US 1/US 64 from the Cary Parkway interchange to the US 64/Tryon Road interchange. The segment had a total of 169 crashes including 107 rear end collisions due to a vehicle being stopped or slowed down (63%), and 23 crashes involving sideswipes between vehicles traveling in the same direction (14%). It should also be noted that the period of analysis includes a majority of the timeframe when the segment was under construction and may not be representative of normal conditions.

2.5.2 INTERSECTION ANALYSIS

In addition to the analysis of roadway segments, the crash evaluation included the analysis of individual intersections and interchanges along the US 64 corridor. A total of 19 intersections and 3 interchanges were analyzed. Unlike for roadway segments, individual intersections and interchanges do not have statewide averages to compare against to determine the magnitude of the crash rate. In order to make a relative comparison between locations it was determined that using a “normal distribution” would be the most appropriate.

A normal distribution is a statistical method used to represent a data set where most of the values in the set are fairly close to the average and there are relatively few values that are much lower or higher than the average. That is to say, when most of the intersections studied have crash rates fairly close to the average crash rate of all intersections studied. When using a normal distribution to represent the behavior of a data set, a value called the “standard deviation” is used to describe how tightly all of the values in the data set are clustered around the average. The lower the standard deviation, the closer the data set is clustered around the average. This type of analysis would show that accident rates within 1 standard deviation of the average would be considered normal (this would capture approximately 68% of all intersections), while those between 1 and 2 standard deviations (capturing 95% of all intersections) would be considered above normal and anything beyond 2 standard deviations would be considered substantially above normal. Table 2.7 shows each intersection and Table 2.8 shows each interchange along the corridor, their crash rate and where the rate falls according to the normal distribution.

Figure 2.7: Traffic Safety Analysis - Segment Analysis Summary

LEGEND

Crash Rate Below Statewide Average

Crash Rate Exceeds Statewide Average But Below Critical Rate

Crash Rate Exceeds Statewide Average and Critical Rate

Traffic Safety Analysis

Segment Analysis Summary

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Table 2.7: Crash Rate Intersection Analysis

Intersection	Total Crashes	Fatal Crashes	Crash Rate[2]	Frequency Level
Tryon Road and US 1 NB Ramp/Regency Parkway	25	0	57.80	Normal
US 64 and Edinburgh Drive	20	0	38.86	Normal
US 64 and Gregson Drive	24	0	58.45	Normal
US 64 and Mackenan Drive/Chalon Drive	9	0	21.92	Normal
US 64 and Autopark Boulevard	4	0	11.24	Normal
US 64 and Lake Pine Drive	35	0	79.91	Normal
US 64 and Shepherds Vineyard Drive	28	0	78.68	Normal
US 64 and Knollwood Drive	2	1	5.89	Normal
US 64 and Laura Duncan Road	41	0	99.58	Above Normal
US 64 and Fern Valley Road	0	0	0.00	Below Normal
US 64 and Green Level Church Road	28	0	55.36	Normal
US 64 and Kelly Road	34	0	109.72	Above Normal
US 64 and Kellyridge Road	0	0	0.00	Below Normal
US 64 and Jenks Road	8	0	28.99	Normal
US 64 and NC 751/New Hill Road	41	0	167.16	Substantially Above Normal
US 64 and Farrington Road/Beaver Creek Road	13	0	55.47	Normal
US 64 and Big Woods Road/Seaforth Road	6	0	28.99	Normal
US 64 and Mt. Gilead Church Road/North Pea Ridge Road	4	0	23.57	Normal
US 64 and Foxfire Trace	0	0	0.00	Below Normal
Average			48.50	
Standard Deviation			44.13	

2 – Crash rate is in crashes per 100 million vehicles entering the intersection from July 2004 through August 2007

Table 2.8: Crash Rate Interchange Analysis

Interchange	Total Crashes	Fatal Crashes	Crash Rate[2]	Frequency Level
US 1/US 64 Interchange	274	0	292.66	Above Normal
US 64 and Davis Drive Interchange	46	0	97.7	Normal
US 64 and NC 55 Interchange	88	0	140.99	Normal
Average			177.12	
Standard Deviation			102.38	

2 – Crash rate is in crashes per 100 million vehicles entering the intersection from July 2004 through August 2007

As shown in Table 2.7, two intersections are above normal and one intersection is substantially above normal. Table 2.8 shows that one interchange has an above normal frequency level. Table 2.9 shows the types of crashes for each intersection or interchange.

Table 2.9: Above Normal Crash Rate Analysis

Intersection/ Interchange	Object	Angle	Pedestrian	Head On	Left-turn	Ran-off Road	Rear End	Right-turn	Sideswipe	Other
US 64 and Laura Duncan Road	0	5	1	0	0	1	23	0	6	0
US 64 and Kelly Road	2	0	0	0	2	0	29	0	0	1
US 64 and NC 751/New Hill Road	0	3	0	1	19	0	11	3	3	1
US 1/US 64 Interchange	17	1	0	0	2	17	199	3	27	8

Chapter 3: Alternatives Analysis

US 64 east of
Haw River
(October 2009)

CHAPTER 3. ALTERNATIVE ANALYSIS

The alternatives considered for the study are described in this chapter. Each alternative is evaluated with respect to its ability to the meet the needs of the study. A number of alternatives were considered during the early phases of the project studies, including the No-Build Alternative, transportation system management alternatives, transportation demand management alternatives, mass transit and build alternatives. For the build alternatives, both short-term (interim) and long-term alternatives were considered.

3.1 PRELIMINARY ALTERNATIVES CONSIDERED

The following alternatives were evaluated to determine if they met the goals established for the study.

> **Study Goal**
> The goal of the study is to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests.

3.1.1 No-Build Alternative

The No-Build Alternative assumes the local transportation system would evolve as currently planned, but without implementation of the recommendations proposed in this study. With the exception of routine maintenance, no change would take place along the existing corridor within the study area. The traffic operations for the No-Build Alternative were analyzed and included in Chapter 2. The results of the analysis showed that 10 of the 11 signalized intersections along the corridor would operate at a failing level and that the travel time for the 19-mile corridor would increase to as much as 54 minutes. Therefore the corridor would not provide the mobility that is desired for a Strategic Highway Corridor as the congestion would not be acceptable to the motoring public and is not considered a reasonable and feasible alternative for this study.

The No-Build Alternative is typically given full consideration and provides baseline conditions with which to compare the improvements and consequences associated with the alternatives being evaluated as a part of this study.

3.1.2 Transportation Systems Management Alternatives

The goal of transportation system management (TSM) is to coordinate all individual elements of transportation systems through regulatory and control policies, so as to achieve the maximum efficiency, safety, productivity and utility of the existing transportation system. TSM measures enhance the operations of a facility while minimizing capital outlay and inconvenience to motorists.

3.1.2.1 Operational Improvements

TSM measures may include operational improvements such as optimizing traffic signal timing, signal coordination, speed restrictions, access control, and turn prohibitions. TSM operational measures usually can be implemented easily and require little capital investment.

3.1.2.2 Physical Improvements

TSM physical improvements include such measures as turning lanes, intersection realignments, or new traffic signals. These physical improvements require greater capital investment than operational improvements; however, the benefits of these physical improvements would be more substantial.

The implementation of TSM operational improvements would not acceptably rectify the long-term operational deficiencies along existing US 64, but do provide benefits as a short-term solution for the corridor. The short-term solutions are described further in subsequent sections of this chapter.

3.1.3 Transportation Demand Management Alternatives

Transportation demand management (TDM) is a term given to a variety of measures used to improve the efficiency of the existing transportation system. TDM addresses traffic congestion by reducing travel demand rather than increasing transportation capacity and focuses on alternatives such as ridesharing, flexible work schedules, telecommuting, guaranteed ride programs, bicycling and walking.

TDM tools, such as ridesharing and guaranteed ride programs, reduce congestion by increasing vehicle occupancy rates. Other TDM tools, such as flexible work schedules, move trips from peak congestion times to non-peak periods. Telecommuting allows people to work from home, reducing the number of trips. Encouraging alternate modes of transportation, such as bicycling and walking, also reduces trips.

The Triangle region has a well established TDM program and has recently expanded the role of TDM in the Triangle by developing the Travel Demand Management Plan for the Triangle Region (www.triangletdmplan.com). TDM measures in place are at least partially accounted for in the calibration of the Triangle Travel Demand Model (the model used to project future traffic volumes for the region), through the evaluation of vehicle occupancy and peak hour evaluation.

TDM is a valuable component of transportation planning in the Triangle region. TDM measures implemented alone would not meet the goals of this study. TDM measures would not substantially reduce peak hour traffic and would not provide adequate relief of congestion along the US 64 corridor. Therefore, TDM is not considered a reasonable and feasible alternative for this study.

3.1.4 Mass Transit Alternatives

The Mass Transit Alternative includes bus or rail passenger service and could include the implementation of express lanes for transit vehicles. A major advantage of mass transit is that it can provide high-capacity, energy-efficient movement in densely traveled corridors. Additionally, it serves high and medium density areas by offering a low-cost option for automobile owners who do not wish to drive, as well as service to those without access to an automobile.

Based on the 2000 Census, 1.2% of workers in Wake County and 0.2% of workers in Chatham County use public transportation as their method of transportation to work.

3.1.4.1 Bus Alternatives

The most typical multi-modal transportation system in North Carolina involves a fixed route, fixed schedule bus system. Because the proposed project corridor serves both local and long distance trips, the evaluation of bus services that meet each need should be examined.

For regional and statewide users, Greyhound Lines, Incorporated (Greyhound) currently provides daily commercial bus service to and from the Triangle Region at stations located in Durham and Raleigh. There currently are no stations in the vicinity of the US 64 corridor that serve longer trips.

Triangle Transit currently operates two peak hour bus routes along the US 64 corridor. Route 305 runs along US 64 from Lake Pine Drive, east to the US 1 interchange and into downtown Raleigh at Moore Square, while Route 311 runs from Lake Pine Drive along NC 55 to Research Triangle Park (RTP). Triangle Transit's *Short Range Transit Plan* includes extending express service from UNC-Chapel Hill to Pittsboro along the US 15-501 corridor in 2011. Cary Transit provides both fixed route and door-to-door transportation within Cary, however the existing routes do not serve the US 64 corridor or adjacent roadways. Cary Transit's door-to-door service is for Cary citizens who are at least 60 years old or disabled and provides service to a portion of the US 64 corridor.

Future plans for Triangle Transit show adding express bus routes along the US 64 corridor from NC 55 to Lake Pine Drive that connect to RTP. An express bus route is also planned along the entire I-540/NC 540 corridor.

3.1.4.2 Rail Alternatives

The only existing passenger rail service in the Triangle Region is provided by Amtrak. The nearest station on the Amtrak system is located in downtown Cary, approximately 3.5 miles north of US 64 and serves three routes: the Carolinian, the Piedmont and the Silver Star. Freight rail in the vicinity of US 64 is served by CSX Transportation and includes two grade separated crossings of US 64 between Laura Duncan Road and NC 55.

Future transit options for the Triangle region were evaluated from May 2007 to April 2008 by the Special Transit Advisory Commission (STAC), which was a broad based citizen group with 38 members from across the region and was appointed by CAMPO and the Durham-Chapel Hill-Carrboro MPO (DCHC MPO). The purpose of STAC was to assist in the joint development of a plan for a regional transit system and to craft recommendations for the transit component of their respective Long Range Transportation Plans, with a focus on major transit investments. The STAC began by selecting corridors that represent the most heavily traveled and intensely developed activity centers as well as areas emerging as new high-activity centers. A total of 18 corridors were selected for detailed analysis including three corridors that cross the US 64 corridor, as follows:

- Durham to Apex corridor
- Southern Arc I-540 Toll Road corridor
- Apex to Raleigh corridor

The US 64 corridor itself was not selected as a detailed study corridor. The primary reason that the US 64 corridor was not selected as a study corridor was that the goal of the analysis was to connect areas designated as Primary Market Places, which were defined as areas that generate greater than 20 trips per acre or greater that 4 trips per acre for areas with low-income or zero-car households. The only locations along US 64 designated as Primary Market Places by 2035 was the portion of the corridor from NC 540 to US 1. Without any Primary Market Places west of NC 540 it was determined that major transit investment west of NC 540 would not be effective. The three corridors listed above would serve the Primary Market Places designated along the US 64 corridor from NC 540 to US 1, although it would be by crossing the corridor perpendicularly and would not run along the US 64 corridor. The STAC recommendations were then provided to CAMPO and DCHC MPO for inclusion in the Long-Range Transportation Plans. Of the three corridors evaluated in the vicinity of US 64 the Durham to Apex and Southern Arc I-540 corridors were recommended for express bus service and the Apex to Raleigh corridor was recommended to be a light-rail transit corridor with all improvements planned to occur between 2025 and 2035.

3.1.4.3 Express Lane Alternatives

Conventional bus service and fixed guideway rail transit are not the only types of mass transit that are present across the United States. Bus Rapid Transit (BRT) is an emerging technique of providing transit service in urban areas. BRT involves coordinated improvements in a transit system's infrastructure, equipment, operations, and technology that give preferential treatment to buses on urban roadways. BRT is not a single type of transit system; rather it encompasses a variety of approaches, including buses using express lanes as either exclusive busways or high occupancy vehicle (HOV) lanes with other vehicles. BRT service also improves bus service on city arterial streets. Busways, special roadways designed for the exclusive use of buses, can be totally separate roadways or operate within highway rights of way separated from other traffic by barriers.

The use of BRT along the US 64 corridor was considered by CAMPO in the development of the Long-Range Transportation Plan and by the Corridor Study Team and determined that the demand along the corridor was not sufficient to justify the implementation cost, nor would it reduce traffic along US 64 to a level that would make the existing infrastructure adequate. The use of HOV lanes was also considered but was determined to not be reasonable and feasible as it would require expanding the footprint of the project beyond what would be constructed under the build alternative. It was decided that BRT and HOV applications would not be considered as viable alternatives, but that care would be taken in the development of the build alternatives such that it would not preclude implementation of these strategies in the future if conditions change.

3.1.4.4 Ability of Mass Transit to Meet Project Goals

Mass transit alternatives alone would not attract sufficient ridership to alleviate projected congestion along the project corridor. Additionally, the Triangle Travel Demand Model already takes into account transit ridership in the projected traffic volumes for the proposed study area. Therefore, mass transit measures implemented alone would not meet the goals of the study and are not considered reasonable and feasible.

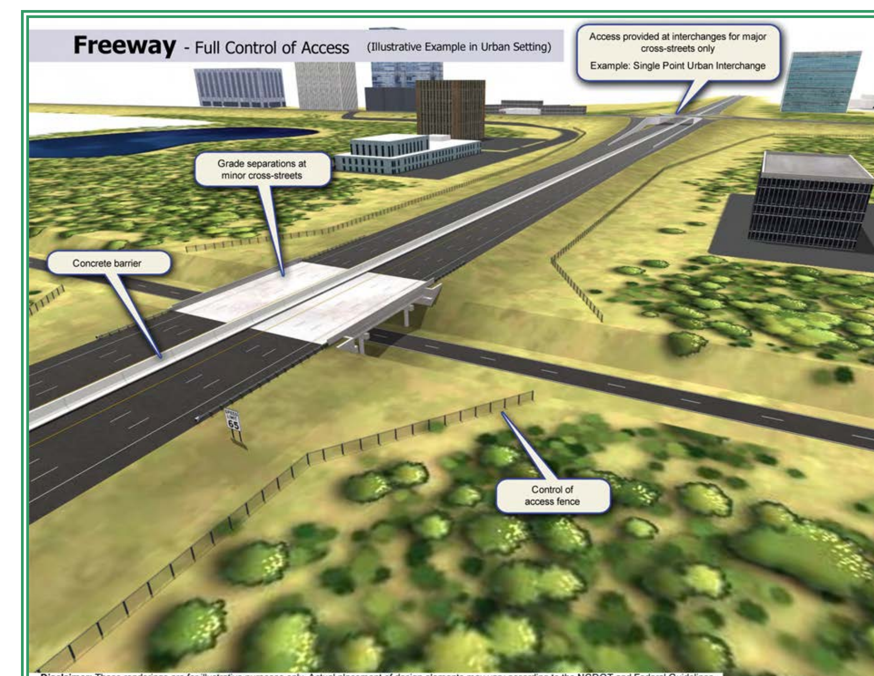
3.1.5 BUILD ALTERNATIVES

The implementation of Build Alternatives would include modifying or expanding the existing US 64 roadway to provide a facility that meets the goals of the study. The primary goals of the study are to preserve and enhance mobility and safety along the corridor while balancing community access and interests. The *US 64 Corridor Study Phase I Report* concluded that the corridor vision for US 64 from Raleigh to Statesville would be a freeway facility. The NCDOT Strategic Highway Corridors Vision Plan includes US 64 as a freeway from west of Asheboro to west of Jordan Lake, as an expressway across Jordan Lake, as a freeway from east of Jordan Lake to NC 540, and as an expressway from NC 540 to US 1. In order to fully evaluate a full range of alternatives for this study the evaluation of the corridor as a freeway, an expressway and as a facility with signalized intersections was undertaken.

The following sections provide general descriptions of each type of build alternative considered as well as a preliminary evaluation of its ability to meet the goals of the study.

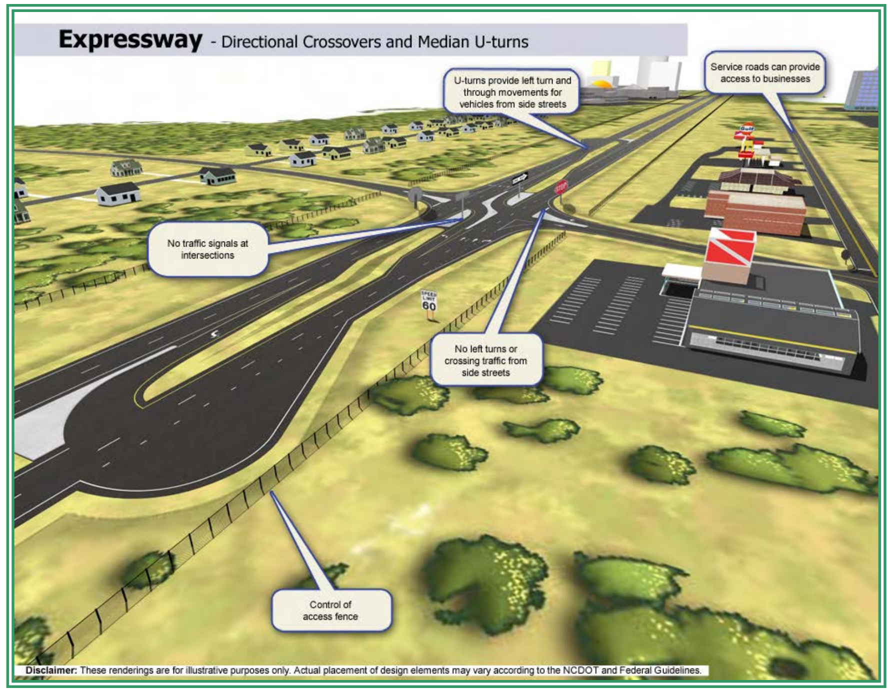
3.1.5.1 Freeway Alternative

Freeways are characterized by a divided roadway with full control of access and include grade separations or interchanges at cross streets. Freeways provide the highest level of mobility of all types of roadways and the lowest level of access, which is allowed only at interchanges. They have a speed limit of 55 mph or greater. The most common application of freeways is on the Interstate system, although numerous freeways exist along routes not designated as Interstate highways. To provide access to properties along freeways, service roads that connect to cross streets with interchanges are typically constructed. Examples of freeways in the Triangle Region include I-40, I-540, US 64/264 Knightdale Bypass and US 70 Clayton Bypass.



Based on the evaluation of a freeway alternative in previous studies and by the CST it was determined that a freeway alternative would meet the goals of the study and would be most appropriate for the portion of the corridor between the US 64 Pittsboro Bypass and NC 540 with the exception of the portion across Jordan Lake.

3.1.5.2 Expressway Alternative



Expressways are characterized by a divided roadway with limited or partial control of access. Access is provided only at interchanges for major cross streets and at-grade intersections for minor cross streets. Expressways provide high mobility with low-to-moderate access and have speed limits of 45 mph to 60 mph. Expressways do not allow traffic signals and strongly discourage direct driveway connections. At-grade median crossovers are allowed for traffic crossing the expressway and for traffic making u-turns. In urban areas with higher traffic volumes, median crossovers may not be provided if adequate safe gaps in traffic cannot be provided. The portion of US 64 from Green Level Church Road to Laura Duncan Road is an example of an urban expressway. The section from Mt. Gillead Church Road to Farrington Road, across Jordan Lake is an example of a rural expressway.

Based on the evaluation of an expressway alternative in previous studies and by the CST it was initially determined that an expressway alternative would best meet the goals of the study and be most appropriate for the portion of the corridor across Jordan Lake and from NC 540 to US 1.

3.1.5.3 Signalized Intersection Alternative

Signalized Intersections are roadways with traffic signals. A corridor of signalized intersections is commonly referred to as an arterial or boulevard and is the existing classification for a majority of the US 64 corridor within the study area.

Based on the evaluation of a Signalized Intersection alternative by the CST it was determined that a Signalized Intersection alternative was not likely to meet most of the goals of the study; however, based on the potential impacts associated with freeway and expressway facilities it was decided that signalized intersection alternatives could be considered, where appropriate, as a means to minimize the effects on the local communities. The CST determined that the only portion of the corridor where a signalized intersection alternative may be appropriate is the section of US 64 from east of Lake Pine Drive to the US 1 interchange.

3.1.6 PRELIMINARY ALTERNATIVES CARRIED FORWARD FOR ADDITIONAL STUDY

Based on the preliminary alternatives considered it was determined by the Corridor Study Team that the only type of alternative that met the long-term project goals was the Build Alternative. The US 64 corridor was broken into sections, based on facility type, for the development of the detailed Build Alternatives as follows:

- US 64 from US 64 Business interchange to west of Jordan Lake – **Freeway**
- US 64 across Jordan Lake – **Expressway**
- US 64 from east of Jordan Lake to NC 540 – **Freeway**
- US 64 from NC 540 to Lake Pine Drive – **Expressway**
- US 64 from east of Lake Pine Drive to US 1 Interchange – **Expressway or Signalized Intersections**

The evaluation of the Long-term Build Solutions is discussed further in Section 3.4.

Additionally, due to the likely expense and timeframe for implementing the Build Alternatives, it was decided by the Corridor Study Team that Short-term Concepts or Transportation System Management (TSM) Alternatives would also be developed that would improve mobility, safety and pedestrian accessibility along the corridor with minimal capital expenditures, extending the lifespan of the corridor until a time when the long-term Build Alternative could be implemented. The Short-term Concepts for the US 64 corridor are discussed further in Section 3.3.

3.2 SIGNALIZED INTERSECTION, EXPRESSWAY AND FREEWAY CONCEPTS

Based on the results of the preliminary alternative evaluation, three facility types were chosen as potential solutions for portions of the corridor. Potential applications of each of the facility types and the potential benefits and limitations of each concept are presented in this section.

3.2.1 INTRODUCTION

An intersection is a junction between two roads without a bridge. For many junctions with major roads in North Carolina, such as US 64 in Wake County, a traffic signal is often used at the crossing of the two roads to let different directions of travel go at different times. Since both roads are at the same vertical grade, these junctions are sometimes called at-grade intersections. The different possible travel movements at the intersection include left turns, (straight) through, etc. from the various directions approaching the intersection.

An interchange is a junction between two roads with a bridge carrying one of the roads over the other and ramps connecting the roadways to provide access. Since the crossing roads are at different vertical grades, these junctions are sometimes called grade-separated interchanges. Sections of divided highways that have zero signalized intersections – with all major crossings using interchanges – are called freeways (i.e., free flow travel without traffic signals) or expressways (i.e., express travel without traffic signals).

The goal of any intersection or interchange design is to provide the best possible user experience within the context of the natural and built environment, and amidst financial, time, and other limitations.

The users of an intersection or interchange might include any of the following modes of travel:

- Pedestrians
- Cars

- Trucks
- Bicyclists
- Transit vehicles
- Emergency vehicles

The purposes of travel for those traveling through a junction could be any of the following:

- Commuting to work
- School
- Shopping
- Out-of-town travel
- Visiting neighbors
- Leisure
- Responding to emergencies

The following are the possible directions of travel for users at a location:

- Major roadway, straight through
- Minor roadway, straight through
- Turning right or left from major roadway to minor roadway
- Turning right or left from minor roadway onto major roadway

Of course, different intersection and interchange options at any location will optimize the travel experience of various user modes, trip purposes, travel directions, and travel origins. In addition, there are other tradeoffs to consider beyond user experience, including cost and context sensitivity. However, while there is no single right answer, some designs will be better than others at meeting various goals.

For intersections along major roadways, such as US 64 in western Wake County, a primary design goal is to streamline travel flow for users in the main direction of travel, while minimizing adverse impacts to other travel directions, within the context of the natural and built environment and amidst financial, time, and other limitations. From a purely traffic operations standpoint, this goal requires the consideration of various intersection design alternatives that will allow users along US 64 to see green lights more often at traffic signals. Each of the intersection options described in Section 3.2.2 are innovative intersection designs that reroute left turns to or from US 64, and/or reroute travel for those crossing US 64. Doing so eliminates the need for the traffic signal to allow for one or more turning or crossing travel movements, and the time thus saved by reducing one or more of those signal phases can be given back to US 64 in the form of longer or more frequent green time. Of course, the best design may or may not be the one that retains the most green time for US 64, since there are other tradeoffs to consider, including financial, neighborhood context, impacts to travel in other travel directions, etc.

For interchanges along major roadways, the primary goal of eliminating travel conflicts with the major roadway has been achieved by definition – by the bridge. In addition, the use of a bridge may (or may not) also improve the user experience for other directions of travel as well. As with intersection design, the goal of interchange design is to improve travel in all directions within the context of the natural and built environment and amidst financial, time, and other limitations. Each of the interchange options in Section 3.2.3 and 3.2.4 are interchange designs that optimize different characteristics at the expense of others, such as land costs, construction costs, pedestrian and vehicle travel along the side street, left turning travel, etc.

The decision of whether to use an intersection or interchange at a given location, as well as the specific intersection or interchange design selection, is always based on an analysis of tradeoffs: financial, available land, construction cost, environmental impact, neighborhood impact, benefits and challenges for users along the major roadway, benefits and tradeoffs for travel along the minor roadway, etc. In general, the worst interchange will still operate better than the best intersection – because the bridge allows two conflicting directions of traffic to go at the same time, one on top of the other. And in general, any interchange will cost far more than any intersection, because bridges cost more than pavement on gravel and earth.

While there is no single right answer, there are better and worse designs for both interchanges and intersections at a given location, based on a particular set of goals for the location as well as the characteristics that pertain to that junction, including context and specific design constraints. It may be that an interchange provides a better set of tradeoffs than an intersection, but funding does not allow for bridge construction, at least in the near term, so that both a short-term preferred intersection design and a long-term preferred interchange design are developed for a location.

Innovative intersection design alternatives are included in Section 3.2.2, with a summary in Table 3.1.

Interchange design options are found in Section 3.2.3 and 3.2.4, with a summary in Table 3.2.

3.2.2 Signalized Intersection Concepts

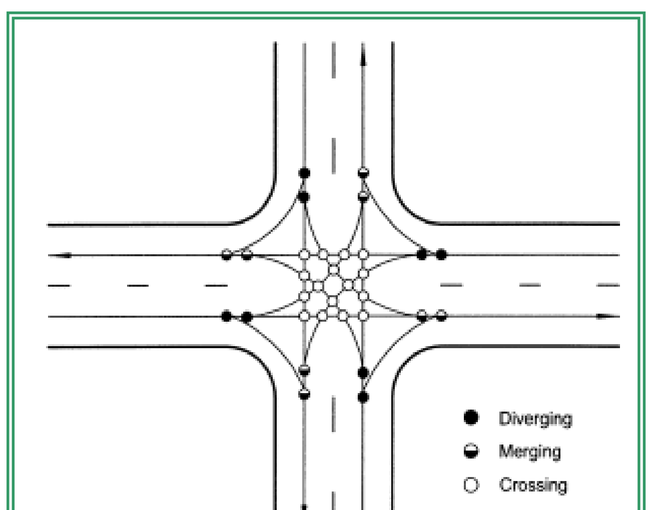
The range of solutions for improving existing signalized intersection facilities is accomplished through either expanding the facility by adding additional through and/or turn lanes or by improving the efficiency of the intersections themselves. For many years the preferred method of improving signalized corridors has been to provide additional capacity by adding additional lanes to the facility. Studies have shown that this method can be very costly and have diminishing returns. This issue has caused a new line of thinking to emerge, with alternative methods being considered to improve the operations of intersections without adding additional through lanes. This section will present the concepts for improving signalized intersection facilities and is based largely on the information presented in the Federal Highway Administration's Publication *Signalized Intersections: Informational Guide*.

3.2.2.1 Traditional Intersection Treatments

Traditional intersection treatments include allowing traffic movements from all directions at each intersection. Signalized intersections typically include providing lanes for turning vehicles and may include providing exclusive green arrows at signals for turning vehicles. Many of the intersections along US 64, including the intersection of US 64 and Mackenan Drive/Chalon Drive (shown at right) would be categorized as traditional intersections.

The benefits of the traditional intersection are that it provides for direct access for all directions of travel and provide for pedestrians crossing the roadways. The fundamental limitations for traditional intersections are that they are limited in the volume of traffic that can pass through them in a given time period. At traditional intersections, the amount of green time is proportioned based on the traffic volumes for each movement. As volumes increase, the green time is forced to be divided among more movements. For example, as the volume of left turn vehicles increases, eventually an exclusive green turn arrow is added to the signal for the left-turn traffic. By adding this additional movement it takes time away from another movement. As more movements are added as exclusive movements the signal becomes more inefficient as it requires time to transition from one movement to another movement.

Eventually the amount of traffic that can be processed by a given intersection is exceeded and the signal begins to fail. When a conventional intersection is no longer able to process the volume approaching the intersection the typical method of improvements is to add additional turn lanes and/or additional through lanes. As stated above, this method of expansion can be cost prohibitive, include impacts to the natural and human environments and provide diminishing returns because the larger footprint requires increased time for vehicles and pedestrians to travel through the intersection.



Source: FHWA Signalized Intersections: Informational Guide

Additionally, the safety of traditional intersections is problematic due to the large number of conflict points. The diagram, shown at left, displays the conflict point for a traditional intersection, with each conflict point representing a location for a potential crash. A traditional intersection includes 32 conflict points.

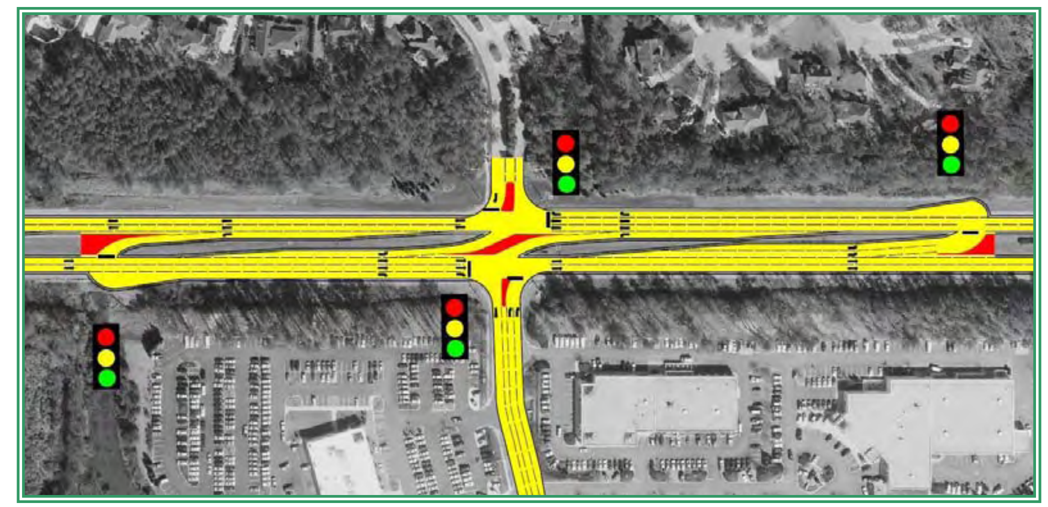
The primary method for improving upon the traditional intersection is to reduce the number of conflict points at the intersection. This provides safety and traffic operations benefits by reducing the number of movements who share the green time and by reducing the number of conflicting volumes at a single location. The goal of many of the unconventional intersections types is to spread out the movements into more than one location to allow for fewer conflict points and more green time for each of the movements. The signalized intersection concepts discussed in the following sections have emerged as the preferred method for improving the safety and efficiency of a corridor without greatly increasing the footprint of the intersections along the corridor.

3.2.2.2 Superstreet

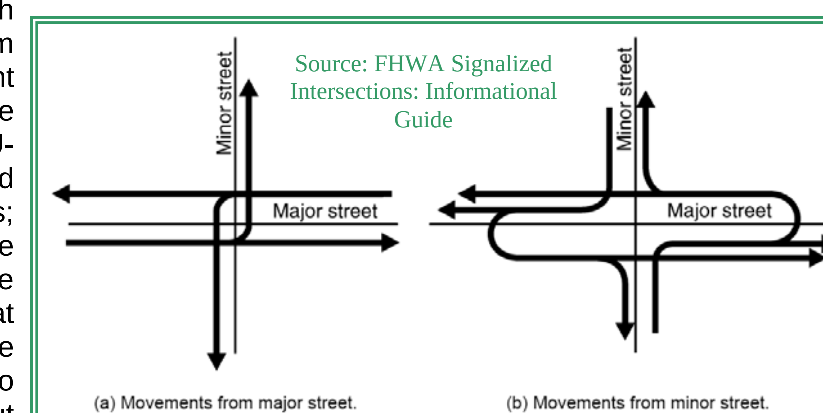
The Superstreet concept refers to a reconfiguration of a traditional intersection by redirecting some or all of the left turn movements away from the main intersection. The left turn movements are re-routed to median U-turn locations approximately 600 feet downstream. There are two primary applications of Superstreets and a third related application that is often considered to be part of the Superstreet concept. The two primary applications are the Superstreet with Direct Major Street Left-turns and the Superstreet with Indirect Major Street Left-turns. The third related type is a Superstreet with Direct Minor Street Left-turns. Each of the three types is described in detail in the following sections.

Superstreet with Direct Major Street Left-turns

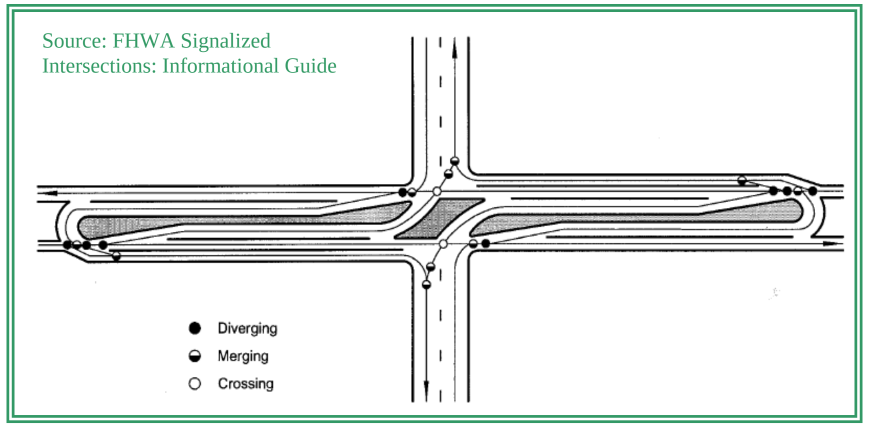
The application of the Superstreet with Direct Major Street Left-turns is the most common in urban locations and is the standard application unless there is an overwhelming factor that would result in considering one of the other Superstreet configurations. The Superstreet with Direct Major Street Left-turns requires the through and left turning vehicles from the minor street approach to turn right, proceed to the downstream U-turn and then return in the opposite direction. The movements from the major street are unaffected as the main intersection still allows for all movements from the major street. The illustration below shows the Superstreet with direct major street left-turns.



The primary benefit of this configuration is that redirecting the through and left turn movements to the median U-turn location reduces the number of conflicting movements that need separate signal phases at the main intersection to only two. The two signal phases would first give a green light to the major street through traffic, followed by the second phase which would give the green light to the left turns from the major street at the same time as the right turns from the minor street, because the movements do not conflict. The two median U-turn locations would also be signalized and would operate similarly with only two phases; the first again being the through traffic and the second allowing the U-turn movement. The reduction in the number of movements that occur at each intersection allows the intersection to operate more efficiently and to give more of the green time (typically about 70% of the total cycle length) to the heavy through movements. An additional benefit of the Superstreet concept is that because no traffic is crossing the median from the minor street, each direction of the major street can operate independent of the other direction allowing the signals to be coordinated to progress as though each direction were a one-way street. Due to this increased ability to coordinate the signals along the corridor, it is likely that as long as the motorists follow the speed limit, they will only need to stop once along the length of the Superstreet corridor. A comparison of the



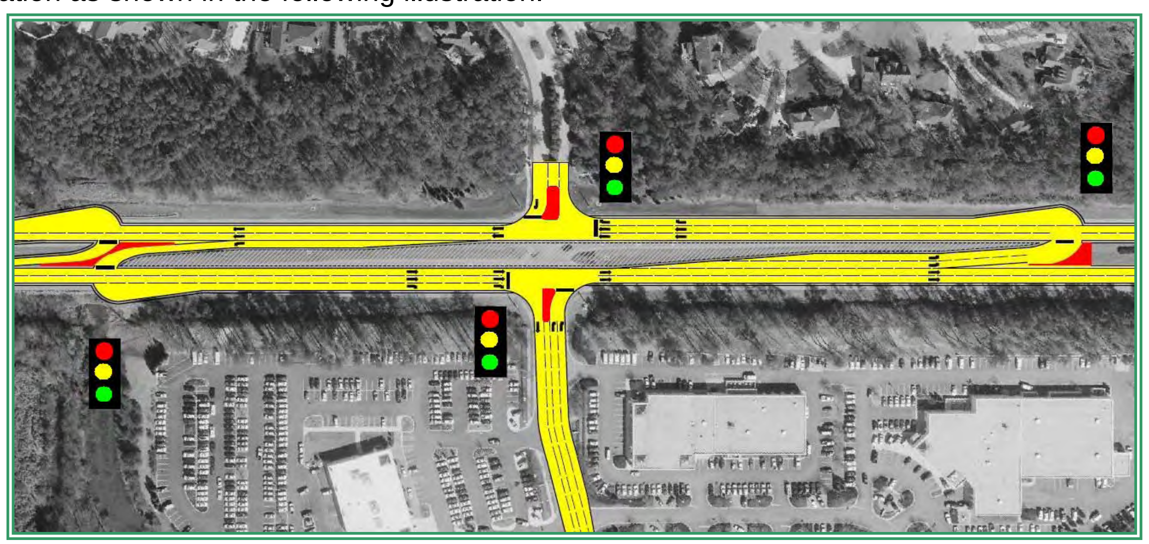
Source: FHWA Signalized Intersections: Informational Guide safety of the Superstreet configuration to a conventional intersection shows that the number of conflict points is reduced from 32 to 20 with the most dangerous crossing maneuvers (causing angle or "t-bone" accidents) reduced from 16 to 2 as shown in the following illustration.



The Superstreet does have a potential limitation for pedestrians because it utilizes a two-stage diagonal crossing that also requires some pedestrians to first cross the minor street before crossing the major roadway. The pedestrian crossing maneuvers occur at the same time as the major street traffic is turning left and the minor street traffic is turning right, thus allowing for pedestrians to cross without a conflicting traffic movements as typically occurs at traditional intersections.

Superstreet with Indirect Major Street Left-turns

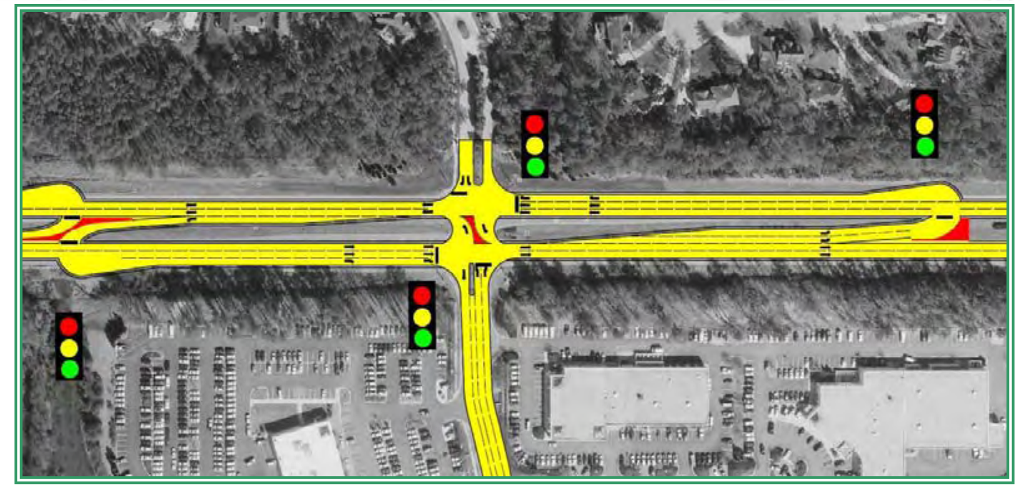
The Superstreet with indirect major street left-turns is very similar to the configuration with the direct major street left-turns with the exception that the left-turn movements from the major street are redirected to the downstream U-turn location as shown in the following illustration.



The benefits of this configuration over the previous configuration are that it provides for a more aesthetic environment, provides additional refuge for pedestrians and further reduces the number of conflict points to 12 including the elimination of all crossing conflicts. The redirection of the major street left-turn movement can result in additional stress on the u-turn signals and have the potential to reduce the efficiency of the traffic operations slightly.

Superstreet with Direct Minor Street Left-turns

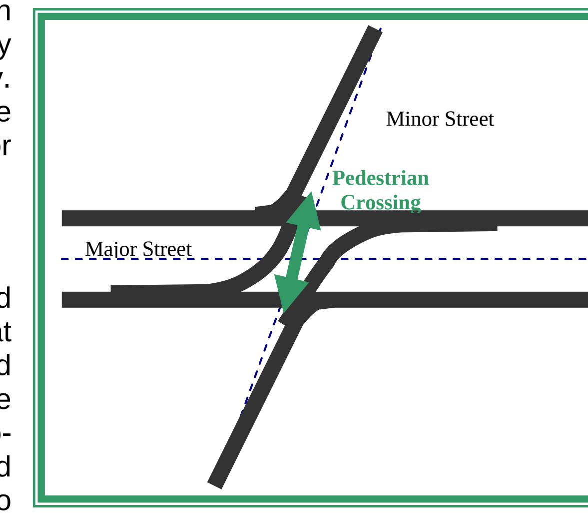
The third variation of the Superstreet concept is the Superstreet with Direct Minor Street Left-turns, which allows left-turns from the minor street directly onto the major street roadway. The left turns from the major street roadway to the minor street are directed to a downstream u-turn location, identical to the movement in the Superstreet with Indirect Major Street Left-turns. The minor street through movements are accommodated in the same manner as with all of the other Superstreet concepts requiring vehicles to turn right and make a u-turn at a downstream location. The Superstreet with Direct Minor Street Left-turns is shown in the following illustration.



The benefits of this configuration over the other Superstreet concepts are that it can accommodate high left-turn volumes from a minor street which may overwhelm the U-turn signal. The limitations associated with this configuration are that it does not allow for both sides of the major street to operate independently due to the left-turn movements requiring the major street traffic signals be combined as a single signal. There are also concerns with how pedestrians would navigate this configuration as the crossing pattern is a two-stage crossing that has more conflicts with turning traffic due to the left-turn movements and would likely require a longer wait time in the median to make the second stage of the crossing.

Superstreet Concept at Skewed Intersections

The Superstreet with Direct Major Street Left-turns concept can be modified slightly at skewed intersections to allow for a nearly perpendicular pedestrian crossing of the major street roadway. This configuration creates a larger central island increasing the pedestrian refuge and allowing for additional safety for pedestrians waiting in the median.

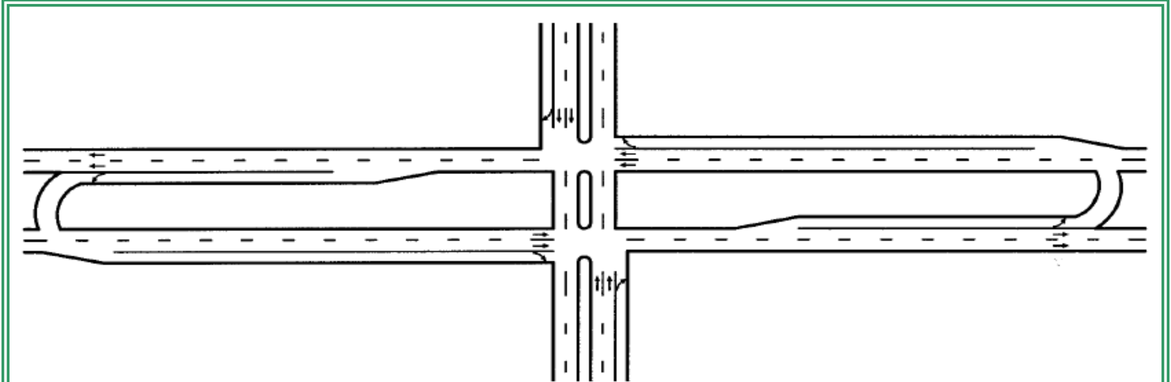


Summary of Superstreet Concept

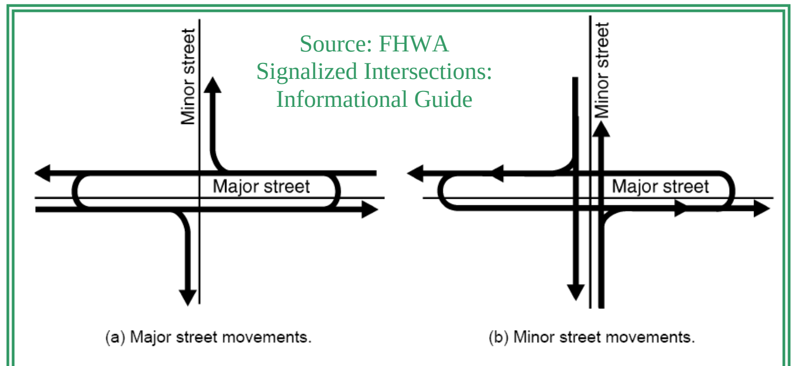
The Superstreet concept provides for substantially improved traffic operations by reducing the number of movements that occur at a single location and by allowing for improved coordination along the facility. The Superstreet does generate several concerns related to safety for pedestrians with a two-stage crossing, concerns with navigation for bicyclists and access to adjacent properties. The Superstreet concept also has several concerns related to bicyclists crossing the intersection, where the bicyclist is forced to avoid the intersection, act as a pedestrian or act as a vehicle. There is not a significant issue if a bicyclist acts as a pedestrian; however if they act as a vehicle there are concerns with safety for bicyclists as they must travel a longer distance and mix with weaving vehicular traffic. The potential benefits and limitations for the Superstreet are shown in Table 3.1.

3.2.2.3 Median U-turn Crossover

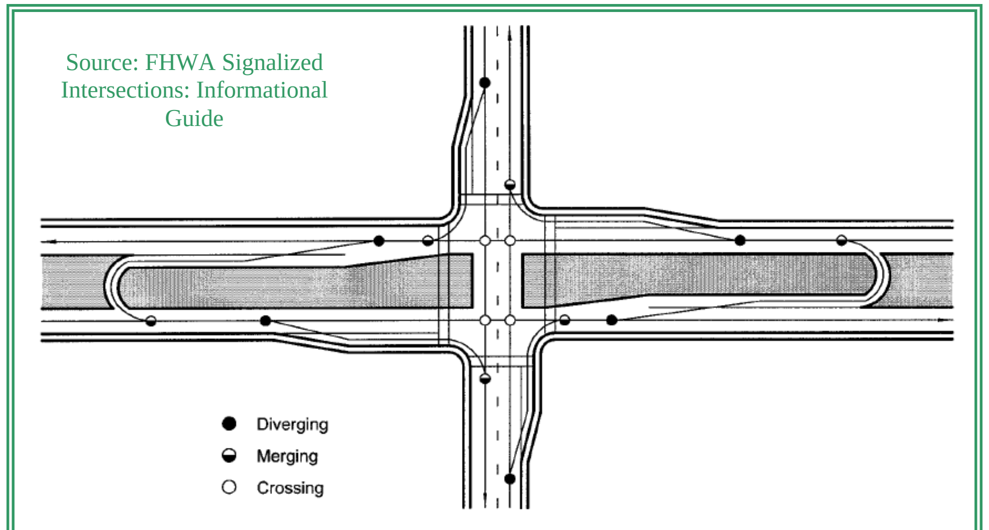
The Median U-turn Crossover is another unconventional intersection type that improves traffic operations by reducing the number of movements that occur at a single intersection. The Median U-turn Crossover is also commonly referred to as the Michigan Left turn due to the widespread use of this intersection type throughout the state. The Median U-turn Crossover concept eliminates all left-turn movements at the main intersection and moves them to median crossovers beyond the intersection. To turn left from the major street the driver crosses through the main intersection, makes a U-turn at the median crossover, returning in the opposite direction, turning right onto the minor street. To turn left from the minor street onto the major street, the movement would be the same as with the Superstreet, where the driver would turn right onto the major street and make a U-turn at the median crossover and continue back through the main intersection. The difference between the Median U-turn Crossover and the Superstreet is that the Median U-turn Crossover allows through traffic from the minor street to pass through the main intersection instead of turning right and using the median U-turn as is required for the Superstreet. The illustration below shows the Median U-turn Crossover.


Source: FHWA Signalized Intersections: Informational Guide

The median U-turns could also be placed on the minor street and would operate with the same traffic pattern or the median U-turns could be placed on both the minor street and the major street to further improve efficiency. The Median U-turn Crossover requires a wide median with a recommended width of 60 feet; otherwise additional pavement should be added to the outside travel lane to safely complete the U-turn maneuver. The ability to coordinate the signals along a corridor is less efficient than with a superstreet because the signals along the corridor must be coordinated in both directions. To improve the efficiency of the signal coordination the Median U-turn Crossover concept is best for corridors with uniform block widths, such as the grid pattern that makes the systems in Michigan very efficient. The Median U-turn Crossover is most suitable for locations that have relatively high major street and minor street through volumes and relatively low left-turn volumes.



Source: FHWA Signalized Intersections: Informational Guide



Source: FHWA Signalized Intersections: Informational Guide

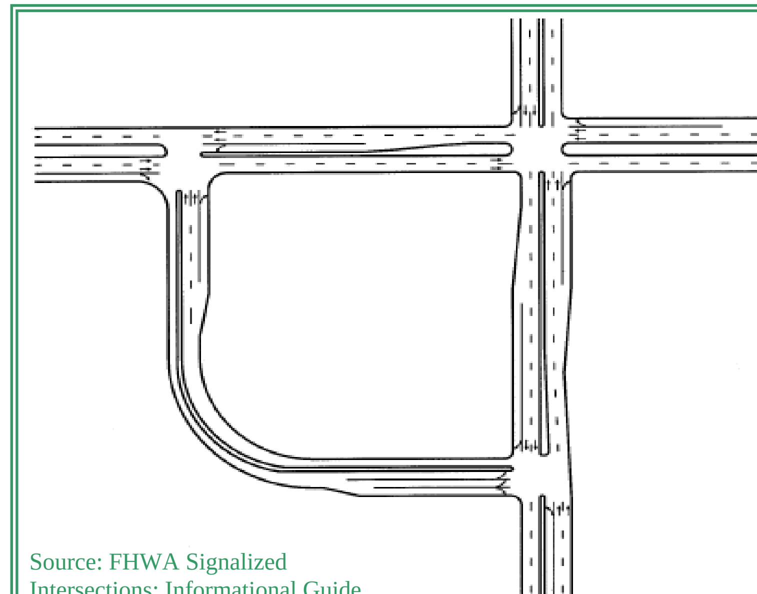
The safety of the Median U-turn Crossover has been evaluated extensively due to the widespread use in Michigan and based on a research study it was determined that the crash rate for facilities with median u-turns was 49 to 52% less than for roadways with traditional intersection configurations along corridors with more than one signal per mile. A comparison of the number of conflict points for a Median U-turn Crossover, shown at left, and a traditional intersection show that the number of conflict points is reduced from 32 to 16 with the Median U-turn Crossover where all 12 of the left-turn crossing maneuvers are eliminated.

The Median U-turn Crossover allows for traditional pedestrian crossings at the main intersection and due to the elimination of the left-turn movements reduces the number of conflicts to pedestrians. The increased median widths required for the Median U-turn results in longer crossing distances for pedestrians and increased delay to vehicular traffic due to long pedestrian crossing time for the signal. Due to this additional length some locations require the use of a two-stage crossing for pedestrians. The Median U-turn Crossover provides for bicycle movements more efficiently than a Superstreet intersection; however for unsignalized Median U-turns the turning paths for u-turn vehicles should be evaluated to ensure that they do not encroach on bike lanes.

Summary of Median U-turn Crossover Concept

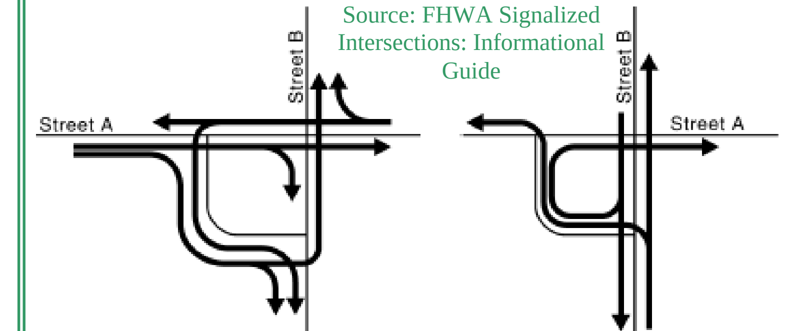
The Median U-turn Crossover concept provides for substantially improved traffic operations by reducing the number of movements that occur at a single location and by allowing for improved coordination along the facility. The Median U-turn Crossover does generate some concerns related to enforcement and education to prevent illegal left turns at the main intersection. There is also the potential for impacts to the access for parcels with direct driveway access to the major street because the access may need to be restricted within the influence area of the median U-turn locations. The potential benefits and limitations for the Median U-turn Crossover are shown in Table 3.1 at the end of this section.

3.2.2.4 Quadrant Roadway


Source: FHWA Signalized Intersections: Informational Guide

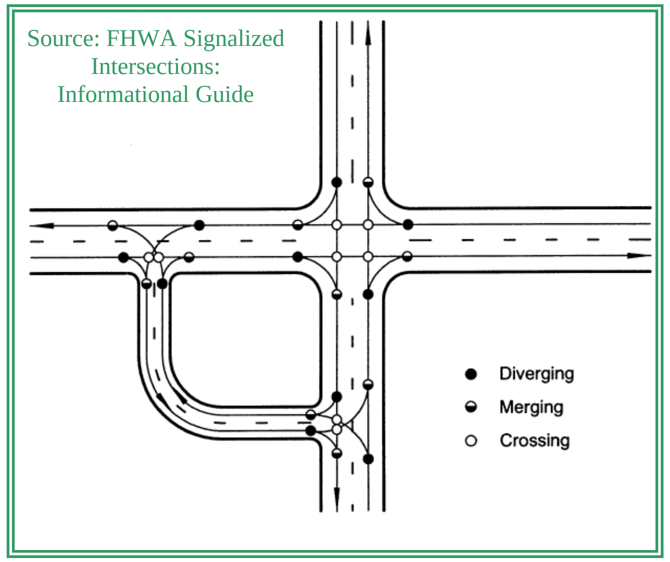
The Quadrant Roadway concept includes providing an additional roadway between two legs of the intersection that accommodates the left-turn movement traffic. Drivers who wish to turn left from either the major street or minor street will be required to drive further, but the efficiency of the main intersection is greatly improved by eliminating the left-turn movements. The Quadrant Roadway creates two additional intersections, approximately 500 feet from the main intersection, to accommodate the left-turn traffic. The illustration at left shows the Quadrant Roadway configuration.

The Quadrant Roadway concept is most applicable for locations that have both high through volumes and high left turn volumes. The concept is also a very good option when the quadrant roadway and intersections already exist as part of the existing development pattern. By eliminating the left-turn movements at the main intersection more green time can be given to the through traffic. The two offset intersections also operate efficiently because they create three-leg intersections. The three leg-intersections are efficient because they allow time for each of the movements; the through movements, the left turn movements to the quadrant roadway and the left turn movements from the quadrant roadway to the major street. The three-leg configuration only includes one of the through movements making it more efficient from a traffic operations standpoint.



Source: FHWA Signalized Intersections: Informational Guide

The Quadrant Roadway is also an effective way to set up an intersection that will eventually be upgraded to an interchange or become a grade separation as it provides for movements that are similar to a ramp and loop at an interchange. For this reason, Quadrant Roadways are often referred to as Square Loop intersections. The Quadrant Roadway concept allows for traditional pedestrian crossings at the main intersection and due to the elimination of the left-turn movements reduces the number of conflicts to pedestrians. The elimination of left-turn lanes also decreases the median width resulting in shorter crossing distances for pedestrians and reduced delay to vehicular traffic due to the shorter pedestrian crossing time for the signal. The pedestrian, however would have to make an additional crossing due to the new intersection included by creating the Quadrant Roadway segment.



A comparison of the safety of the Quadrant Roadway concept to conventional intersections shows that the number of conflict points is reduced from 32 to 28 with the number of merging/diverging conflicts increasing from 16 to 20 and the number of crossing conflicts being reduced from 16 to 8. The results of the safety evaluation show that the Quadrant Roadway offers the potential for a minor increase in rear-end collisions and a major decrease in left-turn collisions. The illustration at left shows the conflict point diagram for the Quadrant Roadway concept.

<u>Summary of Quadrant Roadway Concept</u>

The Quadrant Roadway concept provides for substantially improved traffic operations by reducing the number of movements that occur at a single location. The Quadrant Roadway does generate some concerns related to enforcement and education to prevent illegal left turns at the main intersection. There is also the potential for impacts to access to parcels with direct driveway access to the major street because the access may need to be restricted within the influence area of the Quadrant roadway locations. The potential benefits and limitations for the Quadrant Roadway are shown in Table 3.1 at the end of this section.

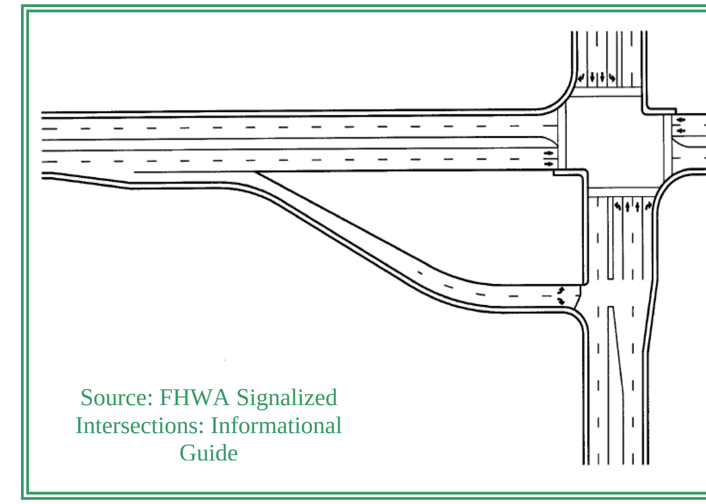
3.2.2.5 Quadrant Roadway with Grade Separation

The Quadrant Roadway with grade separation is a variation on the Quadrant Roadway discussed above. The Quadrant Roadway with Grade Separation adds an overpass at the main intersection improving the operations of the intersection substantially. This configuration can also be developed with Quadrant Roadways in two quadrants and is known as a Quadrant Interchange (discussed in Expressway Concepts section) that eliminate the left-turn movements at one of the roadways and make the intersection operate similar to a scaled down interchange. An example of a single quadrant (left turns allowed on both roadways) is shown at right.

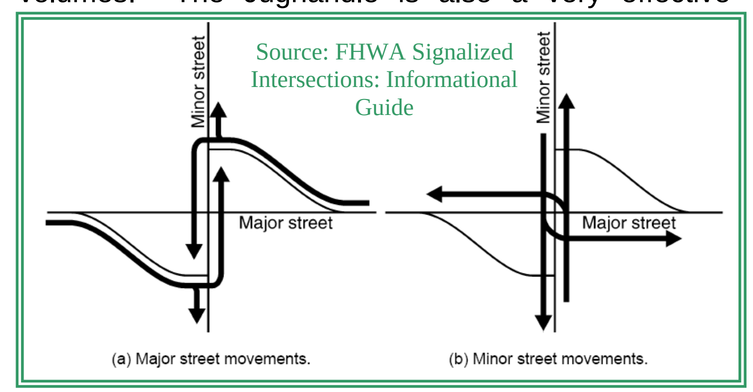
The safety of the Quadrant Roadway with grade separation further improves safety by removing an additional 12 conflict points, reducing the total number of conflict points to 16 as compared to the 32 for a traditional intersection. The safety for pedestrians is greatly improved with the grade separated crossing as it allows for free movement through the intersection due to the overpass structure. One potential limitation of the Quadrant Roadway with Grade Separation is that it may require the acquisition of additional property to allow for the increased elevation of the overpass and may restrict access near the overpass due to the grades on the roadway. Additionally, construction of the overpass at existing intersections may require substantial detour routes or relocation of the roadway in order to keep the existing roadways operational during construction. The potential benefits and limitations for the Quadrant Roadway with Grade Separations are shown in Table 3.1 at the end of this section.

3.2.2.6 Jughandle

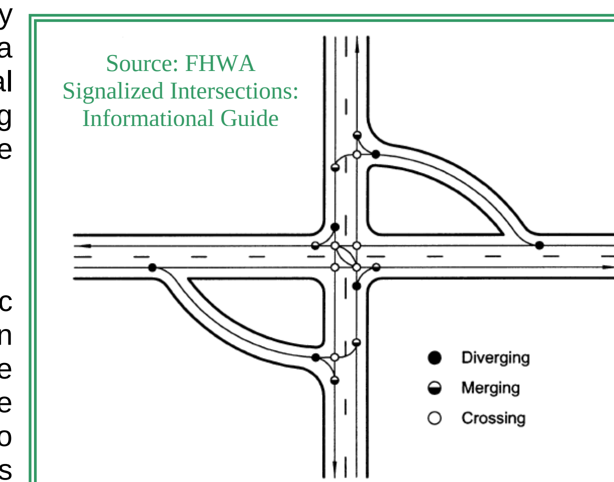
The Jughandle is an unconventional intersection concept that redirects left-turn movements from the major street by creating a one-way ramp that connects to the minor street to allow left-turn movements. The Jughandle concept includes placing the ramps in two quadrants of the intersection in advance of the intersection in each direction. All major street turns – left, right and U-turns are made from the right side of the roadway. Drivers wishing to turn left exit the major roadway at the ramp on the right side and then turn left at the minor street and continue straight through the intersection along the minor street. The illustration at right shows the Jughandle concept.



The Jughandle concept is most appropriate for intersections with high major street through movements, low-to-medium major street left-turn movements, low-to-medium minor street left-turn movements and any amount of minor street through volumes. The Jughandle is also a very effective solution at intersections with narrow medians that cannot accommodate a left-turn lane or cannot accommodate large vehicles making u-turns. The signing of the intersection is vital to the Jughandle concept as it is not intuitive to exit to the right to turn left and requires adequate advanced notice to the driver. The Jughandle concept increases the exposure of pedestrians to traffic due to the additional intersections required, however the pedestrian crossing at the main intersection is narrower due to the lack of left and right turn lanes.



The safety of the Jughandle concept is demonstrated by reducing the number of conflict points in comparison to a traditional intersection from 32 to 26 which offers the potential for a substantial decrease in left-turn collisions. The following illustration shows the conflict diagram for the Jughandle concept.

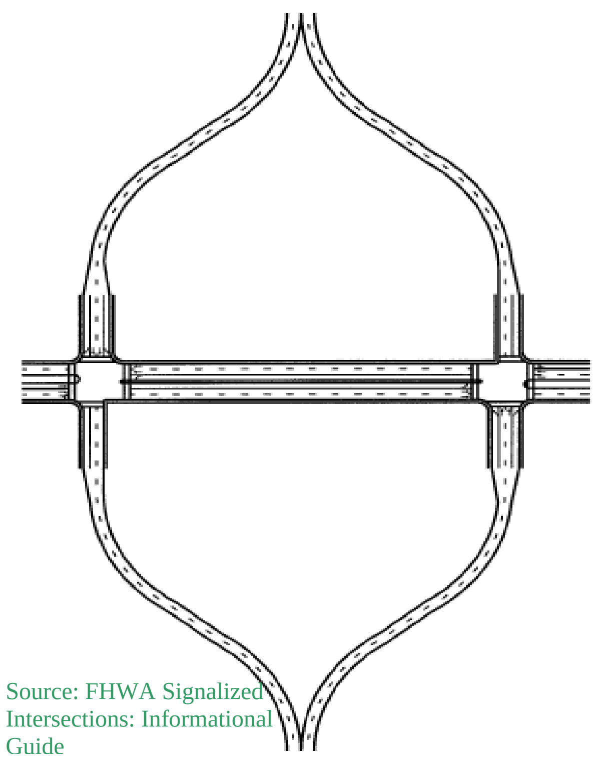


<u>Summary of Jughandle Concept</u>

The Jughandle concept provides for improved traffic operations by redirecting the left turns away from the main intersection, allowing more green time to be allotted to the major street through traffic. The Jughandle does have some potential limitations due to the increased footprint to accommodate the ramps and the potential for conflicts between bicyclists and vehicles at the exit point to the ramps. There is also the potential that the location of the Jughandle ramps may require additional control of access along the minor street which may have an impact on access to adjacent properties. The potential benefits and limitations for the Jughandle are shown in Table 3.1 at the end of this section.

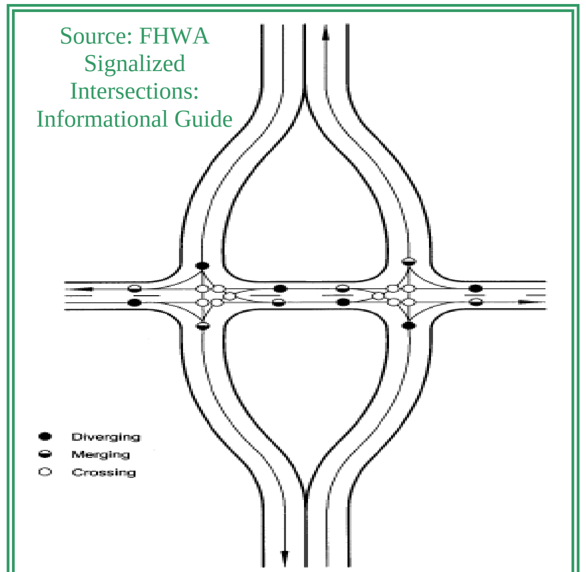
3.2.2.7 Split Intersections

The Split Intersection concept essentially creates an at-grade diamond interchange between two roadways. The Split Intersection requires that the major street roadway split into two one-way streets as it approaches the minor street. This configuration creates two intersections where each intersection serves fewer movements than a single traditional intersection. Each of the intersections would have separate allotments of green time for the major street through, left and right traffic, the minor street left turn traffic and the minor street through traffic, resulting in improved traffic operations. The illustration to the right shows the Split Intersection concept.



Source: FHWA Signalized Intersections: Informational Guide

The Split Intersection concept is most applicable where a future interchange is likely to be constructed but either cannot yet be justified or is too expensive to construct. The benefit of the Split Intersection is that there would not need to be any additional property acquired to construct the diamond interchange in the future. This concept is best used for new roadways being planned or for those that are being retrofitted with an increased level of control of access, such as converting an arterial with signals to an expressway or freeway. The split intersection reduces the pedestrian crossing distance substantially, but because the intersections have the look and feel of an interchange, pedestrians may find them intimidating and drivers may be less aware of pedestrians' presence.



Source: FHWA Signalized Intersections: Informational Guide

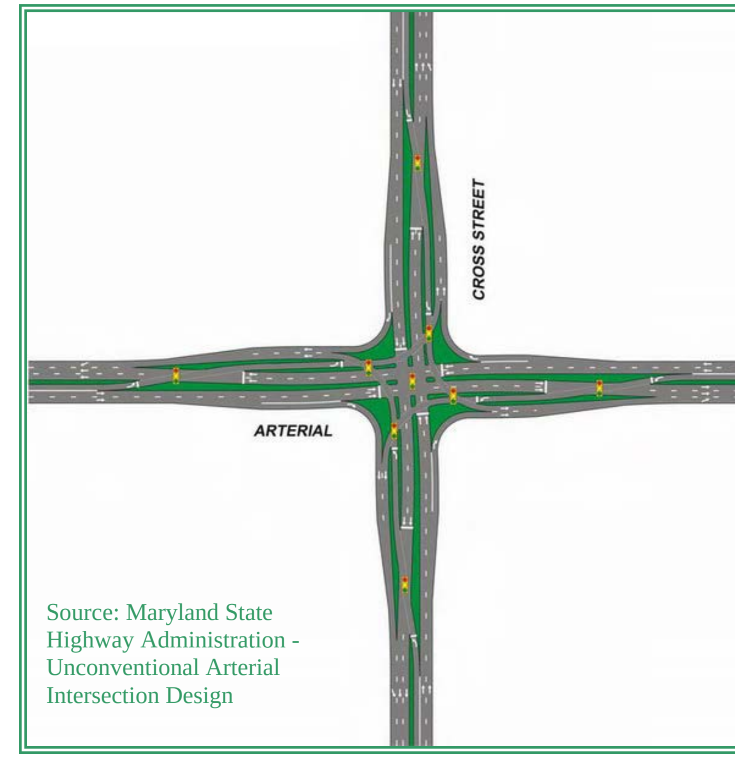
A comparison of the number of conflict points between a Split Intersection and a traditional intersection configuration shows that the number of conflicts is reduced from 32 to 22 with the potential for a significant decrease in left-turn collisions. The illustration at left shows the conflict diagram for the Split Intersection concept.

Summary of Split Intersection Concept

The Split Intersection concept provides for improved traffic operations by splitting out the movements that occur at a traditional intersection into two separate intersections. The concept allows for a substantial increase in the amount of green time that can be allotted to the major street through traffic. The concepts main limitations are that it requires additional land to construct initially and tends to have a higher initial construction cost as compared to other unconventional intersection configurations. The potential benefits and limitations for the Split Intersection are shown in Table 3.1 at the end of this section.

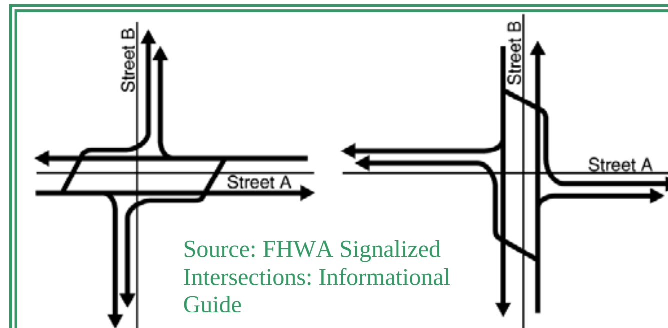
3.2.2.8 Continuous Flow Intersection

The Continuous Flow Intersection concept is another unconventional intersection concept whose goal is to reduce the number of conflicting movements at the main intersection in order to allow for more green time for the major street through traffic. The Continuous Flow Intersection removes the conflict between left-turning vehicles and through traffic in the opposite direction by crossing the left-turn traffic to the left side of the roadway. The crossing from the right side to the left side is accomplished at a midblock signalized intersection for each approach that will include the continuous flow lanes. Note that this section describes an at-grade concept; a grade-separated version of the Continuous Flow Intersection was patented, but the patent expired in 2003.



Source: Maryland State Highway Administration - Unconventional Arterial Intersection Design

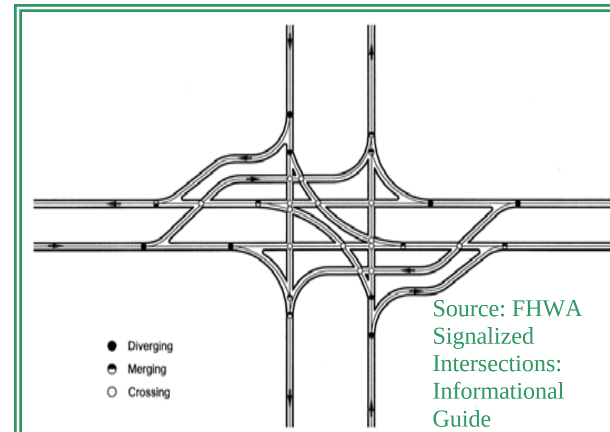
The Continuous Flow Intersection concept is most appropriate with high through and left-turn volumes and minimal u-turn volumes as the configuration restricts these movements. The left-turning vehicles are likely to experience more delay at this type of intersection; however the through traffic operations are substantially improved. The Continuous Flow Intersection concept is extremely flexible and can be implemented from only a single leg to all four legs of the intersection depending on the traffic volumes.



Source: FHWA Signalized Intersections: Informational Guide

The Continuous Flow Intersection does present some challenges for pedestrians although the concept does provide a substantial benefit to pedestrians because all crossings are completed when there is not conflicting turning vehicles. The pedestrian crossing for this concept requires a two-stage crossing and the layout and operation may not be readily apparent to pedestrians, especially visually impaired pedestrians. Due to the unconventional traffic flow the audible clues that visually impaired pedestrians utilize are disrupted and consideration should be given for specially designed pedestrian signals at Continuous Flow Intersections.

The safety of the Continuous Flow Intersection as compared with a traditional intersection configuration results in the total number of conflict points being reduced from 32 to 30 (shown at right) with the potential for a major reduction in left-turn collisions and the potential for a major increase in angle collisions. The education required for drivers at Continuous Flow Intersections is a concern although limited studies have found that drivers quickly adjust to the configuration and after an initial break-in period there is little driver confusion. The maintenance of this concept is also potential concern for snow removal and safety in the event of power outages to the signalized intersections.



Source: FHWA Signalized Intersections: Informational Guide

Summary of Continuous Flow Intersection

The Continuous Flow Intersection concept provides for improved traffic operations by splitting out the left-turn movements in advance of the intersection to eliminate the conflicting movements at the main intersection. The concept allows for a substantial increase in the amount of green time that can be allotted to the major street through traffic. The concept's main limitations are that it requires a larger footprint than traditional intersections; however it is more compact than a typical interchange. There are also concerns with access to adjacent properties due to the requirement for greater access control in the vicinity of the midblock crossing signals. The potential benefits and limitations for the Continuous Flow Intersection are shown in Table 3.1 at the end of this section.

3.2.2.9 Summary of Signalized Intersection Concepts

A summary of the concepts discussed above is shown in Table 3.1. Each of the nine unconventional signalized intersection concepts are compared relative to the Traditional Intersection Treatment for the following attributes:

- Safety (evaluates the vehicular safety of the intersection by comparing the number of conflicts points (potential crash locations) for the concept with the number of conflict points for a traditional intersections)
- Traffic Operations (evaluates the traffic operations of the concept based on overall intersection travel time)
- Bicyclist and Pedestrian (evaluates the ability of the concept to provide for safe and efficient mobility for bicyclist and pedestrians)
- Footprint (evaluates each concept based on the amount of land required to construct the concept)
- Access (evaluates each concept on its ability to provide for efficient access to adjacent parcels and roadways as compared to a traditional intersection)
- Education and Enforcement (evaluates each concepts ability to understood by the driver and the ability to enforce the traffic pattern included in the concept)

The table provides a description of the potential benefits and potential limitations for each concept as well as a qualitative rating for how well it addresses each individual attribute.

The qualitative rating system includes the following measures:

★★★★★ - Favorable
★★★★ - Slightly Favorable
★★★ - Average
★★ - Slightly Unfavorable
★ - Unfavorable

It should also be noted that these qualitative evaluations are for each individual attribute and that the weight of each of the attributes is not equal. Different individuals are likely to prioritize certain attributes higher than other individuals would. For example a business owner may prioritize access to their business with much greater weight, while an avid cyclist may prioritize bicycle/pedestrian considerations. The challenge in evaluating the concepts and developing a solution is that a balanced approach must be taken as no one concept is superior for all attributes. When applied to the US 64 corridor it is important that the individual context for each location be considered when evaluating the potential options.

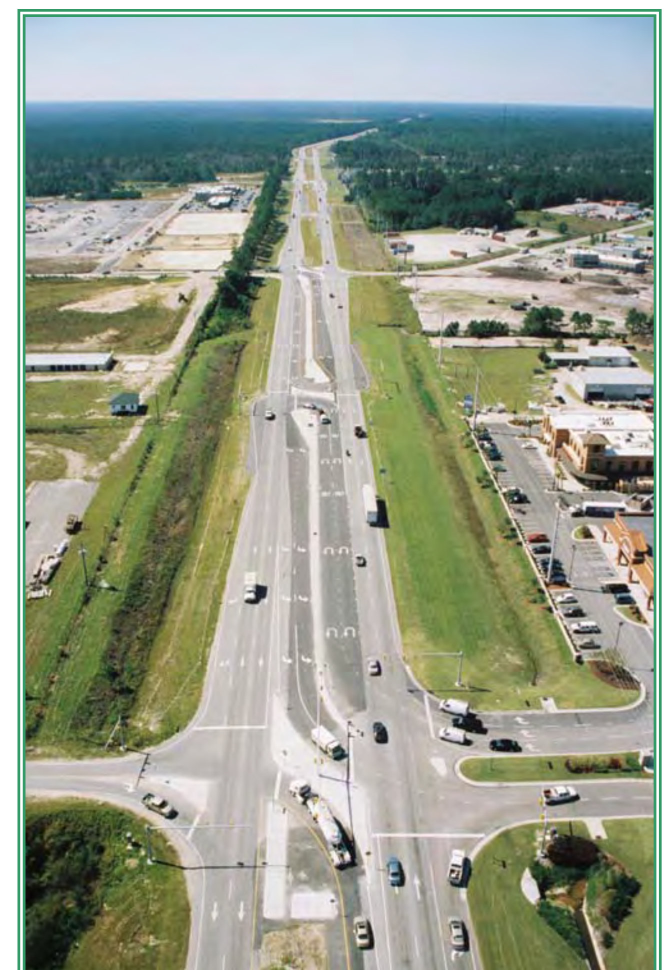


Table 3.1: Signalized Intersection Concepts Summary

Concept Type		Safety	Travel Operations	Bicycle/Pedestrian	Footprint	Access	Education and Enforcement
Traditional Intersection Treatments		★	★	★★★	★★	★★★★★	★★★★★
		32 Conflict Points	Inefficient operation due to many movements being required at a single location	Standard crossing pattern for pedestrians and bicyclists; however some conflicts with vehicles	Larger footprint to accommodate turn lanes and inefficient operation requires more lanes	Provides full access to all movement	Standard configuration, well understood by drivers, pedestrians and bicyclists
Superstreet with Direct Major Street Left-turns		★★★★	★★★★★	★★	★★★	★★★★	★★★
	Potential Benefits	20 Conflict Points	Less delay for major street movements	No conflicting vehicle movements	May reduce need for adding additional lanes	Provides same access as traditional intersection for major street traffic	None
	Potential Limitations	None	Longer travel distance and slightly longer time for minor street movements	2-stage diagonal crossing and concerns with bicycle crossing	Needs wider median or u-turn bulb-outs	Redirects side street through and left-turns to u-turn location	Potential for driver, pedestrian and bicyclist confusion
Superstreet with Indirect Major Street Left-turns		★★★★★	★★★★	★★★	★★★★	★★★	★★★
	Potential Benefits	12 Conflict Points	Less delay for major street through movements	No conflicting vehicle movements and increase refuge in median	May reduce need for adding additional lanes, more aesthetic	Provides same access for major street through and right movements	None
	Potential Limitations	None	Longer travel distance and time for minor street and major street left turns	2-stage diagonal crossing and concerns with bicycle crossing	Needs wider median or u-turn bulb-outs	Redirects major street left and side street through and left-turns	Potential for driver, pedestrian and bicyclist confusion
Superstreet with Direct Minor Street Left-turns		★★★★	★★★	★	★★★	★★★	★★★
	Potential Benefits	20 Conflict Points	Less delay for major street through movements	None	May reduce need for adding additional lanes	Provides for major through and right movements and minor street left-turns	None
	Potential Limitations	None	Longer delay for minor street through and right turn movements	2-stage crossing with extended wait time and bicycle concerns	Needs wider median or u-turn bulb-outs	Redirects major street left-turns and minor street through movements	Potential for driver, pedestrian and bicyclist confusion
Median U-turn Crossover		★★★★	★★★	★★★	★★★	★★★	★★
	Potential Benefits	16 Conflict Points	Less delay for major street through movements	Standard crossing for pedestrians and bicyclists with fewer vehicle conflicts	May reduce need for adding additional lanes	Provides same access for major and minor street through movements	None
	Potential Limitations	None	Longer travel distance and time for minor street and major street left turns	2-stage crossing is typical	Needs wider median or u-turn bulb-outs	Redirects all left-turn movements to u-turn location	Potential for illegal left-turns & driver and bicyclist confusion
Quadrant Roadways		★★	★★★	★★★	★★	★★★	★★
	Potential Benefits	28 Conflict Points – Potential major decrease in left-turn collisions	Potential reduction in delay and queuing	Decreases crossing distance at main intersection by removing left turns	Benefit if roadway already exists	None	None
	Potential Limitations	Potential minor increase in rear-end collisions	Potential for longer travel distance for turning movements	Number of intersections to cross increases	May require additional land and have high construction cost	May reduce access to quadrant roadway and redirects some turns	Potential for illegal left-turns & driver, and bicyclist confusion
Quadrant Roadways with Grade Separation		★★★★	★★★★★	★★★★★	★	★★	★★★★
	Potential Benefits	16 Conflict Points	Reduction in delay and queuing	Removes pedestrian conflicts at main intersection	None	None	None
	Potential Limitations	None	Potential for longer travel distance for turning movements	None	Requires additional land and high construction cost, aesthetic concerns	Redirects more turn movements to quadrant roadway, reduces some access	Minor potential for driver, pedestrian and bicyclist confusion
Jughandle		★★	★★	★★	★	★★★	★★
	Potential Benefits	26 Conflict Points	Reduction in overall intersection travel time	Decreases crossing distance at main intersection by removing left turns	None	None	None
	Potential Limitations	None	Longer travel time for left-turns using Jughandle	Increased number of intersections and concerns with exit to Jughandle conflicting with bicycle lanes	Requires additional land and may have high construction cost	May reduce access near Jughandle and redirects some turns	Potential for illegal left-turns and requires good advanced signing
Split Intersections		★★★	★★	★★★	★	★★★★★	★★★★★
	Potential Benefits	22 Conflict Points	Improves traffic flow for through movements	Shorter crossing distance	Can be step toward interchange at future interchange locations	Provides for all movements	None
	Potential Limitations	Potential for wrong-way movements	May have problems with queuing depending on separation distance	May not be perceived as being pedestrian friendly	High initial land and construction costs	Larger footprint may require some access restrictions	None
Continuous Flow Intersection		★★	★★★	★	★	★★★★	★★
	Potential Benefits	30 Conflict Points	Improves traffic flow for through movements	No vehicle conflicts during pedestrian crossing	None	Provides for all movements	None
	Potential Limitations	Potential for major increase in angle collisions	More delay for left-turn movements	2-stage crossing and concerns with visually impaired pedestrians	Requires additional land and higher construction cost, aesthetic concerns	Larger footprint requires additional access restrictions	Potential for driver, pedestrian and bicyclist confusion

★★★★★ - Favorable ★★★★ - Slightly Favorable ★★★ - Average ★★ - Slightly Unfavorable ★ - Unfavorable

3.2.3 Expressway Concepts

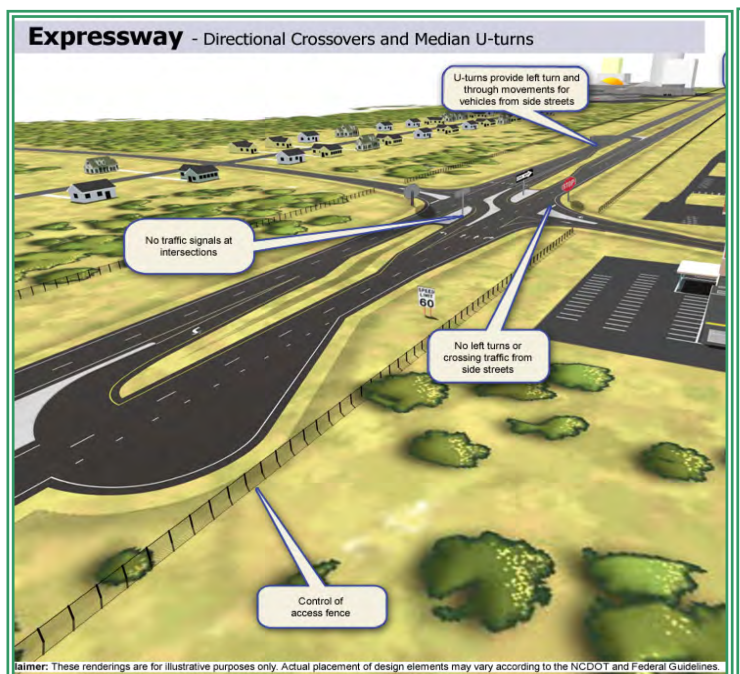
The range of solutions for upgrading an existing signalized intersection facility to an expressway is accomplished through removing the signalized intersections and improving the connections to the existing minor streets. The expressway concepts are generally separated into two categories; urban concepts and rural concepts.

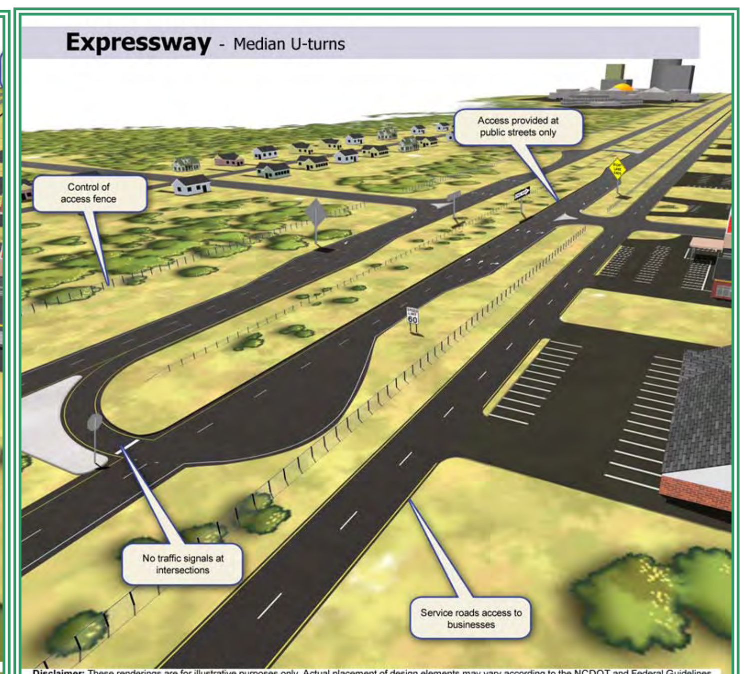
3.2.3.1 Rural Expressway Concepts

The rural concepts are typically converting the major intersections into at-grade unsignalized intersections that allow only right-turn movements to and from the minor street and limited left-turn and U-turn movements at unsignalized locations along the major street. The at-grade intersections include providing adequate acceleration and deceleration lengths to safely transition cars to and from expressway speeds. Rural expressway concepts are typically applicable for divided facilities with projected major street daily traffic volumes less than 25,000 vehicles per day and projected minor street daily volumes less than 2,500 vehicles per day.

Right-in/Right-out with Median U-turns

The preferred method of providing an expressway facility in a rural area is to utilize a configuration that converts minor street intersections to allow only right-turn movements to and from the minor street, which is typically referred to as a "right-in/right-out" configuration. Traffic from the minor street wishing to go straight or left would first turn right onto the major street and then enter a u-turn lane at a location approximately 800 feet downstream where they could make a u-turn in the opposite direction and either turn right into the minor street (completing the through movement) or continue straight through (completing the left turn movement). The left turn traffic is typically handled with either a left turn at the minor street intersection or by traveling beyond the intersection and making a u-turn to travel back to the minor street. The determination of whether or not a direct left turn will be provided is based on the projected volume of traffic on the minor street. This configuration is essentially an unsignalized version of the Superstreet configuration described in the signalized intersection concepts section. The illustrations below show the Right-in/Right-out with Median U-turns concept both with the direct left turns at the minor street (left) and with the median u-turns (right).





3.2.3.2 Urban Expressway Concepts

The urban expressway concepts typically rely on developing grade-separated (overpass) crossings for major side streets and allowing unsignalized connections to minor side streets as long as adequate acceleration and deceleration lengths can be achieved to safely transition cars to and from expressway speeds. The ability to allow unsignalized left-turn and u-turn movements along the major street, as is typical for the rural concepts, is not possible as the major street traffic volume exceeds 25,000 vehicle per day, thus meaning that the access to and from major roadways will require grade separation. In its simplest form, the only way to allow vehicles to cross the median of the major street for volumes greater than 25,000 vehicles per day is with a signalized intersection or with a grade separated crossing. Because expressway facilities do not allow signals, the only means of providing full access is through grade separating the minor street and major street from each other. The following sections detail the concepts that are typically used for expressway facilities in urban areas.

Quadrant Interchange

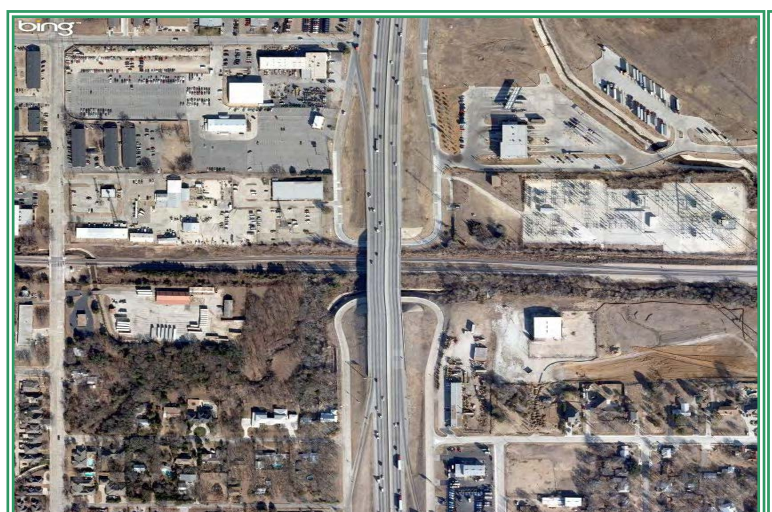
The quadrant interchange is very similar to the Quadrant Roadway with Grade Separations described under the signalized intersection concepts section. The Quadrant Interchange is commonly referred to as a "Square Loop Interchange" as it emulates the functions of a loop and ramp in an interchange in a more compact form. The Quadrant Interchange includes an overpass at the main roadway intersection and quadrant roadways in two quadrants of the intersection. This configuration eliminates the left-turn movements to and from the major street roadway and makes the intersection operate similar to a scaled down interchange. The configuration can also be used with quadrant ramps in all four quadrants, thus eliminating all of the left-turn movements on both the major street and minor street. The elimination of the left-turn movements from the major street allows it to operate without any signalized intersections in accordance with the expressway definition. The following images show examples of Quadrant Interchanges.

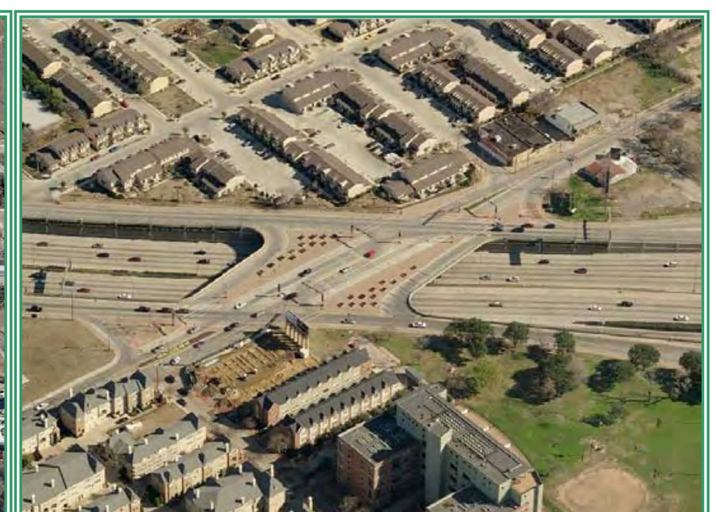
Depending on the traffic volumes on the quadrant roadways, the land inside of the quadrants can be developed with limited access to the quadrant roadways. The major street connections should be designed with adequate acceleration and deceleration lengths to safely transition cars to and from expressway speeds. The length of the quadrant roadways is typically based on the greater of the distance required to connect the grade separated roadways or to accommodate the traffic queued at the signalized intersection on the minor street.

Grade Separated U-turns

The Grade Separated U-turns is a concept that is used along an expressway corridor in conjunction with right-in/right-out intersections to collect all of the traffic that desires to cross the major street as a minor street through or left-turn and have it exit to the right onto a grade separated U-turn bridge. The concept has been utilized in several locations outside of the United States and is typically only used in highly urbanized areas where the cost of acquiring additional property is cost restrictive. The following images show the Grade Separated U-turn concept.


The more common application of the Grade Separated U-turn concept in the United States is in Texas where they are used extensively along with frontage roads that run parallel to the major street roadway. Access to and from local roadways is provided onto the one-way parallel frontage roads and vehicles that wish to turn left follow the frontage road to a location where u-turn movements are allowed either on a bridge over the major street or with the major street passing over the u-turn roadway. The following images show the Grade Separated U-turn concept with parallel frontage roads.

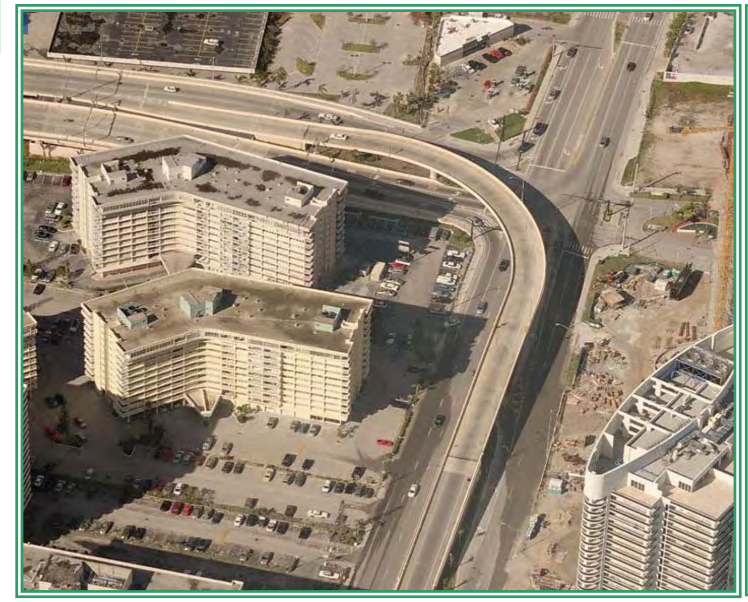
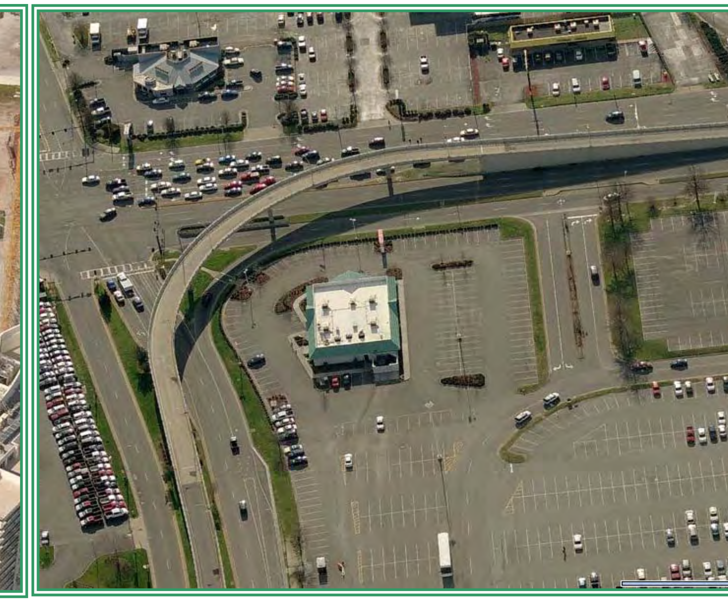




The primary concerns with the Grade Separated U-turn concept is that it takes additional land to construct the frontage roads and the aesthetics related to the grade separation are a concern in the vicinity of residential areas.

Grade Separated Median Left-turn

The Grade Separated Median Left-turn is an expressway concept that allows for left turns from the major street to a minor street by means of a grade separated bridge over the opposing direction of traffic. The use of the elevated bridge eliminates the conflict between the left turning traffic from the major street roadway and the traffic traveling along the major street roadway in the opposite direction. The following images show the Grade Separated Median Left-turn concept.

The primary concerns with the Grade Separated Median Left Turn concept are similar to the Median U-turn concept with the aesthetics and noise impacts related to the grade separation are a concern in the vicinity of residential areas. Additionally, the tighter design for the turning traffic can create the potential for truck rollovers on the ramp

Parallel Frontage Road with Slip Ramps

The most common strategy for urban expressways is to utilize a system of parallel frontage roads that separate local traffic from through traffic. The parallel frontage roads connect to and from the major street through traffic lanes at appropriate locations with slip ramps that enter and exit on the right side of the major street roadway. The parallel frontage road concept is beneficial because it allows for signalized intersections on the frontage road at minor streets that provide access to adjacent property as well as uninterrupted travel along the major street through lanes. With the Parallel Frontage Road concept there are two ways to treat the minor street access points; either as three-leg intersections without major street cross access or as four-leg intersections that include a grade separated crossing of the major street through traffic. The grade separated cross streets can also be utilized for vehicles who wish to make left turns where a minor street intersects the frontage road at a three-leg intersection. To accommodate the left-turn movement, the driver would make a right turn onto the frontage road and travel to the next four-leg intersection with a grade separation, turn left onto the crossing roadway and then left again onto the frontage road traveling in the opposite direction. The driver would then merge onto the expressway at a slip ramp entrance. The locations of slip ramps are placed such that they can provide an adequate level of access to and from the frontage roadways without overloading the major street through lanes or the frontage roads. The location of the parallel frontage roads in relation to the major street through travel lanes is dependent on the constraints along the corridor. The frontage roads could be separated by barriers or retaining walls where there is little available land along the corridor or could be separated from the major street traffic even as far outward as one block away from the major street through traffic with access to property along both sides of the frontage road. The following image shows the Parallel

Frontage Road with Slip Ramps concept along the Durham Freeway.

The primary concern with the Parallel Frontage Road with Slip Ramps is the size of the footprint required to accommodate the frontage roads and slip ramps. Additionally, due to the need to grade separate the minor streets, the major street through lanes are often constructed as overpasses or bridge structures over the existing minor streets which generate concerns due to noise and the aesthetics in residential areas.

Reduced Form Interchanges

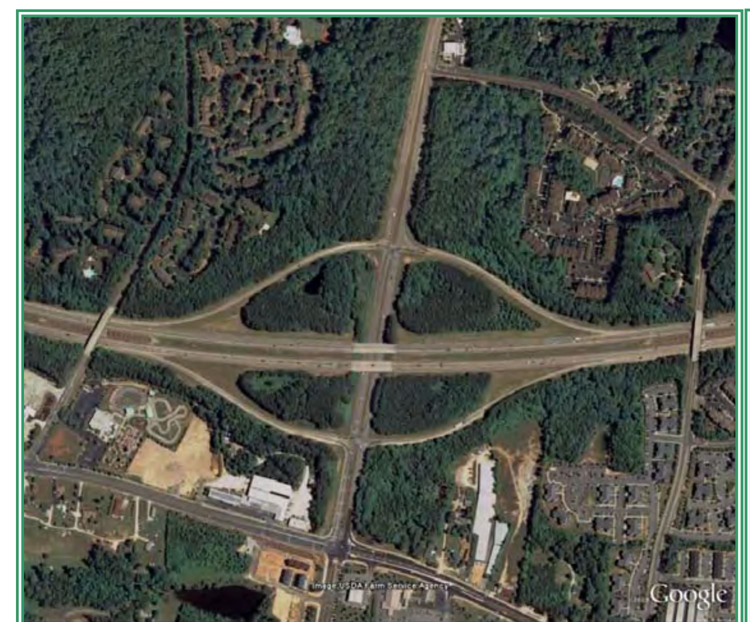
The urban expressway often functions similarly to a freeway system due to the need to grade separate the crossing movements to and from minor streets. Because of this, the practice of utilizing freeway interchanges that are modified to be more compact is a common strategy for urban expressway corridors. The design speed of the urban expressway facility is typically less that that of an urban freeway and the expectation from drivers is such that it is acceptable to have lower speed connections to the expressway major street. The interchange types for freeways are discussed in Section 3.2.4 and these configurations can be modified slightly to allow for a more compact footprint that better fits into the context of an urban expressway corridor. The primary changes to the configurations are to allow for lower speed ramps and loops that have adequate acceleration and deceleration lengths to safely transition cars to and from expressway speeds. The typical design speed for ramps exiting and entering an expressway with a design speed of 55 miles per hour would be 30 miles per hour as opposed to 50 miles per hour for a typical freeway. The design speed for loops is typically reduced from 30 miles per hour to 20 miles per hour which results in a much smaller radius for the loop. In addition to standard ramps and loops, any flyover ramps could be constructed with reduced design speeds of 20-30 miles per hour as opposed to 50-60 miles per hour for a freeway facility thus substantially reducing the size of the ramp. The design of any reduced form interchange should be evaluated to determine that the design will operate safely and that it does not violate driver expectations.

3.2.4 FREEWAY CONCEPTS

The range of solutions for upgrading an existing signalized intersection facility to a freeway is accomplished through removing the signalized intersections and either removing the minor street connections or upgrading the connections to interchanges. This section presents the different configurations for freeway interchanges. Freeway interchanges are typically broken into two classifications; service interchanges and system interchanges, with the major distinction being the type of facility that intersects the freeway. A service interchange is an interchange between a freeway and a minor street that is not another freeway or expressway and includes unsignalized or signalized intersections along the minor street. A system interchange is an interchange between two controlled access facilities such as freeways and expressways. System interchanges are typically very complex, have numerous potential solutions based on the traffic volumes and in general are unique solutions to the given area. For this reason, this section focuses only on service interchanges. To protect the traffic operations and safety of the interchange, NCDOT policy calls for a minimum length of 1000 feet along the minor street, from the location where the ramp or loop ties to the minor street, to have controlled access with no roadways or driveways allowed in this area. Therefore any service road needed to maintain access along the freeway once it is upgraded must tie in at a location that is a minimum of 1000 feet from the ramp intersection.

3.2.4.1 Simple Diamond Interchange

The Simple Diamond interchange is the standard configuration for NCDOT in rural areas. The configuration includes a single ramp in each of the four quadrants with the intersections along the minor street placed 800-1000 feet apart. The configuration allows for the interchange to be upgraded to include internal loops, if traffic volumes increase in the future, without having to reconstruct the interchange or purchase additional property. This interchange configuration provides low-to-medium traffic capacity, has a low construction cost and requires a medium-to-high amount of land to construct. The following images show examples of Simple Diamond interchanges.

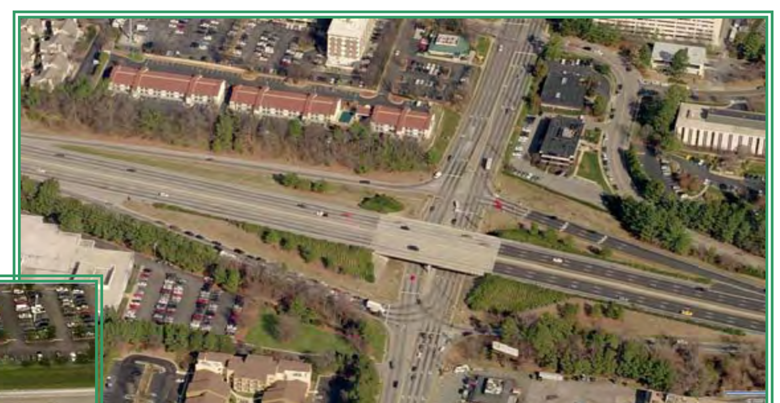


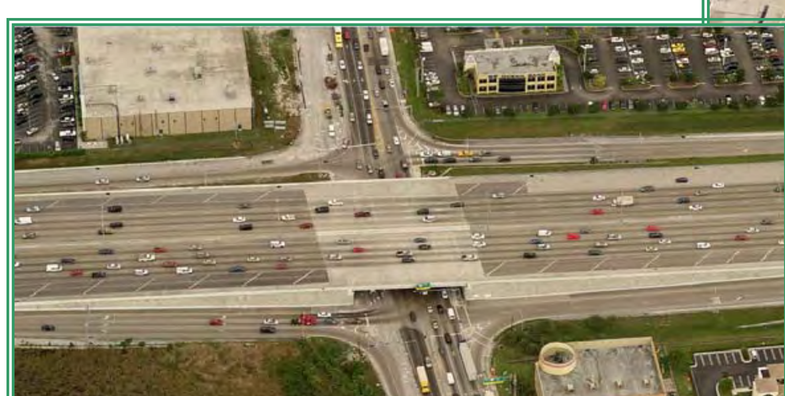
3.2.4.2 Compressed Diamond Interchange

The Compressed Diamond interchange configuration is a variation of the Simple Diamond interchange and is characterized by reducing the distance between where the ramps connect to the minor street from greater than 800 feet to a range of 400-800 feet. This configuration does not allow for the addition of future loop ramps and is best in rural areas where future traffic volumes are not likely to increase, such as in locations in sensitive watersheds or with natural features that limit future growth. This interchange configuration provides low-to-medium traffic capacity, has a low construction cost and requires a medium amount of land to construct. The following images show examples of Compressed Diamond interchanges.

3.2.4.3 Tight Urban Diamond Interchange

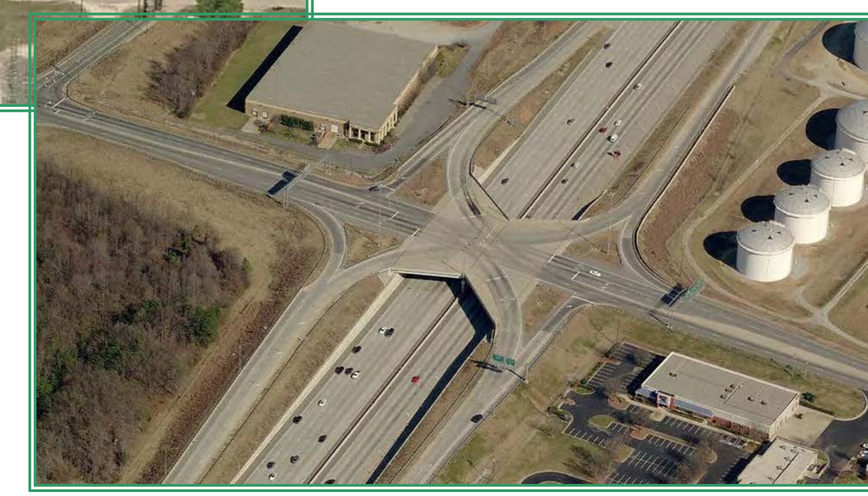
The Tight Urban Diamond Interchange (TUDI) is a further variation of the Simple and Compressed Diamond configurations that is typically only used in urban areas where there is substantial constraints on the property immediately adjacent to the intersection. The TUDI further reduces the distance between the ramp intersections to less than 400 feet, which typically requires that retaining walls be constructed between the ramps and the freeway. This interchange configuration provides medium-to-high traffic capacity, has a high construction cost and requires a low amount of land to construct. The following images show examples of TUDI interchanges.





3.2.4.4 Single Point Urban Interchange

The Single Point Urban Interchange (SPUI) is a variation of a TUDI that includes a single signal that controls all of the traffic at the interchange. The signal is located in the center of the intersection and controls three sets of movements. The first set of movements are the through movements along the minor street, the second set is for the left turn movements from the ramps to the minor street and the third set of movements is for the left turns from the minor street to the ramps. The turning movements at a SPUI pass through a single intersection, similar to a traditional intersection, therefore the turning movements overlap each other and can occur at the same time. The turning movements either occur on a butterfly shaped bridge above the freeway or below the freeway overpass. The right turn movements are usually controlled by yield signs with acceleration lanes where the ramp intersects the minor street, although some SPUI's include signals for the right turn traffic, which is detrimental to the overall traffic operations of the interchange. One of the main concerns with SPUI's is that the traffic signal does not include any protected movements where pedestrians can cross perpendicular to the minor street because the traffic flow is continuously flowing. This interchange configuration provides medium-to-high traffic capacity, has a high construction cost and requires a low amount of land to construct. The following images show examples of SPUI interchanges.



3.2.4.5 Partial Cloverleaf Interchange

The Partial Cloverleaf Interchange is an interchange configuration that includes adding at least one loop to a diamond interchange design. The partial cloverleaf interchange has several forms including configurations that place a pair of loop/ramp combinations in opposite quadrants of the interchange or on the same side of the minor street, which is common when there is a constraint such a river or railroad on one side of the minor street. A Partial Cloverleaf Interchange can either use a loop in place of a ramp or in addition to a ramp, allowing for less conflict on the minor street by eliminating some of the left turn movements. In general the traffic operations of a Partial Clover Interchange improve as additional loops are added without the removal of the ramps, thus providing for additional flexibility to accommodate future traffic demand. To preserve the traffic operations of a Partial Cloverleaf Interchange it is important that the design not include surface streets that connect opposite the location where the ramp and loop connect to the minor street as this configuration has a substantial negative effect on the traffic operations of the signal. This interchange configuration provides medium-to-high traffic capacity, has a medium construction cost and requires a medium amount of land to construct. The following images show examples of Partial Cloverleaf Interchanges.

3.2.4.6 Full Cloverleaf Interchange

The Full Cloverleaf Interchange is a further expansion of the Partial Cloverleaf configuration where a total of four ramps and four loops are included in the design, accommodating movements in all directions without making any left turns. The Full Cloverleaf Interchange can be very efficient and is sometimes used for freeway-to-freeway connections for lower volume freeways. The major downside to the Full Cloverleaf is that it includes a total of four weaving movements between each of the loops which can result in traffic safety and operation inefficiency. To improve the safety and operations of Full Cloverleaf interchanges a parallel roadway, called a Collector-Distributor (C-D) can be constructed that exits from the freeway in advance of the interchange, connects to all of the interchange ramps and loops, including the weaving section, and then merges back into the freeway. The C-D roadway redirects the turning movements and weaving movements away from the higher speed through traffic on the freeway, improving the safety and traffic operations of both facilities. This interchange configuration provides medium traffic capacity, has a medium construction cost and requires a high amount of land to construct. The following images show examples of Full Cloverleaf Interchanges.

3.2.4.7 Split Diamond Interchange

The Split Diamond Interchange concept builds off of the traditional diamond configurations; however instead of having ramps tie to a single minor street the Split Diamond has a pair of ramps to one minor street and a second pair of ramps on a parallel minor street with a pair of one-way roadways connecting the minor streets between the ramps. This configuration is beneficial where there are multiple major roadways crossing a freeway that are too close to each other to each have an interchange. The Split Diamond allows for access to these multiple minor street crossings and improves the overall traffic operations in the area by spreading out the traffic onto multiple minor streets instead of just one. This interchange configuration provides medium-to-high traffic capacity, has a medium construction cost and requires a medium amount of land to construct. The images at right show examples of Split Diamond Interchanges.

3.2.4.8 Roundabout Interchange

The Roundabout interchange concept has been used for many years and recently has re-emerged in several revised forms as interchange concepts that are both highly functional for traffic flow and aesthetic.

Rotary Roundabout Interchange

The traditional use of Roundabouts for interchanges included having a single large roundabout where the ramps tie to the minor street, typically with the freeway crossing over the roundabout. This configuration was commonly referred to as a Rotary Interchange and was found most often in Massachusetts and throughout New England. The primary concerns with the Rotary Interchange were that they required a very large footprint and extensive bridging along the freeway while only providing a low level of traffic operations due to the constraint on traffic capacity of the single-lane roundabouts. For these reasons the Rotary Interchange is typically not used in urban areas, with very few having been built in the past several decades, and many of the original interchanges being replaced by more common forms of interchanges such as diamonds and partial cloverleaf interchanges.

Modern Roundabout Interchange

The new form of Roundabout interchanges that have become exceeding popular in the past decade utilize a pair of smaller radius roundabouts at each point where the ramp intersects the minor street. The pair of roundabouts allow for good traffic operation and allow the minor street crossing of the freeway to occur on a single bridge. The bridge crossing of the freeway is typically narrower than for a traditional diamond interchange because the Roundabout Interchanges do not include left turn lanes. For this reason, the Roundabout Interchange has been a popular low-cost retrofit for diamond interchanges that have narrow two-lane bridges over the freeway, because they can vastly improve the traffic operations without reconstructing the bridge over the freeway. For higher volume right turn movements bypass lanes can be constructed such that the traffic does not enter the roundabouts, thus increasing the traffic capacity of the configuration.

Recently a more compressed form of Roundabout Interchange has emerged that combines the best features of the Rotary Interchange with the best features of the Modern Roundabout Interchange to form an extremely compact interchange design. The design is currently being implemented for the first time in Carmel, Indiana along Keystone Parkway. The concept is essentially to create a TUDI interchange with a single roundabout that has been compressed into a figure-eight configuration. The interchange concept allows for excellent traffic operations and in some locations includes a dual lane roundabout and right-turn bypass lanes resulting in traffic operations that are comparable to many diamond interchange configurations. The primary benefit of the concept is that they are much more aesthetic and pedestrian friendly than traditional interchanges and in the Carmel application resulted in substantially fewer property relocations. The Carmel application also lowered the major street through lanes below grade to minimize the effects of noise and to improve the aesthetics along the corridor.

3.2.4.9 Summary of Freeway Concepts

A summary of the freeway concepts discussed above is shown in Table 3.2 on the following page. Each of the nine freeway concepts are compared for the following attributes:

- Traffic Operations (evaluates the traffic operations of the concept based on overall interchange travel time)
- Bicyclist and Pedestrian (evaluates the ability of the concept to provide for safe and efficient mobility for bicyclist and pedestrians)
- Footprint (evaluates each concept based on the amount of land required to construct the concept)
- Construction Cost (evaluates each concept based on the likely cost to construct the concept)

The table provides a description of the potential benefits and potential limitations for each concept as well as a qualitative rating for how well it addresses each individual attribute. The qualitative rating system includes the following measures:

★★★★★	- Favorable
★★★★	- Slightly Favorable
★★★	- Average
★★	- Slightly Unfavorable
★	- Unfavorable

It should also be noted that these qualitative evaluations are for each individual attribute and that the weight of each of the attributes is not equal. Different individuals are likely to prioritize certain attributes higher than other individuals would. For example a property owner who walks to the grocery store may prioritize bicycle/pedestrian accommodations with much greater weight, while a commuter may prioritize traffic operations. The challenge in evaluating the concepts and developing a solution is that a balanced approach must be taken as no one concept is superior for all attributes. When applied to the US 64 corridor it is important that the individual context for each location be considered when evaluating the potential options.

Table 3.2: Freeway Concepts Summary

Interchange Type		Traffic Operations	Bicycle/Pedestrian	Footprint	Construction Cost
Simple Diamond		★★	★★★★★	★	★★★★
	Potential Benefits	Can be expanded with loops to improve traffic operations in the future	All pedestrian crossings can be made without conflicting with vehicles	None	Due to spread out configuration may allow for narrower bridges
	Potential Limitations	Bridges may not be setup to accommodate future expansion	None	Requires a very large area of land	None
Compressed Diamond		★★	★★★★★	★★	★★★★
	Potential Benefits	None	All pedestrian crossings can be made without conflicting with vehicles	None	None
	Potential Limitations	Cannot be expanded by adding loops and bridges may not accommodate future turn lanes	None	Requires a large area of land	None
Tight Urban Diamond		★★★★	★★★★★	★★★★★	★
	Potential Benefits	Traffic signals can be coordinated to allow traffic to flow more freely	All pedestrian crossings can be made without conflicting with vehicles	Can reduce impacts in areas where land prices are very high or where constraints exist	None
	Potential Limitations	Requires additional lanes outside of interchange to hold left turn traffic	None	None	Tight configuration requires wider bridges and retaining walls
Single Point Diamond		★★★★	★★	★★★★★	★
	Potential Benefits	Reduces the conflict between left turning traffic by overlapping movements	None	Can reduce impacts in areas where land prices are very high or where constraints exist	None
	Potential Limitations	If ramp traffic requires signal for right turn traffic operations can be affected	Crossing minor street cannot be done without stopping all traffic. Free flow turns may conflict with pedestrians and bicyclists	None	Tight configuration requires larger or longer bridges and retaining walls
Partial Cloverleaf		★★★★	★★★	★★★	★★★
	Potential Benefits	Adding additional loops and ramps can greatly improve traffic operations	Potential that pedestrian crossings can be made without conflicting with vehicles if loops aren't free flowing	Can convert ramps to loops and eliminate property acquisition in some quadrants of the interchange	None
	Potential Limitations	Adding minor street intersection opposite ramp connections can greatly reduce traffic capacity	Conflicts with pedestrians and bicyclists can occur if free flowing loops are included in the design	Adding additional ramps and loops will increase the property needed	None
Full Cloverleaf		★★★	★	★	★★★★
	Potential Benefits	Eliminates all left turn movements	None	None	Due to spread out configuration may allow for narrower bridges
	Potential Limitations	Creates four weaving sections between each set of loops that may negatively affect traffic operations	Problematic for pedestrians and bicyclists due to weaving section between loops and potential for free flowing ramps	High speed connections require larger radius ramps that increase the size of the interchange	Can be very costly if collector-distributor roadways are needed
Split Diamond		★★★★	★★★★★	★★	★★
	Potential Benefits	Allows for multiple high volume minor streets in close proximity to have access	All pedestrian crossings can be made without conflicting with vehicles	Provides improved access to more property	None
	Potential Limitations	The overall traffic capacity of the interchange is reduced because the ramps include through traffic movements	None	Requires land to construct roadway between ramps connecting minor streets between ramps	Requires additional roadways and more bridges and can include retaining walls if there are constraints adjacent to the freeway
Roundabout - Rotary		★★	★★★★	★★	★★★
	Potential Benefits	None	Accommodates pedestrians well for low volume roundabouts with low speeds	None	None
	Potential Limitations	The traffic operations are constrained by the roundabouts ability to handle the traffic volumes	Can increase pedestrian distance for larger radius roundabouts. Do not accommodate bicyclist as safely	Requires large footprint to accommodate larger radius roundabout	Larger radius roundabouts require either very long bridges along the freeway or multiple bridges for the roundabout
Roundabout - Modern		★★★	★★★	★★★★★	★
	Potential Benefits	Can include multilane roundabouts and bypass lanes for high right turn traffic	Accommodates pedestrians well for low volume roundabouts with low speeds	Can reduce impacts in areas where land prices are very high or where constraints exist	None
	Potential Limitations	May not be able to handle extremely high left turn volumes	Potential for conflicts with right turn bypass lanes and for visually impaired pedestrians. Do not accommodate bicyclist as safely	None	Tight configuration requires retaining walls and non standard bridge shapes

★★★★★ - Favorable ★★★★ - Slightly Favorable ★★★ - Average ★★ - Slightly Unfavorable ★ - Unfavorable

3.3 SHORT-TERM SOLUTION

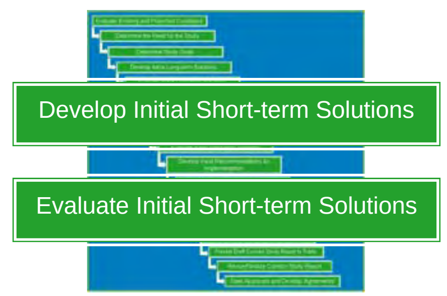
The short-term goal for the corridor is to enhance mobility, safety and pedestrian needs at the major intersections along US 64 at a minimal cost. The process used to determine the effectiveness of the potential signalized concepts described in Section 3.2.2 at addressing the short-term goal is described in this section along with the recommended short-term solutions resulting from that process. The long-term goal and recommended solutions are discussed in Section 3.4.

In the discussion of the short-term solution, the following terms are used:

- **Concept** – refers to a type of treatment at an intersection, like those described in Section 3.2 (e.g., superstreet).
- **Configuration** - one concept may have multiple designs or configurations (e.g., Superstreet with Direct Major Street Left Turns, Superstreet with Indirect Major Street Left Turns, etc.).
- **Solution** – refers to the application of a concept (and configuration) at a specific location (e.g., the application of the Superstreet with Major Street Left Turns is the solution at Edinburgh Drive). The solution recommended for each intersection is a part of the overall Short-term Solution.

3.3.1 Initial Evaluation of Short-term Concepts

The initial evaluation of short-term concepts was geared toward evaluating the potential signalized intersection concepts and selecting a short-term solution that would best meet the short-term goals established for the corridor. The discussion in this sub-section provides the results of the initial evaluation of the short-term concepts in general terms. A summary of the initial evaluation process is provided in Section 3.3.2 and intersection- and corridor-specific details are described in Section 3.3.4.



3.3.1.1 Traditional Intersection Treatments

The use of traditional intersection treatments was eliminated as a potential short-term solution because numerous signalized intersections along this corridor were already operating at an unacceptable level and the only means to improve the traffic operations if this concept was used would be to add additional through lanes along US 64. The cost of adding through lanes was not compatible with the short-term goal and would have impacts to adjacent communities due to the additional roadway width.

3.3.1.2 Superstreet

The Superstreet emerged as the preferred concept for treating intersections along the corridor with the Superstreet with Direct Major Street Left-turns being the configuration that was the most appropriate for urban corridors. The Superstreet with Indirect Major Street Left-turns was considered but was not chosen as a viable configuration due to concerns with roadways not having direct access off of US 64 and slightly reduced operations associated with routing the US 64 left turns through the median u-turn locations. The Superstreet with Direct Minor Street Left-turns was considered but was not determined to be a viable configuration as many of the intersections did not include high enough left-turn volumes to warrant this configuration, nor was there enough of a benefit to overcome the negative effect on the ability to coordinate the signals.

3.3.1.3 Median U-turn Crossover

The Median U-turn Crossover concept was given a great deal of consideration, particularly at a few of the higher volume intersections, because it allows for minor street through movements and traditional pedestrian crossing patterns. However, due to the irregular spacing of the minor streets associated with this concept, it would be difficult to coordinate the signals along the corridor and improve traffic flow substantially. Upon detailed discussion and evaluation by the Corridor Study Team, it was decided that the superior traffic operations associated with the superstreet concept outweighed the positives associated with the Median U-turn and it was eliminated as a potential short-term solution in the initial evaluation.

3.3.1.4 Quadrant Roadway

The Quadrant Roadway concept was evaluated for several intersections along the corridor; however, it was determined that the quadrant roadway was either not feasible or would not provide a substantial enough benefit to justify the expense and additional land required for construction. This concept was eliminated from further consideration as a short-term solution.

3.3.1.5 Quadrant Roadway with Grade Separation

The Quadrant Roadway with Grade Separation was eliminated for the same reasons as the standard Quadrant Roadway. There was only one location along the corridor where the concept would be feasible (Lake Pine Drive) and the Quadrant Interchange configuration was being proposed as the long-term solution.

3.3.1.6 Jughandle

The Jughandle was considered for the intersections along the corridor. Due to the development patterns along the corridor, the land required to construct the Jughandle ramps, and the more modest improvements in traffic operations as compared to the other potential options. It was determined that this concept was not viable and was eliminated.

3.3.1.7 Split Intersection

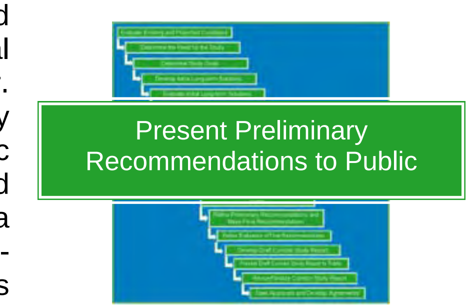
The Split Intersection concept was eliminated by the Corridor Study Team because it would have required a substantial amount of additional land to construct and is intended more for new roadways that will eventually be upgraded to an interchange. Because of the impacts associated with this concept and since this is not a new construction project, the Split Intersection was eliminated from further consideration.

3.3.1.8 Continuous Flow Intersection

The Continuous Flow Intersection concept was considered because of its substantial benefits to traffic operations. It was eliminated because it was determined by the Corridor Study Team to be unsightly, not matching with the context of the corridor and too confusing for drivers and pedestrians.

3.3.2 Initial Selection of Short-term Solutions

Based on the initial evaluation of short-term solutions, it was determined that the Superstreet with Direct Major Street Left-turns would be the initial preferred solution for each of the intersections along the US 64 corridor. The preliminary short-term solution design plans and traffic capacity analysis were then completed and the results were presented to the public at a second workshop on April 27-28, 2009. Based on comments received at the workshop and during the comment period following the workshop, a community meeting was held on July 16, 2009 to further discuss the long-term and short-term solutions for the corridor. Based on the comments from the workshop and community meeting, a list of public concerns with the short-term solutions was developed by the Corridor Study Team. The following list represents the major concerns with the Superstreet as a short-term solution from the public perspective:



- The Superstreet would not be safe, especially with requiring u-turns and weaving across traffic.
- Aesthetics along the corridor would be negatively affected by the Superstreet.
- The speed limit along US 64 is too high for superstreet design.
- The Superstreet would not preserve the community along the corridor and would divide the communities on the north and south side of the highway.

- Connectivity across US 64 would be negatively affected, especially to Apex Community Park.
- US 64 is a local road and should be treated more like a street and less like a highway by not giving the majority of the green time to the through traffic.
- The Superstreet would have negative effects on access to neighborhoods and businesses.
- The Superstreet would increase the response time for emergency access vehicles.
- The navigation of the Superstreet would be confusing and would not improve traffic flow for vehicles.
- The navigation of the Superstreet for bicyclists (especially advanced bicyclists) would be unsafe if they were required to make the u-turn movements with vehicular traffic.
- The Superstreet would have negative effects on traffic operations for the minor streets.
- The Superstreet would be unsafe for bicycle travel along US 64 due to the u-turn bulb-outs.
- The two-stage diagonal pedestrian crossing required at Superstreet intersections is unsafe.
- The Superstreet would have a negative affect on access to the library.
- The use of a Superstreet at Laura Duncan Road near Apex High School would impact the safety of students crossing US 64 since they would have to wait in the median during the two-stage crossing.
- The Superstreet would have a negative effect on school bus safety.

3.3.3 Further Detailed Evaluation of Short-term Concepts

Due to the public's concerns, the Corridor Study Team decided re-evaluate the corridor for both the short-term and long-term solutions. The Corridor Study Team decided that the corridor, while it functions as a system, has unique circumstances at different intersections and that, for this reason, a single concept and configuration cannot be used as the short-term solution along the entire corridor. Additionally, it was determined that some of the concerns with pedestrians and bicyclists may not be able to be accommodated to an acceptable level by a signalized intersection concept, such as those considered for the short-term solution, and that expressway options may be the best way to address the concerns. The Corridor Study Team decided that, if a viable short-term solution was not available, the intersection would be prioritized for an upgrade to a long-term solution that could better address the needs without spending money on a short-term solution that would not provide adequate benefits.

Based on the re-evaluation of the signalized intersection concepts, three concepts emerged as strong candidates to address the public's concerns to the greatest extent possible and provide for a short-term solution that addresses the goals for the corridor. Additionally, long-term concepts such as interchanges would be evaluated if none of the three concepts were determined to be adequate. The three signalized intersection concepts and a summary of the potential benefits and limitations of each is presented in the following section.

Superstreet with Direct Major Street Left-turns

This was the configuration originally selected for the corridor and was retained because of the benefits to traffic operations that it provides. The concept has been shown to be a safe design for vehicles and accommodates pedestrians without conflicts with turning vehicles. The main concerns were shown above in Section 3.3.2.

Superstreet with Indirect Major Street Left-turns

This configuration was selected as a potential short-term solution because it would provide, in addition to the benefits of the Superstreet with Direct Major Street Left-turns, a more aesthetic facility and would provide an improved refuge for pedestrian and bicycle crossing of US 64 due to the full median. The potential drawbacks of this configuration are that it cannot process as much traffic as the Superstreet with Direct Major Street Left-turns, it is more restrictive on access to neighborhoods and businesses, it may increase emergency response times and it has the same effects on the minor street traffic flow.

Median U-turn Crossover

This concept was selected as a potential short-term solution because it would provide benefits such as good traffic operations, straight across access from minor streets and a standard pedestrian and bicycle crossing pattern. The potential drawbacks of this concept are that it cannot process as much traffic as a Superstreet due to the limited ability to coordinate signals in both directions, it has the perception of reducing access to neighborhoods and businesses, it disrupts driver expectations if left-turns are allowed elsewhere along the corridor and it can be difficult to enforce the left turn prohibitions.

3.3.4 Short-term Solution Corridor Evaluation

The Corridor Study Team evaluated the US 64 corridor on an intersection-by intersection basis to determine the most appropriate short-term solution at each location. For each location the unique circumstances and context of the intersection were evaluated and a preferred solution was selected. The evaluation only included the major intersections along the corridor and did not include an evaluation of all of the existing median openings along the corridor. The feasibility of maintaining the minor roadway connections and median openings along the corridor would need to be evaluated further. If a pattern of accidents or operational problems emerges in the future, these locations may be modified or closed following a more thorough study and public involvement process.

Firefox Trace

The intersection of US 64 and Firefox Trace is a low volume intersection west of the Haw River and is the only access point along US 64 between the US 64 Bypass of Pittsboro and the Haw River. There is minimal pedestrian traffic at this location and most bicycle traffic would be along US 64. For these reasons the preferred solution for this intersection was determined to be an unsignalized Superstreet with Direct Major Street Left-turns.

Mt. Gilead Church Road/North Pea Ridge Road

The intersection of US 64 and Mount Gilead Church Road/North Pea Ridge Road is an existing, signalized intersection between the Haw River and Jordan Lake. There is minimal pedestrian traffic at this location and most bicycle traffic would be along US 64. For these reasons the preferred solution for this intersection was determined to be a signalized Superstreet with Direct Major Street Left-turns.

Big Woods Road/Seaforth Road

The intersection of US 64 and Big Woods Road/Seaforth Road is an existing, unsignalized intersection,between the Haw River and Jordan Lake. There is minimal pedestrian traffic at this location and most bicycle traffic would be along US 64, although a future county park is planned along Big Woods Road, north of US 64. The preferred solution for this intersection was determined to be a signalized Superstreet with Direct Major Street Left-turns that may be able to be designed such that nearly perpendicular pedestrian crossings are included due to the skew of the intersection.

Farrington Road/Beaver Creek Road

The intersection of US 64 and Farrington Road/Beaver Creek Road is an existing signalized intersection slightly east of Jordan Lake. There is minimal pedestrian traffic at this location and most bicycle traffic would be along US 64. For these reasons the preferred solution for this intersection was determined to be a signalized Superstreet with Direct Major Street Left-turns.

NC 751/New Hill Road

The intersection of US 64 and NC 751/New Hill Road is an existing signalized intersection with minimal pedestrian or bicycle traffic. The preferred solution for this intersection was determined to be a signalized Superstreet with Direct Major Street Left-turns that may be able to be designed such that nearly perpendicular pedestrian and bicycle crossings are included due to the skew of the intersection.

Jenks Road

The intersection of US 64 and Jenks Road is an existing unsignalized three-leg intersection in an area that is beginning to transition into a more suburban area and includes a future extension to the south of US 64. There currently is minimal pedestrian traffic at this location; however, it is likely that pedestrian traffic will increase as the area becomes more developed. The preferred solution for this intersection was determined to be a signalized Superstreet with Direct Major Street Left-turns that may be able to be designed such that nearly perpendicular pedestrian and bicycle crossings are included when the roadway is extended south of US 64 due to the skew of the existing intersection.

Kellyridge Road

The intersection of US 64 and Kellyridge Road is an existing unsignalized three-leg intersection that provides access to the Abbington Subdivision. The existing intersection is approximately 800 feet west of the future quadrant interchange at Kelly Road that will be constructed as a part of the NC 540 Triangle Expressway project. The preferred solution at this location is to convert the full movement intersection to a left-in/right-in/right-out intersection that would only allow right turns onto and off of Kellyridge Road and the left turn onto Kellyridge Road from US 64 westbound. This solution would eliminate the left turn movement from Kellyridge Road to US 64 westbound due to the safety concerns resulting from the close proximity to the Kelly Road entrance ramp. The left turn movement would be provided at the Kelly Road quadrant interchange and there currently is direct access between the Abbington Subdivision and Kelly Road. The elimination of the left-turn out of Kellyridge will likely reduce the amount of cut through traffic in the Abbington Subdivision which was a concern raised at the public workshops.

Kelly Road

The intersection of US 64 and Kelly Road is an existing unsignalized intersection with major street direct left-turn movements allowed. The intersection will be upgraded to a quadrant interchange by the North Carolina Turnpike Authority as a part of the NC 540 Triangle Expressway project with Kelly Road being built over US 64 with ramps connecting the roadways on the west side of Kelly Road. The short-term solution does not include any changes to the planned configuration.

Green Level Church Road

The intersection of US 64 and Green Level Church Road is an existing signalized three-leg intersection. The intersection will be converted to a right-in/right-out configuration by the North Carolina Turnpike Authority as a part of the NC 540 Triangle Expressway project. The short-term solution does not include any changes to the planned configuration.

NC 55 Interchange

The existing US 64 interchange with NC 55 does not include any changes under the short-term solution.

Fern Valley Lane

The intersection of US 64 and Fern Valley Lane was recently converted to a right-in/right-out intersection with a major street direct left-turn. The short-term solution does not include any changes to this configuration.

Davis Drive/North Salem Street Interchange

The US 64 interchange with Davis Drive/North Salem Street does not include any changes under the short-term solution.

Laura Duncan Road

The intersection of US 64 and Laura Duncan Road is an existing signalized intersection and includes the only marked pedestrian crossing of US 64 within the study area. The main concern at this location is the safety of pedestrians and bicyclists due to the close proximity to Apex High School. Four short-term concepts were evaluated for this location and the potential benefits and drawbacks are summarized as follows:

- Superstreet with Direct Major Street Left-turns – The potential safety issues for pedestrian and bicyclists associated with this configuration were of major concern. After discussion, the Corridor Study Team determined that this configuration was not reasonable at this location.

- Superstreet with Indirect Major Street Left-turns – This configuration would provide for improved safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median; however it would still require a two-stage crossing. This configuration would also provide for additional green space and would be more aesthetically pleasing than the option with direct major street left-turns. The traffic operations would also be substantially reduced due to the large number of left-turning vehicles for US 64 to Laura Duncan Road that would be required to use the downstream median U-turn lanes. Additionally, there would not be any cross access across Laura Duncan Road and the need for a specialized pedestrian crossing would eliminate many of the benefits gained in being able to coordinate the signals. Based on discussion the Corridor Study Team determined that this configuration was not reasonable at this location.

- Median U-turn Crossover – This configuration would also provide for improved safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median; however, it would still require a two-stage crossing to provide for adequate traffic operations. This configuration would also allow for Laura Duncan Road through movements and connectivity across US 64 to the Apex Community Park. The traffic operations would be substantially reduced due to the large number of left-turning vehicles for US 64 to Laura Duncan Road that would be required to use the downstream median U-turn lanes. Additionally, there were concerns with compliance to the left-turn restriction, especially with young drivers at the high school. Based on discussion the Corridor Study Team determined that this configuration was not reasonable at this location.

- Pedestrian Bridge/Tunnel – This concept was evaluated but determined to be the best solution due to the cost and that it would need to be removed once an interchange is implemented.

Therefore, it was determined that none of the potential short-term solutions would provide acceptable traffic operations and overcome the concerns voiced by the public. The Corridor Study Team decided that the Laura Duncan Road intersection would not include a “true” short-term solution (a lower cost interim measure) and that a long-term solution providing an interchange would be prioritized to a level that would allow for the ability to safely move vehicular, pedestrian and bicycle traffic while providing connectivity across US 64 between the high school and Apex Community Park. The description of what will be included for this intersection is covered in detail under the Long-term solution discussion in Section 3.4.5.

Knollwood Drive

The intersection of US 64 and Knollwood Drive is an existing unsignalized three-leg intersection. The preferred solution at this location was determined to be a left-in/right-in/right-out intersection. However, due to the close proximity to Lake Pine Drive and the public's desire to maintain the aesthetics and minimize the amount of construction, the U-turn movement to US 64 westbound is not included immediately downstream of the Knollwood Drive intersection and the U-turn movements would have to occur as a part of the Lake Pine Drive intersection. Because this location is a three-leg intersection; the Superstreet with Indirect Major Street Left-turns is not reasonable as it would move the left turn from US 64 to a U-turn movement which would serve the same traffic, requiring the same amount of construction and potentially adding an additional signal. The Median U-turn concept is not feasible at this location because of the three-leg configuration.

Lake Pine Drive

The intersection of US 64 and Lake Pine Drive is an existing signalized intersection. The main concerns at this location are the safety of pedestrians and bicyclists due to the close proximity to Apex Community Park, the perception that there is a very high volume of through traffic at this location, and the desire to provide good access to the library. Three short-term concepts were evaluated for this location and the potential benefits and limitations are summarized as follows:

- Superstreet with Direct Major Street Left-turns – The potential safety issues for pedestrian and bicyclists associated with this configuration were of major concern as well as the inability to provide for cross access. Based on discussion the Corridor Study Team determined that this configuration was not reasonable at this location.

- Superstreet with Indirect Major Street Left-turns – This configuration would improve safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median, provide additional green space, and be more aesthetically pleasing than the option with direct major street left-turns. The traffic operations would be substantially reduced due to the large number of left-turning vehicles for US 64 to Lake Pine Drive that would be required to use the downstream median U-turn lanes. Additionally, there would not be any cross access across Lake Pine Drive. Based on discussion, the Corridor Study Team determined that this configuration was not reasonable at this location.

- Median U-turn Crossover – This concept would also improve safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median; however, it would still require a two-stage pedestrian crossing to provide for adequate traffic operations. This concept would also allow for Lake Pine Drive through movements and connectivity across US 64 to the Apex Community Park and facilitate access to the library. The traffic operations would be reduced due to the large number of left-turning vehicles for US 64 to Lake Pine Drive that would be required to use the downstream median U-turn lanes and the reduced ability to coordinate the signals along the corridor. Based on discussion, the Corridor Study Team determined that this was the best concept for this location because it would provide cross access and improved ability to accommodate pedestrians and bicyclists.

In addition to the Lake Pine Drive intersection design, a signalized pedestrian crossing is included in the plan slightly west of the U-turn movement located west of Lake Pine Drive. This location will improve pedestrian access to the library and to Apex Community Park. The development of the plans for the pedestrian connections to this crossing will be undertaken by the Town of Apex Planning Department.

Autopark Boulevard

The intersection of US 64 and Autopark Boulevard is an existing unsignalized three-leg intersection. The preferred solution at this location was determined to be a Superstreet with Direct Major Street Left-turn. However, due to the close proximity to Mackenan Drive/Chalon Drive intersection, and the public's desire to maintain the aesthetics and minimize the amount of construction, the U-turn movement to US 64 westbound is not included immediately downstream of the Autopark Boulevard intersection and the U-turn movements would have to occur as a part of the Mackenan Drive/Chalon Drive intersection. Because this location is a three-leg intersection the Superstreet with Indirect Major Street Left-turns configuration is not reasonable because it would move the left turn from US 64 to a U-turn movement which would serve the same traffic, requiring the same amount of construction and potentially adding an additional signal. The Median U-turn design is not feasible at this location because of the three-leg configuration.

Mackenan Drive/Chalon Drive

The intersection of US 64 and Mackenan Drive/Chalon Drive is an existing signalized intersection. The main concern at this location is the safety of pedestrians and bicyclists and the aesthetics and connectivity related to the residential neighborhoods in the area. Three short-term concepts were evaluated for this location and the potential benefits and drawbacks are summarized as follows:

- Superstreet with Direct Major Street Left-turns – The potential safety issues for pedestrian and bicyclists associated with this configuration were of concern as well as the inability to provide for cross access. The roadway also serves as a connection to the businesses along Mackenan Drive. Based on discussion, the Corridor Study Team determined that this was the most reasonable solution at this location because it balanced the access to and from both the residential area to the north of US 64 and the commercial area to the south of US 64.

- Superstreet with Indirect Major Street Left-turns – This configuration would improve safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median, would provide for additional green space and would be more aesthetically pleasing than the option with direct major street left-turns. The traffic operations would be slightly reduced due to left-turning vehicles for US 64 to Lake Pine Drive that would be required to use the downstream median U-turn lanes. Additionally, there would not be any cross access between Mackenan Drive and Chalon Drive and there would be reduced access to the roadways because they would operate as right-in/right-out intersections. Based on discussion, the Corridor Study Team determined that this configuration was acceptable, but not the best configuration for this location because it would have too substantial a negative affect on the businesses along Mackenan Drive that rely on more direct access.

- Median U-turn Crossover – This concept would also improve safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median; however, it would still require a two-stage crossing to provide for adequate traffic operations. This configuration would also allow for through movements between Mackenan Drive and Chalon Drive, which is a relatively small movement. The traffic operations would be reduced slightly due to the left-turning vehicles for US 64 to Mackenan Drive/Chalon Drive that would be required to use the downstream median U-turn lanes. Based on discussion, the Corridor Study Team determined that this configuration was not reasonable at this location because the major benefit of providing cross access for vehicles is a very minor movement at this location.

In addition to the Mackenan Drive/Chalon Drive intersection design, a signalized pedestrian crossing is included in the plan slightly west of the U-turn movement located west of Mackenan Drive/Chalon Drive. This location will provide improved pedestrian access to Apex Community Park and will be the location where the future Swift Creek Greenway will cross US 64. The development of the plans for the pedestrian connections to this crossing will be undertaken by the Town of Cary Parks and Recreation Department.

Gregson Drive

The intersection of US 64 and Gregson Drive is an existing signalized three-leg intersection. The primary concerns at this location are providing adequate access to the businesses on the south side of US 64 in a convenient manner. Three short-term concepts were evaluated for this location and the potential benefits and drawbacks are summarized as follows:

- Superstreet with Direct Major Street Left-turns – The potential safety issues for pedestrian and bicyclists associated with this configuration were of minor concern because there is not a roadway on the north side of US 64 to cross to and this configuration would provide the best access for businesses on the south side of US 64. Based on discussion, the Corridor Study Team determined that this configuration was the best solution at this location because it provided the best access and traffic operations and little concern related to pedestrian crossings.

- Superstreet with Indirect Major Street Left-turns – This configuration would improve safety for pedestrians and bicyclists by providing additional pedestrian refuge areas in the median; however, without a roadway on the north side of US 64 this is not likely to be a likely location for pedestrian crossings. The traffic operations would be substantially reduced due to left-turning vehicles for US 64 to Gregson Drive that would be required to use the downstream median U-turn lanes. Additionally, there would a reduction in direct access to the businesses along Gregson Drive due to requiring the U-turn movements. Based on discussion, the Corridor Study Team determined that this configuration was not reasonable at this location.

- Median U-turn Crossover – This concept would not be applicable at this location because there is no minor street through movements at a three-leg intersection.

Edinburgh Drive

The intersection of US 64 and Edinburgh Drive is an existing signalized four-leg intersection with residential neighborhoods north of US 64 and commercial and office use to the south of US 64. The main concern at this location is the safety of pedestrians and bicyclists, the aesthetics and connectivity related to the residential neighborhoods north of US 64, and providing suitable access to the businesses south of US 64. Three short-term concepts were evaluated for this location and the potential benefits and limitations are summarized as follows:

- Superstreet with Direct Major Street Left-turns – The potential safety issues for pedestrian and bicyclists associated with this configuration were of concern as well as the inability to provide cross access. This configuration does provide for good access to both the residential area to the north of US 64 and the commercial area to the south of US 64. Based on discussion, the Corridor Study Team determined that this configuration was the best solution for this location due to the high left turn volumes into the office park.

- Superstreet with Indirect Major Street Left-turns – This configuration is not feasible from a design standpoint because it would require a U-turn intersection east of the Edinburgh Drive intersection. The U-turn crossover is not feasible because the distance between the US 1 interchange ramps and Edinburgh Drive is approximately 1000 feet. This distance is not adequate for providing a U-turn movement due to the conflicts it would create for the signalized intersections at the US 1 ramps to US 64; therefore this configuration was eliminated.

- Median U-turn Crossover – This concept would also require a U-turn intersection east of the Edinburgh Drive intersection; therefore, for the same reasons as the Superstreet with Indirect Major Street left-turns, this configuration was eliminated.

3.3.5 Determination of Final Draft Short-term Solution Recommendations

The results of the short-term corridor evaluation for the intersections within Wake County were presented to a select group of stakeholders for review and comment at the stakeholder meeting held on October 22, 2009. Comments on the short-term solutions included the following:

- Implement the recommended design at Laura Duncan Road and Lake Pine Drive
- Ensure improved pedestrian walkability for crossing US 64, especially to businesses
- Do not focus on through mobility at the expense of local access
- Maintain medians for safety and aesthetics
- Re-open Fern Valley Lane access point as full movement intersection
- Add additional through lanes to US 64 in the median from Autopark Boulevard to US 1 and maintain traditional intersections instead of a superstreet
- Do not implement the superstreet at Edinburgh Drive
- Lower speed limit to 45 miles per hour east of railroad bridges
- Hold off implementing Superstreet as long as possible
- Address safety at Laura Duncan now
- Make Gregson a superstreet with indirect left turns to minimize pavement
- Consider a pedestrian bridge at Apex High School
- Consider the superstreet and aesthetics as it relates to community feel and look
- Abandon short-term solutions (as there is not need) except at Laura Duncan and Lake Pine
- Hold-off on doing anything from US 1 to east of Lake Pine until NC 540 and the additional lane on US 64 are in place and operating so that effects can be measured
- Safety is more important than mobility and should be the primary concern
- Look at parallel routes to US 64 and improve them to increase safety
- Sign US 64 along US 1 and NC 540 and convert existing roadway to US 64 Business/Tryon Road
- Lower speed limit to 45 miles per hour east of Kellyridge Roadandinclude design features that signal to the driver that the context of the corridor has changed
- Delay the conversion of Kellyridge Road to right-in/right-out and consider a signal due to access concerns
- Purchase land in southeast quadrant of Laura Duncan intersection and see if it could be used to improve the intersection
- Take immediate measures to improve safety at the Laura Duncan Road pedestrian crossing

Based on the comments and discussion at the stakeholder meeting, the Corridor Study Team met and developed the Draft Final Recommendations for the Short-term Solution. The only design change to the short-term solutions that were recommended prior to the stakeholder meeting was to combine the u-turn to eastbound US 64 for Mackenan Drive/Chalon Drive with the direct left turn to Autopark Boulevard. This design change will provide more green space in the median, but will result in a slightly longer travel distance for drivers utilizing the u-turn.

The short-term solution at Laura Duncan Road was also discussed and the Corridor Study Team agreed that the short-term and long-term solution should be the tight interchange, but also decided that if development in the area occurs prior to the implementation of the interchange, that making a private entity pay for the interchange would be difficult. If development in the vicinity of Laura Duncan Road would cause a negative effect to traffic operations, the Corridor Study Team agreed that construction of a Median U-turn Crossover by a private developer would be an adequate means of mitigating the effects. The Median U-turn Crossover concept may also help facilitate the construction of the future interchange. The design of the Median U-turn Crossover for this location is included in Appendix D.

3.3.5.1 Summary of Final Draft Short-term Solution Recommendations

A summary of the Final Draft Short-term Solution Recommendations is included in Table 3.3.

Table 3.3: Final Draft Short-term Solution Recommendations

Intersection/Interchange	Final Draft Short-term Solution
Firefox Trace	Superstreet with Direct Major Street Left Turn
Mt. Gilead Church/Pea Ridge Road	Superstreet with Direct Major Street Left Turn
Big Woods/Seaforth Road	Superstreet with Direct Major Street Left Turn
Farrington/Beaver Creek Road	Superstreet with Direct Major Street Left Turn
NC 751/New Hill Road	Superstreet with Direct Major Street Left Turn
Jenks Road	Superstreet with Direct Major Street Left Turn
Kellyridge Road	Left-in/Right-in/Right-out
Kelly Road	No change from configuration constructed as part of NC 540 project
NC 540	No change from configuration constructed as part of NC 540 project
Green Level Church Road	No change from configuration constructed as part of NC 540 project
NC 55	No change from existing configuration
Fern Valley Lane	No change from existing configuration
Davis Drive	No change from existing configuration
Laura Duncan Road	Tight Interchange (Modern Roundabout Configuration Preferred) as long-term solution that will be implemented as soon as possible. Note: Interim solution may include Median U-turn Crossover if privately funded
Knollwood Drive	Left-in/Right-in/Right-out
Lake Pine Drive	Median U-turn Crossover
Autopark Boulevard	Left-in/Right-in/Right-out
Mackenan/Chalon	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Gregson Drive	Superstreet with Direct Major Street Left Turn
Edinburgh Drive	Superstreet with Direct Major Street Left Turn
US 1 Interchange	No change from existing configuration

The detailed design of the Final Draft Short-term Solution Recommendations is presented in Section 3.5.

In addition to the detailed recommendations on the design of the short-term solution, recommendations are being made for the corridor by the Corridor Study Team and are included in Section 4.2.4.

3.3.6 Short-term Solution Traffic Volumes and Traffic Operations

The goal of the Short-term Solution is to improve traffic operations along the corridor and extend the lifespan of the existing corridor until the long-term solutions are needed and can be implemented. Based on this, the goal of the short-term solutions is to provide for adequate traffic operations until the year 2025.

3.3.6.1 Future Traffic Volume Projections

The determination of the future traffic volumes for 2025 are based on interpolating the traffic volumes for the 2007 existing conditions and 2035 no-build traffic developed in Section 2.3.2. A summary of the 2025 Short-term Solution traffic volumes for each of the major roadways along the corridor is shown in Figure 3.1. As noted previously, one of the main factors affecting the traffic operations along the corridor is the high volume of left turns (especially from the minor streets) at many of the intersections. Table 3.4 shows several of the major intersections along the corridor and the percentage of the volumes at the intersection that are making left turns.

Table 3.4: Percent of Vehicles Making Left Turns

Intersection	Intersection Approach	Percent of Vehicles Making Left Turns
US 64 at Farrington Road/Beaver Creek Road	US 64 Eastbound	5.0%
	US 64 Westbound	6.7%
	Beaver Creek Road Northbound	19.4%
	Farrington Road Southbound	59.6%
US 64 at Jenks Road	US 64 Eastbound	23.3%
	Jenks Road Southbound	50.0%
US 64 at Laura Duncan Road	US 64 Eastbound	13.7%
	US 64 Westbound	5.5%
	Laura Duncan Road Northbound	35.7%
	Laura Duncan Road Southbound	32.8%
US 64 at Lake Pine Drive	US 64 Eastbound	11.8%
	US 64 Westbound	9.0%
	Lake Pine Drive Northbound	11.1%
	Lake Pine Drive Southbound	40.0%
US 64 at Gregson Drive	US 64 Westbound	18.7%
	Gregson Drive Northbound	34.5%
US 64 at Edinburgh Drive	US 64 Eastbound	1.6%
	US 64 Westbound	13.5%
	Edinburgh Drive Northbound	21.0%
	Edinburgh Drive Southbound	58.8%

Figure 3.1: 2025 Short-term Solution Daily Traffic Volumes

LEGEND

2025 Short-term Solution Daily Traffic Volumes

Short-term Design

2025

2025 Short-term Solution

Daily Traffic Volumes

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3.3.6.2 Short-term Solution Level of Service

The LOS for the major intersections along the corridor was evaluated based on the 2025 traffic volumes for the Short-term Solution design. A summary of the LOS for each intersection is included in Table 3.5 and shown on Figure 3.2.

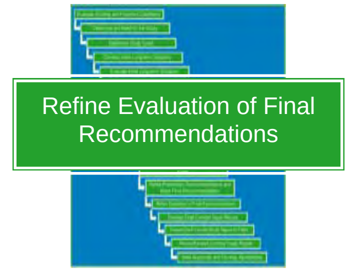

Table 3.5: 2025 Short-term Solution Level of Service Analysis

Signalized Intersections	Signal Location	2025 AM/PM Peak Hour LOS
US 64 at Mt. Gilead Church Road/N. Pea Ridge Road	US 64 U-turn East of Mt. Gilead Church Road[1]	C/C
	US 64 U-turn West of Mt. Gilead Church Road	B/B
	US 64 Eastbound at Mt. Gilead Church Road	B/A
	US 64 Westbound at Mt. Gilead Church Road	B/B
US 64 at Big Woods Road/Seaforth Road	US 64 U-turn East of Big Woods Road	A/A
	US 64 U-turn West of Big Woods Road	B/B
	US 64 Eastbound at Big Woods Road	A/A
	US 64 Westbound at Big Woods Road	C/C
US 64 at Farrington Road	US 64 U-turn East of Farrington Road	C/B
	US 64 U-turn West of Farrington Road	B/B
	US 64 Eastbound at Farrington Road	C/B
	US 64 Westbound at Farrington Road	B/C
US 64 at NC 751/New Hill Road	US 64 U-turn East of NC 751	C/B
	US 64 U-turn West of NC 751	C/C
	US 64 Eastbound at NC 751	C/B
	US 64 Westbound at NC 751	C/D
US 64 at Jenks Road	US 64 U-turn West of Jenks Road	C/C
	US 64 Westbound at Jenks Road	D/D
US 64 at Lake Pine Drive	US 64 U-turn East of Lake Pine Drive	B/E
	US 64 U-turn West of Lake Pine Drive	D/F
	US 64 at Lake Pine Drive	F/F
US 64 at Mackenan Drive/Chalon Drive	US 64 U-turn East of Chalon Drive	A/C
	US 64 U-turn West of Chalon Drive(at Autopark Blvd.)	C/A
	US 64 Eastbound at Chalon Drive	F/E
	US 64 Westbound at Chalon Drive	B/C
US 64 at Gregson Drive	US 64 U-turn East of Gregson Drive	B/F
	US 64 Eastbound at Gregson Drive	F/D
US 64 at Edinburgh Drive	US 64 U-turn West of Edinburgh Drive	A/E
	US 64 Eastbound at Edinburgh Drive	F/F
	US 64 Westbound at Edinburgh Drive	D/F
Signalized Intersections	**Signal Location**	**2025 AM/PM Peak Hour LOS**
US 64 at US 1 Southbound Ramps	US 64 Eastbound at US 1 SB Ramp	C/F
	US 64 Westbound at US 1 SB Ramp	F/E
Unsignalized Intersections	**Turn Location**	**2025 AM/PM Peak Hour LOS**
US 64 at Firefox Trace	US 64 U-turn East of Firefox Trace	C/C
	US 64 U-turn West of Firefox Trace	C/C
	US 64 Eastbound at Firefox Trace	F/F
	US 64 Westbound at Firefox Trace	E/F
US 64 at Kellyridge Road		F/F
US 64 at Knollwood Drive		F/F
US 64 at Shepherds Vineyard Drive		F/F

Notes: 1 – This intersection operates acceptably as an unsignalized intersection

The analysis indicates that 11 of the 32 signalized intersections and 5 of the 7 unsignalized are projected to be operating at an unacceptable LOS E or F in 2025. For those intersections operating at LOS E or F, upgrading to the long-term solutions should be considered. The timeframe for implementation for the short-term and long-term solutions is included in Chapter 4.

An additional measure to show the traffic operations along the corridor is through the use of travel time. Table 3.6 shows the approximate travel time for the 19-mile US 64 corridor from the US 64 Bypass west of Pittsboro to the US 1 interchange in Cary for each direction of US 64 in the AM and PM peak periods.

Table 3.6: 2025 Short-term Solution Travel Time Summary

Roadway	2025 Short-term AM/PM Travel Time
US 64 Eastbound	39 minutes/31 minutes
US 64 Westbound	28 minutes/36 minutes

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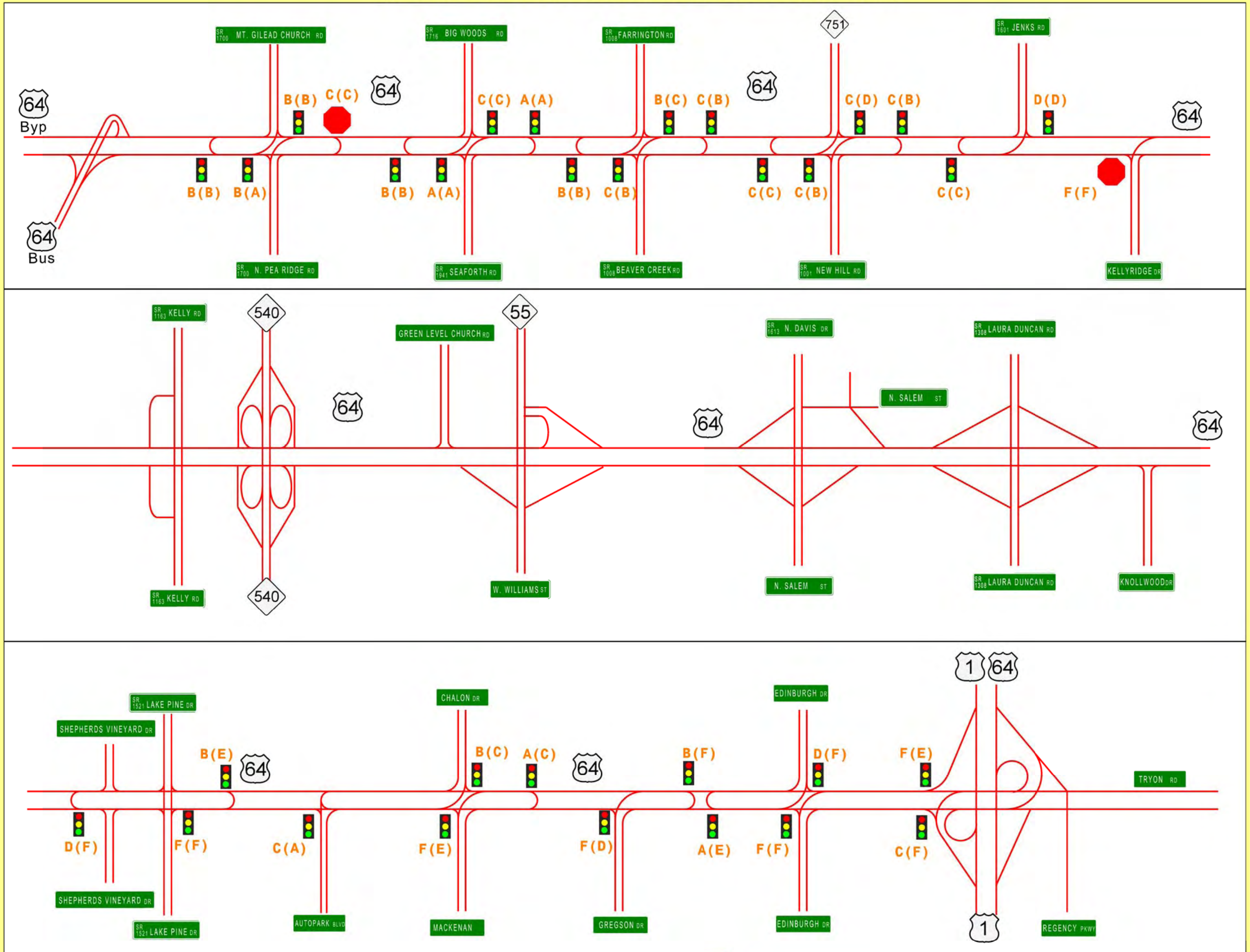
Figure 3.2: 2025 Short-term Solution Level of Service Summary



LEGEND

Unsignalized Intersection

Signalized Intersection

C(C) Level of Service - AM(PM)

Short-term Solution
2025 Build

Level of Service

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3.3.7 Short-term Solution Concerns and Unresolved Issues

The concerns the public voiced about the initial short-term solution have been considered and accommodated in the recommended short-term solution to the greatest extent possible. It is understood that not all comments and concerns could be completely addressed by the design. At each intersection, the Corridor Study Team attempted to balance the effects to provide a solution that would best address the goals for the corridor and the public's concerns.

There were still some concerns that remain unresolved with regard to the short-term solution and will require additional analysis. The additional analysis of the following concerns is needed prior to implementing the short-term solutions but is considered outside the scope of this study.

- There is a need to determine a safe method of travel for advanced bicyclists at the superstreet intersections. It is understood that advanced bicyclists do not desire to dismount their bicycle and act as pedestrians at the superstreet intersection, which is the preferred method for crossing at a superstreet intersection. There needs to be additional evaluation of the superstreet concept to determine how to best allow bicyclists to act as vehicles and navigate the intersection in a safe manner.

- There is a need to determine a safe method for crossing a superstreet intersection where it is likely that the enforcement of the pedestrian crossing pattern will not be properly adhered to. This is of concern at locations in the vicinity of schools where students have exhibited crossing patterns that are in violation of the accepted crossing pattern.

3.4 LONG-TERM SOLUTION

The goal of the long-term solution for the corridor is to enhance mobility, safety and pedestrian accessibility along US 64 for the design year 2035. The process used to select a recommended long-term solution is described in this section.

The following terms are used in the discussion of the long-term solution:
- **Concept** – refers to the different types of freeways and expressways described in Section 3.2.3 and 3.2.4.
- **Scenario** – Five different general combinations of the freeway and expressway concepts were initially evaluated. These combinations were described as Scenarios A, B, C, D and E.
- **Initial Long-term Concept** – Scenarios A, B, C, D and E are also referred to as Initial Long-term Concepts.
- **Alternative** – Three of the initial scenarios were included in a more detailed preliminary study. The scenarios carried forward are called Alternative 1, 2 and 3.
- **Preliminary Long-term Solution** – is the label given to Alternatives 1, 2 and 3.
- **Preliminary Recommended Long-term Solution** - As the study progressed, elements of these three alternatives were combined to create Alternative 4, also known as the "Preliminary Recommended Long-term Solution.
- **Recommended Draft Long-term Solution** – Following further comment and consideration the alternatives and concepts were re-evaluated. The resulting recommendation from that analysis is referred to as the Draft Recommended Long-term Solution.
- **Final Draft Recommended Long-term Solution**– The Recommended Draft Long-term Solution was presented in a stakeholder meeting. One change was made and the resulting solution is called the Final Draft Recommended Long-term Solution. This solution is the ultimate recommendation included in this report which the public will have the opportunity to review.
- **Recommended Long-term Solution** – will be the title given to the solution resulting from the public review of this report.

3.4.1 Evaluation of Initial Long-term Concepts

The first step in developing the long-term solution was to develop general concepts for the corridor. These general concepts were evaluated for their potential to meet the goals for the corridor and did not include an evaluation of detailed design elements, such as the interchange configuration or detailed location of service roads. The initial evaluation of the corridor included evaluating the corridor based on the results of the *US 64 Corridor Phase I Report* which recommended a freeway from the US 64 Pittsboro Bypass to west of Jordan Lake, an expressway across Jordan Lake, a freeway from east of Jordan Lake to NC 540, and an expressway from NC 540 to US 1. The initial evaluation included five long-term scenarios that are described in the following sections.

3.4.1.1 Long-term Scenario A

The initial concept for Long-term Scenario A is shown in Figure 3.3.

<u>Freeway segment from Pittsboro to Jordan Lake:</u>

Interchanges would be provided at the following locations:

- Mt. Gilead Church Road/ North Pea Ridge Road
- Big Woods Road/ Seaforth Road

The current access to US 64 from Fire Fox Trace would be closed and traffic would access US 64 from US 64 Business. A service road would provide access from the parcels north of US 64 between the Pittsboro Bypass and the Haw River that connects to Eubanks Road. East of the Haw River, the south side of US 64 as well as a small portion of the north side would be re-routed on service roads that connect to Mt. Gilead Church Road and North Pea Ridge Road. A service road is also included along the south side of US 64 that connects to Seaforth Road.

<u>Expressway segment across Jordan Lake:</u>

Due to the environmental and regulatory constraints in the vicinity of Jordan Lake, an expressway would be included that would have right-in right-out access with direct major street left-turns (commonly referred to as left-overs) at the three access points near the lake.

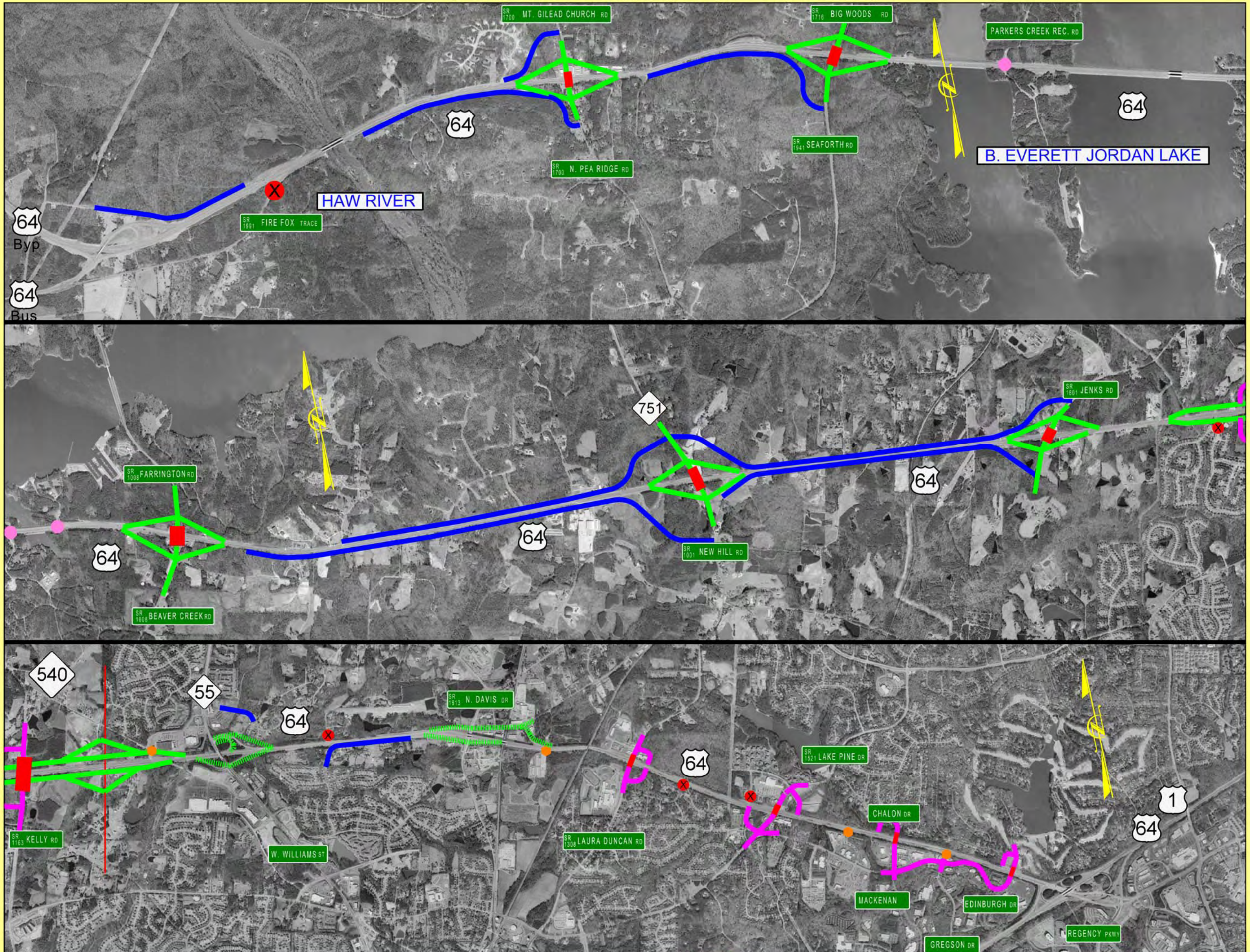
<u>Freeway segment from Jordan Lake to NC 540:</u>

Interchanges would be provided at the following intersections:

- Farrington Road/Beaver Creek Road
- NC 751/New Hill Road
- Jenks Road

The segment between Kelly Road and NC 540 is likely to have substantial operational problems in the future due to the close spacing between the NC 540 interchange and the Kelly Road Quadrant Expressway interchange (commonly referred to as "square loops"). To alleviate this problem a Collector-Distributor (C-D) roadway (a parallel roadway that separates traffic that is leaving/coming to US 64 from the through traffic) was proposed that would serve all traffic to/from Kelly Road, NC 540 and Green Level Church Road (for US 64 westbound traffic).

Figure 3.3: Initial Long-term Concept – Scenario A



LEGEND
Cul-de-sac
Right-in/Right-out
Right-in/Right-out with Major Street Lefts
Service Road
Freeway/Interchange
Existing Freeway/Interchange
Expressway/Quadrant Interchange
Bridge

Initial Long-term Concept

Scenario A

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This segment also includes nearly continuous service roads on both the north and south sides of US 64 from Farrington Road to Kelly Road to provide access to the parcels and roadways that currently have access that would be severed. The service roads connect back to each of the interchange roadways to provide access.

The existing connection to US 64 from Kellyridge Road would be removed and access from the subdivision would be relocated to Kelly Road due to the close proximity of the access point to the Kelly Road square loop roadways.

Expressway segment from NC 540 to US 1/64:

This segment would retain the existing interchanges at NC 55 and Davis Drive/North Salem Street. The existing connection to US 64 from Fern Valley Lane would be removed and access would be relocated to NC 55 by extending the subdivision road. The parcels that currently access US 64 on the south side, between NC 55 and Davis Drive, would be accessed by a service road. The existing connection to a commercial facility and the Trackside North development on the south side of US 64, opposite the exit to North Salem Street would be maintained as a right-in/right-out intersection due to its location between the railroad tracks.

Quadrant Interchanges are proposed at both Laura Duncan Road and Lake Pine Drive, while the existing access points from Knollwood Road and Shepherds Vineyard Road would be closed and re-routed to existing access points. The existing full movement intersection to Autopark Boulevard would be converted to a right-in/right-out intersection.

The section of US 64 from Mackenan Drive/Chalon Drive to Edinburgh Drive would be converted to a pair of Quadrant Interchanges with Mackenan Drive/Chalon Drive and Edinburgh Drive converted to grade separations. A new connection between US 64 and Mackenan Drive/Chalon Drive is proposed to provide access to/from Chalon Drive. A second new connection between US 64 and Edinburgh Drive on the north side of US 64 is proposed to provide access to Edinburgh Drive and the MacGregor Downs subdivision. On the south side of US 64, Gregson Drive would be converted to a right-in/right-out intersection and Old Raleigh Road would provide access via the right in/right out intersections at Autopark Boulevard and Gregson Drive.

The interchange at the split of US 1/US 64 would also be improved to remove the signalized intersection where the US 1 ramps connect to US 64. The range of improvements for this interchange would be examined further during the detailed design phase of the study.

3.4.1.2 Long-term Scenario B

The initial concept for Long-term Scenario B is shown in Figure 3.4.

Freeway segment from Pittsboro to Jordan Lake:

This segment is identical to Scenario A.

Expressway segment across Jordan Lake:

This segment is identical to Scenario A.

Freeway segment from Jordan Lake to NC 540:

This segment is identical to Scenario A with the exception of not providing an interchange at NC 751/New Hill Road due to the presence of a historic property on the south side of US 64. This scenario includes more extensive service roads on the south side of US 64.

Expressway segment from NC 540 to US 1/64:

This segment is similar to Scenario A in that it maintains the existing interchanges at NC 55 and Davis Drive, closes Fern Valley Lane, Knollwood Drive and Shepherds Vineyard Road access points, has the same access roads and provides Quadrant Interchanges at Laura Duncan Road and Lake Pine Drive.

The major difference in Scenario B is the area between Autopark Boulevard and Edinburgh Drive. Under Scenario B; traffic on westbound US 64 destined for Edinburgh Drive, Gregson Drive, Mackenan Drive/Chalon Drive and Autopark Boulevard would exit onto a parallel roadway within the US 1/64 interchange that is bridged over the US 64 westbound entrance ramp. The roadway would be a one-way roadway westbound to Edinburgh Drive, which would be a right-in/right-out intersection, where it would become a two-way roadway. The roadway would then rise vertically and have a three-leg intersection where Gregson Drive would be grade separated over US 64. Continuing to the west, the service road would have a right-in/right-out intersection with Chalon Drive and to the west would again become a one-way roadway, re-entering US 64 westbound. In the eastbound direction Old Raleigh Road would be utilized as a service road and Mackenan Drive and Edinburgh Drive would be converted to right-in/right-out intersections.

3.4.1.3 Long-term Scenario C

The initial concept for Long-term Scenario C is shown in Figure 3.5.

Freeway segment from Pittsboro to Jordan Lake:

This segment is identical to Scenario A, except it would provide a Quadrant Expressway Interchange with Big Woods Road/Seaforth Road to minimize the footprint near Jordan Lake.

Expressway segment across Jordan Lake:

This segment is identical to Scenario A

Freeway segment from Jordan Lake to NC 540:

This segment is identical to Scenario A with the exception of the interchange at Farrington Road/Beaver Creek Road being changed to a Quadrant Expressway Interchange.

Expressway segment from NC 540 to US 1/64:

This segment is similar to Scenario A in that it maintains the existing interchanges at NC 55 and Davis Drive, closes Fern Valley Lane and Knollwood Drive access points, has the same access roads and provides a quadrant interchange at Laura Duncan Road.

The major difference in Scenario C is the area from Lake Pine Drive to Edinburgh Drive. Under Scenario C, Lake Pine Drive would become an urban interchange and the Autopark Boulevard intersection would be converted from a full movement intersection to a right-in/right-out interchange. The connections to US 64 from Mackenan Drive and Chalon Drive would become a grade separation due to the close proximity to Gregson Drive, which would become a three-leg diamond interchange. The intersections at Edinburgh Drive would become right-in/right-out. U-turns along this portion of the corridor would be provided at the interchanges.

Figure 3.4: Initial Long-term Concept – Scenario B

LEGEND

- Cul-de-sac
- Right-in/Right-out
- Right-in/Right-out with Major Street Lefts
- Service Road
- Freeway/Interchange
- Existing Freeway/Interchange
- Expressway/Quadrant Interchange
- Bridge

Initial Long-term Concept

Scenario B

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Figure 3.5: Initial Long-term Concept – Scenario C

LEGEND

- Cul-de-sac
- Right-in/Right-out
- Right-in/Right-out with Major Street Lefts
- Service Road
- Freeway/Interchange
- Existing Freeway/Interchange
- Expressway/Quadrant Interchange
- Bridge

Initial Long-term Concept

Scenario C

US 64 Corridor Study
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3.4.1.4 Long-term Scenario D

The initial concept for Long-term Scenario D is shown in Figure 3.6.

Freeway segment from Pittsboro to Jordan Lake:

This segment is identical to Scenario A.

Expressway segment across Jordan Lake:

This segment is identical to Scenario A

Freeway segment from Jordan Lake to NC 540:

This segment is identical to Scenario A.

Expressway segment from NC 540 to US 1/64:

This segment is similar to Scenario A in that it maintains the existing interchanges at NC 55 and Davis Drive; closes Fern Valley Lane, Knollwood Drive and Shepherds Vineyard Road access points; has the same access roads and provides Quadrant Interchanges at Laura Duncan Road and Lake Pine Drive.

The major difference in Scenario D is that the Autopark Boulevard intersection would be closed and the Mackenan Drive/Chalon Drive, Gregson Drive and Edinburgh Drive intersections would all be converted to right-in/right-out intersections. To provide for the U-turn movements, two Grade Separated U-turn Bridges would be provided, with one having bridges over Edinburgh Drive.

3.4.1.5 Long-term Scenario E

The initial concept for Long-term Scenario E is shown in Figure 3.7.

Freeway segment from Pittsboro to Jordan Lake:

This segment is identical to Scenario A.

Expressway segment across Jordan Lake:

This segment is identical to Scenario A

Freeway segment from Jordan Lake to NC 540:

This segment is identical to Scenario A.

Expressway segment from NC 540 to US 1/64:

This segment would create a system of parallel, one-way, frontage roads that run adjacent to US 64 on the north and south side with slip ramps (roadways connecting the frontage road to the main roadway) connecting the mainline of US 64 to frontage roads. In order to provide full movement between the frontage roads and US 64, the following roadways would include grade separations: NC 55, Davis Drive, Laura Duncan Road, Lake Pine Drive, Autopark Boulevard, Mackenan Drive/Chalon Drive, Gregson Drive and Edinburgh Drive. Examples of this is are common in Texas and on the Long Island Expressway.

3.4.1.6 Initial Long-term Solution Scenario Analysis

After an initial analysis of the scenarios, it was determined that three would be carried forward for further study. The major difference amongst the scenarios was at the eastern end of the corridor, therefore the analysis has been broken into segments. An overall evaluation of the scenarios from Pittsboro to the NC 540 portion is presented and then the individual scenarios for the NC 540 to US 1 portion are evaluated individually. The results of the evaluation are included as follows:

Freeway segment from Pittsboro to Jordan Lake:

It was determined that interchanges would be provided at the following locations for the development of all alternatives:

- Mt. Gilead Church Road/ North Pea Ridge Road
- Big Woods Road/ Seaforth Road

The Town of Pittsboro stated that they may be opposed to closing access at Firefox Trace and it was determined that alternatives would be examined that provide connectivity for Firefox trace to US 64 Business as this was located in the freeway portion of the study. It was also determined that the Scenario C option to provide a Quadrant Expressway Interchange with Big Woods Road/Seaforth Road was not in keeping with the desire for a freeway facility and would be eliminated from further consideration.

Expressway segment across Jordan Lake:

Due to the environmental and regulatory constraints in the vicinity of Jordan Lake, an expressway would be included that would include right-in/right out access with direct major street left-turns at the three access points near the lake. There was also concern that, due to the high traffic volumes along US 64, the direct major street left-turns may eventually create a safety concern and that alternatives should be developed with and without the direct major street left-turns.

Freeway segment from Jordan Lake to NC 540:

It was determined that interchanges would be provided at the following locations for the development of all alternatives:

- Farrington Road/Beaver Creek Road
- NC 751/New Hill Road
- Jenks Road

Additionally, it was determined that a C-D roadway would be used to serve all traffic to/from Kelly Road, NC 540 and Green Level Church Road (for US 64 westbound traffic). At the request of the Corridor Study Team, it was also decided that the C-D in the eastbound direction should be designed to allow a right-in/right-out intersection at Kellyridge Road. It was also determined that at least one alternative should investigate extending the C-D through the NC 55 interchange, at least in the westbound direction. It was determined that the interchange at NC 751/New Hill Road was needed in all alternatives and that the removal of the interchange as proposed in Scenario B was not feasible. It was also determined that the Scenario C option to provide a Quadrant Expressway Interchange with Farrington Road was not in keeping with the desire for a freeway facility and would be eliminated from further consideration.

Figure 3.6: Initial Long-term Concept – Scenario D

LEGEND

- Cul-de-sac
- Right-in/Right-out
- Right-in/Right-out with Major Street Lefts
- Service Road
- Freeway/Interchange
- Existing Freeway/Interchange
- Expressway/Quadrant Interchange
- Bridge

Initial Long-term Concept

Scenario D

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Figure 3.7: Initial Long-term Concept – Scenario E

LEGEND

- Cul-de-sac
- Right-in/Right-out
- Right-in/Right-out with Major Street Lefts
- Service Road
- Freeway/Interchange
- Existing Freeway/Interchange
- Expressway/Quadrant Interchange
- Bridge

Initial Long-term Concept

Scenario E

US 64 Corridor Study
Wake & Chatham Counties

Expressway segment from NC 540 to US 1/64:

The scenarios were evaluated individually for this segment. The results are summarized as follows:

Scenario A

It was determined that Scenario A would have more substantial impacts than the other alternatives, especially due to the quadrant ramps at Mackenan Drive/Chalon Drive and at Edinburgh Drive. Additionally the alternative did not provide a substantial increase in the overall capacity along the corridor and there were concerns it would not provide for adequate traffic operations. Therefore, Scenario A was eliminated from further study.

Scenario B

It was determined that Scenario B would be carried forward for additional studies, although NCDOT raised concerns with the safety of the frontage road on the north side of US 64 including both one-way and two-way traffic.

Scenario C

It was determined that Scenario C would be carried forward for additional studies with a few modifications. It was decided that Laura Duncan Road would be an interchange, Autopark Boulevard would become a cul-de-sac and Edinburgh Drive would become a grade separation.

Scenario D

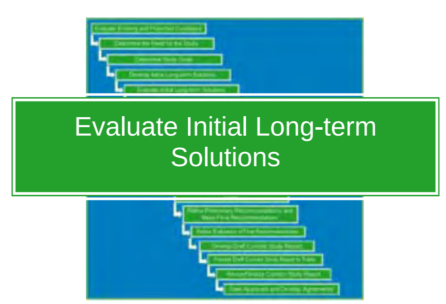
It was determined that Scenario D would have substantial visual effects and that it did not meet the aesthetic vision for the area. Therefore, Scenario D was eliminated from further study.

Scenario E

It was determined that Scenario E would be carried forward for additional studies, although the Town of Cary raised concerns with the width of the roadway and how it may affect residences and development along the corridor.

3.4.2 Development of Preliminary Long-term Solution (Alternatives 1, 2 and 3)

Following the evaluation of the initial five concepts, three of the scenarios were carried forward for additional detailed study. The three scenarios were labeled as Preliminary Long-term Solutions, given the names Alternative 1, 2 and 3, and detailed design layouts were developed for presentation to the public at Workshop #1. The following is a summary of each of the Preliminary Long-term Solutions.



3.4.2.1 Alternative 1

The design of Alternative 1, shown in Figure 3.8, includes the following features:

- US 64 west of the Haw River would be upgraded to a freeway facility by removing the existing direct access, including the closing of Firefox Trace and the access road opposite Firefox Trace. Access would be redirected to US 64 Business and Eubanks Road.
- The intersection with Mt. Gilead Church Road and North Pea Ridge Road would be converted to a partial cloverleaf interchange with all ramps and loops on the western side of Mt. Gilead Church/N. Pea Ridge. The existing Mt. Gilead Church Road/N. Pea Ridge Road would be relocated slightly to the west and grade separated over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.
- The intersection with Big Woods Road and Seaforth Road would be converted to a partial cloverleaf interchange with all ramps and loops on the western side of Big Woods/Seaforth. The configuration would not impact the USACE property or the North Carolina Department of Forest Resources Demonstration Forest Area with existing Big Woods Road/Seaforth Road being relocated slightly to the west and grade separated over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.
- The section of US 64 in the vicinity of Jordan Lake originally was to be upgraded to an expressway facility by converting the existing full movement intersections to right-in/right-out intersections with major street direct left-turn movements from US 64 to the minor street. Following discussion with the Corridor Study Team and consideration of the traffic volumes and safety concerns, it was decided that the major street left-turns would not be included in any of the build alternatives. The ability to make u-turns would be accommodated at the interchange with Big Woods Road/Seaforth Road to the west and Farrington Road/Beaver Creek Road to the east.
- The intersection with Farrington Road and Beaver Creek Road would be converted to a compressed diamond interchange with US 64 being constructed over Farrington Road/Beaver Creek Road due to the existing location of Farrington Road and the narrow right-of-way through the USACE property. Service roadways would also be constructed to eliminate the existing direct access to US 64. The ability to connect the service roads to the east of the interchange back to Farrington Road was evaluated and determined not to be feasible, because it would require crossing USACE property to make the connection. On the south side of US 64, the service road is continuous from Beaver Creek Road to New Hill Road.
- The intersection with NC 751 and New Hill Road would be converted to a compressed diamond interchange. Due to the presence of a historic property on the south side of US 64, the interchange would need to be constructed with US 64 being relocated to the north and constructed over NC 751/New Hill Road. Service roadways would also be constructed to eliminate the existing direct access to US 64.
- The intersection with Jenks Road would be converted to an interchange and would include a future extension of Jenks Road to the south of US 64 creating a four-leg interchange. The interchange would be a combination of a diamond interchange and a partial clover interchange with two diamond ramps on the north side of US 64 and a partial clover configuration with a ramp and loop in the southwest quadrant. Jenks Road would be relocated slightly to the west and would have Jenks road crossing over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.
- The section of US 64 in the vicinity of Kelly Road, NC 540 and Green Level Church Road would be upgraded beyond the improvements proposed under the Triangle Expressway project being constructed by the NC Turnpike Authority. The proposed design includes introducing a two-lane C-D roadway in both directions beginning between Jenks Road and Kelly Road. The C-D roadway in the eastbound direction would include a right-in/right-out intersection with Kellyridge Road, would reconnect to the quadrant interchange at Kelly Road, would tie to the NC 540 cloverleaf interchange and re-enter US 64 prior to the bridge carrying Creekside Landing Drive over US 64. In the westbound direction, the C/D would begin between NC 55 and Green Level Church Road and would include a right-in/right out intersection with Green Level Church, would reconnect to the NC 540 cloverleaf interchange and the Kelly Road quadrant interchange before re-entering US 64 east of Jenks Road. Also a service road connection to Jenks Road would be constructed to provide access to properties along US 64 to the west of Kelly Road.
- The section of US 64 from the existing NC 55 interchange through the existing Davis Drive interchange would be upgraded to provide a higher level of access control as an expressway facility. US 64 to the west

Figure 3.8: Preliminary Long-term Solution – Alternative 1

of NC 55 would be expanded to include an auxiliary lane between NC 55 and the C-D roadway proposed. The interchange at NC 55 would maintain its existing configuration but would be upgraded to include additional through lanes in the southbound and northbound directions, additional turn lanes along NC 55 and additional turn lanes on the ramps. An auxiliary lane is included between NC 55 and Fern Valley Drive (north of US 64) and Blackburn Road (south of US 64). Both intersections would be converted to right-in/right-out intersections by removing the median opening. The auxiliary lane would then continue to the east to the Davis Drive interchange. The Davis Drive interchange would maintain its existing configuration but would be expanded to a seven-lane section through the interchange and include additional turn lanes on Davis Drive and the ramps. A service road parallel to US 64 on the south side is proposed to eliminate direct connections to US 64 such that the existing interchanges, the auxiliary lanes and the right-in/right-out intersections can operate acceptably.

- The section of US 64 in the vicinity of the Laura Duncan Road intersection would be converted to an expressway by providing a Quadrant Expressway Interchange. Laura Duncan Road would be relocated slightly to the east and grade separated over US 64, resulting in the relocation of the business in the northeast quadrant. The relocation is to allow for construction to occur without closing the roadway. Quadrant ramps are proposed in the northeast and southeast quadrants to provide access to Laura Duncan Road. Additionally, the existing intersection at Merchant Drive would be utilized as a connection to Laura Duncan Road via Laura Village Road.

- The section of US 64 from Knollwood Drive to the US 1 interchange includes upgrading the facility to an expressway. Knollwood Drive would be converted to a right-in/right-out intersection with an auxiliary lane from Laura Duncan Road to the west and Shepherds Vineyard Road to the east. The Lake Pine Drive intersection would become a grade separated quadrant interchange with the right-in/right-out access occurring to the west of the intersection at Shepherds Vineyard Drive, where the existing median opening would be closed.

- Continuing along US 64 in the eastbound direction, the roadway access would be converted to a series of right-in/right-out intersections with access to US 64 westbound being provided by a grade separation at Gregson Drive. The intersections at Autopark Boulevard, Mackenan Drive and Edinburgh South Drive would be converted to right-in/right-out intersections and are connected by a continuous auxiliary lane. Old Raleigh Road would act as a two-way service road connecting the intersections. The grade separation at Gregson Drive would carry US 64 over Gregson Drive in order to minimize impacts.

- US 64 in the westbound direction would have a parallel service road that provides access to the roadways and properties on the north side of US 64. A service road would begin at the convergence of the two-lane ramp from US 1 southbound with a ramp connection from westbound Tryon Road. The one-way service road would merge from three-lanes to two-lanes prior to reaching Edinburgh Drive where a right-in/right-out intersection would be included. At Edinburgh Drive the service road would become a two-way service road with two-lanes in the westbound direction and one lane in the eastbound direction. The eastbound lane would terminate as a left-turn onto Edinburgh Drive and would be controlled by a raised concrete island. The service road would continue west to the Gregson Road underpass allowing for access to the roadways and properties on the south side of US 64. Further to the west, the service road would intersect with Chalon Drive as an intersection that would include a left turn onto the eastbound service road, beginning the roadway in the eastbound direction. From Chalon Drive, the two-lane service road would again be a one-way roadway and would merge onto US 64 at a location opposite Autopark Boulevard.

- The US 1 interchange would be upgraded to provide for adequate traffic operations and remove the signal for westbound Tryon Road traffic crossing US 64 eastbound to access the US 1 southbound ramp. To provide additional traffic capacity and improved route continuity at the US 1 interchange, the ramp from US 1/64 southbound to US 64 westbound would be improved to provide a two-lane exit via a shared through/right lane along US 1. The ramp from US 64 eastbound to US 1/64 northbound would also be improved to accommodate a two-lane ramp, requiring additional widening on US 1/64 northbound to accept three ramp lanes entering. The third ramp lane would be tapered out prior to the Cary Parkway interchange. In order to eliminate the existing signal at the US 1 southbound ramp, an elevated left-turn bridge in the median is proposed. The bridge would exit from Tryon Road, under the US 1 bridges, and would begin to elevate after passing beyond the US 1 bridges. The lane would rise in elevation as either a bridge or through the use of retaining walls, before turning to the south and crossing over US 64 eastbound along a curved bridge. The bridge would continue to the south and eventually tie back to the existing ramp location where it would combine with traffic from US 64 eastbound before merging with US 1 south.

3.4.2.2 Alternative 2

The design of Alternative 2, shown in Figure 3.9, includes the following features:

- The section of US 64 west of the Haw River would be identical to Alternative 1.

- The intersection with Mt. Gilead Church Road and North Pea Ridge Road would be converted to a tight urban diamond interchange. The existing Mt. Gilead Church Road/N. Pea Ridge Road would be relocated slightly to the west and grade separated over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.

- The intersection with Big Woods Road and Seaforth Road would be similar to the configuration for Alternative 1, due to the constraints of the USACE property. However, for Alternative 2, Big Woods/Seaforth Road was relocated further to the west to avoid the New Hope Rural Archeological Historic District.

- The section of US 64 in the vicinity of Jordan Lake would be identical to Alternative 1.

- The intersection with Farrington Road and Beaver Creek Road would be converted to an interchange that would be a combination of a compressed diamond configuration and a partial cloverleaf interchange. The north side of US 64 would have diamond ramps located in each quadrant and the south side of US 64 would have a ramp and loop in the southeast quadrant of the interchange. Due to the existing location of Farrington Road and the narrow right-of-way through the USACE property, the interchange would need to be constructed with US 64 being constructed over Farrington Road/Beaver Creek Road. Service roadways would also be constructed to eliminate the existing direct access to US 64. The ability to connect the service roads to the east of the interchange back to Farrington Road was evaluated and determined not to be feasible because it would require crossing USACE property to make the connection. On the south side of US 64, the service road is continuous from Beaver Creek Road to New Hill Road.

- The intersection with NC 751 and New Hill Road would be converted to a standard diamond interchange in order to accommodate future loops with NC 751/New Hill Road being relocated slightly to the east and constructed over US 64. Due to the presence of a historic property on the south side of US 64, the interchange is designed such that an avoidance alternative to impacting the property (Alternative 1) could be constructed in the event that the property still maintains its historic designation when the project moves forward into the detailed environmental analysis phase. Service roadways will also be constructed to eliminate the existing direct access to US 64. Access to the west will be provided along parallel service roads and access to the east is provided by continuous service roads that parallel US 64 between NC 751/New Hill Road and Jenks Road.

- The intersection with Jenks Road would be converted to an interchange and would include a future extension of Jenks Road to the south of US 64, creating a four-leg interchange. The interchange would be a partial clover interchange with all of the ramps and loops on the west side of Jenks Road. Jenks Road would be relocated slightly to the west to provide the ability to maintain access to the road during construction and would have Jenks road crossing over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.

Figure 3.9: Preliminary Long-term Solution – Alternative 2

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Existing Bridges to Remain
- Pavement Constructed Under NC 540 Project

Preliminary Long-term Solution

Alernative 2

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- The section of US 64 in the vicinity of Kelly Road, NC 540 and Green Level Church Road would be upgraded beyond the improvements proposed under the Triangle Expressway project being constructed by the NC Turnpike Authority and is very similar to Alternative 1. The main difference would be that, in the westbound direction, the C-D roadway would begin east of the NC 55 interchange, extend through the NC 55 interchange, include Green Level Church Road as a right-in/right out intersection, would reconnect to the NC 540 cloverleaf interchange and the Kelly Road quadrant interchange before re-entering US 64 east of Jenks Road.

- The section of US 64 from the NC 55 interchange to Davis Drive would be similar to Alternative 1, with the main difference being that the ramps connecting to westbound US 64 would be along the C-D roadway. An auxiliary lane is included between the C-D to the west of NC 55 and the Davis Drive interchange. The Davis Drive interchange would maintain its existing configuration but would be expanded to provide additional through lanes and include additional turn lanes on Davis Drive and the ramps.

- The existing connections to US 64 from Fern Valley Drive and Blackburn Road would be eliminated. A service road from Thorn Hollow drive to NC 55 would provide the access to the property that currently accesses US 64 via Fern Valley Drive, while the properties that access US 64 via Blackburn Road have access to NC 55 via existing roadways. An additional service road parallel to US 64 on the north and south side, west of Davis Drive, is proposed to eliminate direct connections to US 64 such that the existing interchanges, the auxiliary lanes and the right-in/right-out intersections can operate acceptably.

- The Laura Duncan Road intersection would be converted to a tight urban diamond interchange and would operate essentially as a freeway section. In order to minimize impacts along Laura Duncan road and to facilitate the construction, US 64 would be reconstructed over Laura Duncan Road which would remain in its existing location. Due to the interchange proposed for Laura Duncan Road, the existing CSX Railroad bridge over US 64 would need to be replaced due to the additional horizontal clearance required under the structure. In order to reconstruct the bridge and maintain train traffic, a new bridge parallel to the existing bridge would be required, along with the relocation of the track on each side of the bridge.

- The section of US 64 from Knollwood Drive to the US 1 interchange includes the upgrading of the facility to what is essentially a freeway. The connection to US 64 from Knollwood Drive would be removed and an auxiliary lane would be constructed in both directions between the Laura Duncan Road and Lake Pine Drive. The Lake Pine Drive intersection would become a tight urban diamond interchange configuration with access to Shepherds Vineyard Drive being closed. In order to minimize impacts along Lake Pine Drive and to facilitate construction, US 64 would be reconstructed over Lake Pine Drive which would remain in its existing location. Continuing to the west, the intersection at Autopark Boulevard would be removed, the intersection at Mackenan Drive/Chalon Drive would be converted to a grade separation over US 64 and auxiliary lanes along US 64 in each direction would be provided. The existing intersection at Gregson Drive would be converted to a three-leg tight-urban diamond interchange, again with US 64 being reconstructed over Gregson Drive and auxiliary lanes would be provided to the US 1 interchange. The existing intersection at Edinburgh Drive would be converted to a grade separation similar to the separation at Mackenan Drive/Gregson Drive, with a grade separation over US 64. Access to and from the north side of US 64 would be accomplished by utilizing Old Raleigh Road as a local street with access to US 64 provided at the Gregson Drive interchange and the Lake Pine Drive interchange. The existing intersection between Old Raleigh Road and Gregson Drive would become a roundabout.

- The US 1 interchange configuration would be identical to Alternative 1 except the two lane ramp from US 1 southbound would merge directly into US 64 westbound as opposed to merging onto the service road.

3.4.2.3 Alternative 3

The design of Alternative 3, shown in Figure 3.10, includes the following features:

- The section of US 64 from the US 64 Pittsboro Bypass to NC 751/New Hill Road would be identical to Alternative 1.

- The intersection with NC 751 and New Hill Road would be converted to a partial cloverleaf interchange with the ramps and loops located to the west of NC 751/New Hill Road. Due to the presence of a historic property on the south side of US 64, the interchange would need to be constructed with NC 751/New Hill Road relocated to the west and constructed over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.

- The intersection with Jenks Road would be converted to an interchange and would include a future extension of Jenks Road to the south of US 64, creating a four-leg interchange. The interchange would be a partial clover interchange with a pair of ramps and loops in the northeast and southwest quadrants and a ramp in the northwest quadrant. Jenks Road would be relocated slightly to the west to provide the ability to maintain access to the road during construction and would have Jenks road crossing over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64.

- The section of US 64 in the vicinity of Kelly Road, NC 540 and Green Level Church Road would be upgraded beyond the improvements proposed under the Triangle Expressway project being constructed by the NC Turnpike Authority. The proposed design includes introducing a set of parallel one-way frontage roads in each direction along US 64. The one-way frontage roads would typically be two-lanes in each direction and would connect to the mainline of US 64 via slip ramp connections. The parallel frontage roads would continue from west of Kelly Road to Edinburgh Drive.

- In the vicinity of Kelly Road, NC 540 and Green Level Church Road; the proposed design is very similar to the C-D roadway proposed in Alternatives 2 and 3. The two-lane frontage road begins in both directions between Jenks Road and Kelly Road. The frontage road in the eastbound direction would include a right-in/right-out intersection with Kellyridge Road, would reconnect to the quadrant interchange at Kelly Road, would tie to the NC 540 cloverleaf interchange, continue east under the bridge carrying Creekside Landing Drive over US 64 and continue east toward the NC 55 interchange. In the westbound direction, the frontage road would extend through the NC 55 interchange, include Green Level Church Road as a right-in/right out intersection, and would reconnect to the NC 540 cloverleaf interchange and the Kelly Road quadrant interchange before re-entering US 64 east of Jenks Road. A service road connection to Jenks Road would be constructed to provide access to properties along US 64 to the west of Kelly Road.

- The section of US 64 from the existing NC 55 interchange through the existing Davis Drive interchange would we upgraded to accommodate the parallel frontage road concept with two-lanes in each direction. The interchange at NC 55 would also include a pair of slip ramps within the interchange area that provide access from the eastbound frontage road to eastbound US 64 and from westbound US 64 to the westbound frontage road. The interchange at NC 55 would maintain its existing configuration; however, the bridge on NC 55 over US 64 would need to be replaced to allow for the wider cross section along US 64. In addition to the bridge, the interchange would be upgraded to include additional through lanes in the southbound and northbound directions, additional turn lanes along NC 55 and additional turn lanes on the ramps.

- Between the NC 55 interchange and the Davis Drive interchange, the existing connections to Fern Valley Drive and Blackburn Road would be maintained with access to the frontage roads. To the east of Fern Valley Drive and Blackburn Road a pair of slip ramps are included that provide access from eastbound US 64 to the eastbound frontage road and from the westbound frontage road to westbound US 64.

- The Davis Drive interchange would maintain its existing configuration but would be expanded to include additional through lanes on Davis Drive through the interchange, would require new bridges along US 64 to carry the frontage road traffic, and include additional turn lanes on Davis Drive and the ramps.

Figure 3.10: Preliminary Long-term Solution – Alternative 3

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Existing Bridges to Remain
- Pavement Constructed Under NC 540 Project

Preliminary Long-term Solution

Alernative 3

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- Due to the wider typical section for the parallel frontage roads, the existing US 64 bridges over the CSX Railroad are not adequate and would require new bridges parallel to the existing bridges to carry the frontage roads. Additionally, the CSX Railroad bridge over US 64 would need to be replaced due to the additional horizontal clearance required under the structure. In order to reconstruct the bridge and maintain train traffic, a new bridge parallel to the existing bridge would be required, along with the relocation of the track on each side of the bridge.

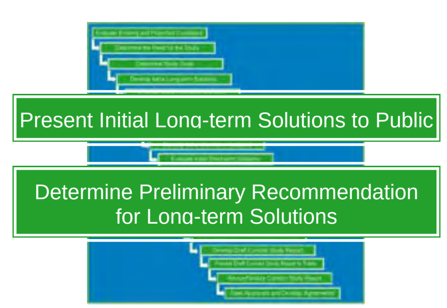
- The section of US 64 in the vicinity of the Laura Duncan Road intersection would maintain the frontage road concept through the intersection. Due to the impacts associated with carrying Laura Duncan Road over US 64 the design includes US 64 being reconstructed over Laura Duncan Road for the US 64 through movements. The existing connection at Merchant Road would be maintained and would tie to the westbound frontage road.

- The section of US 64 from Knollwood Drive to the US 1 interchange would maintain the frontage road concept to the west through the intersection with Edinburgh Drive. The connection to US 64 from Knollwood Drive would be maintained and would tie to the eastbound frontage road. A pair of slip ramps are included in the design between Knollwood Drive and Lake Pine Drive that allow access from the eastbound frontage road to eastbound US 64 and from westbound US 64 to the westbound frontage road. The existing connections to Shepherds Vineyard Drive on each side of US 64 would be maintained with connections to the frontage roads. Due to the impacts associated with carrying Lake Pine Drive over US 64, the design includes US 64 being reconstructed over Lake Pine Drive for the US 64 through movements. Continuing to the east, two pairs of slip ramps are included that provide access to and from the frontage roads in each direction and occur prior to the existing connection to Autopark Boulevard. The Autopark Boulevard connection would be maintained as a right-in/right-out intersection onto the eastbound frontage road. To the east of the intersection at Autopark Boulevard, the major street through traffic on US 64 would cross over Mackenan Drive/Chalon Drive on new bridges constructed over Mackenan/Chalon in the same fashion as those at Laura Duncan Road and Lake Pine Drive. Between Mackenan Drive/Chalon Drive and Gregson Drive, a pair of slip ramps that provide access from US 64 eastbound to the eastbound frontage road and from the westbound frontage road to westbound US 64 are included in the design. The existing intersection at Gregson Drive would be reconfigured with US 64 being reconstructed over Gregson Drive similar to the previous three intersections. To the east of Gregson Drive, the final set of slip ramps that provide access from the eastbound frontage road to eastbound US 64 and from westbound US 64 to the westbound frontage road, are included in the design. The frontage road system continues to the east and terminates at Edinburgh Drive, which would be reconstructed over US 64 slightly to the west of the existing intersection.

- The US 1 interchange configuration would be identical to Alternative 2 except for the westbound Tryon Road traffic crossing under a flyover bridge from the US 1 southbound ramp which would create the US 64 mainline in the median of US 64.

3.4.3 Development of Preliminary Recommended Long-term Solution (Alternative 4)

Using the Preliminary Long-term Solutions developed by the Corridor Study Team, the design plans for the three alternatives were completed and the results were presented to the public at Workshop #1 on May 19-20, 2008. Based on comments received at the workshop and during the comment period following the workshop, a list of public concerns with the Long-term Solutions were developed by the Corridor Study Team and included the following concerns:



- Many of the comments focused on a concern for access, impacts to property and the affects on property values in the study area.

- Access concerns focused on opposition to individual neighborhoods being blocked for emergency vehicles, school buses and public buses. Some participants did not like the service road system.

- There was concern about providing better pedestrian and bike facilities and access to/from public facilities.

- There were concerns that the proposed study was not in line with locally adopted plans.

- There were concerns with safety along the corridor, especially at Apex High School.

- There were concerns with noise and air pollution as a result of the implementation of the study goals.

- There were concerns that the study did not include the implementation of mass transit.

- There were concerns with routing through traffic along US 64 through the developed areas in Cary and Apex instead of along NC 540.

- Out of 47 comments, only 13 people clearly stated a preference to the proposed alternatives: Alternative 2 received eight supporters, Alternative 3 had three supporters and two favored Alternative 1.

Following Workshop #1 the Corridor Study Team met and discussed the public comments and developed a Preliminary Recommendation for the Long-term Solution, which was a combination of elements from all three of the Preliminary Long-terms Solution Alternatives as well as a variation of Alternative 3 that reduced the magnitude of the design in the residential areas through Cary and Apex. Because the Preliminary Recommended Alternative was a hybrid of the previous alternatives, it was named Alternative 4. A detailed description of the Alternative 4 design, shown in Figure 3.11, is included as follows:

- The section of US 64 west of the Haw River would be upgraded to a freeway facility by removing the existing direct access including the closing of Firefox Trace and the access road opposite Firefox Trace with the access being redirected to US 64 Business and Eubanks Road. This was the configuration proposed for Alternatives 1, 2 and 3.

- The intersection with Mt. Gilead Church Road/North Pea Ridge Road would be converted to a tight urban diamond interchange. The existing Mt. Gilead Church Road/N. Pea Ridge Road would be relocated slightly to the west and grade separated over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64. This was the configuration proposed in Alternative 2.

- The intersection with Big Woods Road/Seaforth Road would be converted to a partial clover leaf interchange configuration with all ramps and loops on the western side of Big Woods/Seaforth Road. The configuration was determined to be the optimal configuration because it did not impact the USACE property or the North Carolina Department of Forest Resources Demonstration Forest Area. However, the interchange would impact the New Hope Rural Historic Archeological District. It was determined by NCDOT that the impact was not likely to be considered an impact to a resource identified as resource under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources. The existing Big Woods Road/Seaforth Road will be relocated slightly to the west and grade separated over US 64. Service roadways will also be constructed to eliminate the existing direct access to US 64. This was the configuration proposed for Alternative 1.

- The section of US 64 in the vicinity of Jordan Lake originally would have been upgraded to an expressway facility by converting the existing full movement intersections to right-in/right-out intersections, due to the traffic volumes and safety concerns associated with the existing full movement intersections. The ability to make u-turns would be accommodated at the interchange with Big Woods Road/Seaforth Road to the west and Farrington Road/Beaver Creek Road to the east. This was the configuration proposed for Alternatives 1, 2 and 3.

Figure 3.11: Preliminary Recommended Long-term Solution – Alternative 4

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Sidewalk/Mult-use Path
- Proposed Right-of-way
- Existing Right-of-way
- Existing Bridges to Remain
- Pavement Constructed Under NC 540 Project

Preliminary Recommended Long-term Solution

Alernative 4

US 64 Corridor Study
Wake & Chatham Counties

- The intersection with Farrington Road/Beaver Creek Road would be converted to a compressed diamond interchange with US 64 being constructed over Farrington Road/Beaver Creek Road due to the existing location of Farrington Road and the narrow right-of-way through the USACE property. Service roadways would also be constructed to eliminate the existing direct access to US 64. The ability to connect the service roads to the east of the interchange back to Farrington Road was evaluated and determined not to be feasible because it would require crossing USACE property to make the connection. On the south side of US 64, the service road is continuous from Beaver Creek Road to New Hill Road. This was the configuration proposed for Alternative 1.

- The intersection with NC 751/New Hill Road would be converted to a standard diamond interchange in order to accommodate future loops if future traffic volumes increase substantially with NC 751/New Hill Road being relocated slightly to the east and constructed over US 64. Due to the presence of a historic property on the south side of US 64, the interchange is designed such that an avoidance alternative to impacting the property could be constructed in the event that the property still maintains its historic designation when the project moves forward into the detailed environmental analysis phase. Service roadways will also be constructed to eliminate the existing direct access to US 64. Access to the west will be provided along parallel service roads and access to the east is provided by continuous service roads that parallel US 64 between NC 751/New Hill Road and Jenks Road. This was the configuration proposed for Alternative 2.

- The intersection with Jenks Road would be converted to an interchange and would include a future extension of Jenks Road to the south of US 64 creating a four-leg interchange. The interchange would be a combination of a diamond interchange and a partial clover interchange with two diamond ramps on the north side of US 64 and a partial clover configuration with a ramp and loop in the southwest quadrant and a ramp in the southeast quadrant. Jenks Road would be relocated slightly to the west and would have Jenks road crossing over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64. This is a variation of the configuration proposed for Alternative 1.

- The section of US 64 in the vicinity of Kelly Road, NC 540 and Green Level Church Road would be upgraded beyond the improvements proposed under the Triangle Expressway project being constructed by the NC Turnpike Authority. The proposed design includes introducing a two-lane C-D roadway in both directions beginning between Jenks Road and Kelly Road. The C-D roadway in the eastbound direction would include a right-in/right-out intersection with Kellyridge Road, would reconnect to the quadrant interchange at Kelly Road, would tie to the NC 540 cloverleaf interchange and re-enter US 64 prior to the bridge carrying Creekside Landing Drive over US 64. In the westbound direction, the C-D roadway would begin east of the NC 55 interchange, extend through the NC 55 interchange, include Green Level Church Road as a right-in/right out intersection, would reconnect to the NC 540 cloverleaf interchange and the Kelly Road quadrant interchange before re-entering US 64 east of Jenks Road. Also a service road connection to Jenks Road would be constructed to provide access to properties along US 64 to the west of Kelly Road. This was the configuration proposed for Alternative 2.

- The interchange at NC 55 would maintain its existing configuration with several improvements including adding additional through lanes on NC 55 and turn lanes. The existing connections to US 64 from Fern Valley Drive would be eliminated and a service road from Thorn Hollow Drive to NC 55 would provide the access to the property that currently accesses US 64 via Fern Valley Drive. The connection to Blackburn Road would be maintained as a right-in/right-out intersection with a continuous auxiliary lane between the NC 55 interchange and the Davis Drive interchange. This is a variation of the configuration proposed for Alternative 2.

- The section of US 64 in the vicinity of the Davis Drive interchange would be upgraded to provide a higher level of access control as an expressway facility. An auxiliary lane is included between the C-D to the west of NC 55 and the Davis Drive interchange. The Davis Drive interchange would maintain its existing configuration but would be expanded to include additional through lanes on Davis drive through the interchange and additional turn lanes would be provided. Due to the width of the existing bridge opening along Davis Drive, under US 64 it is likely that the bridges would need to be reconstructed. An additional service road parallel to US 64 on the north and south side, west of Davis Drive, is proposed to eliminate direct connections to US 64 such that the existing interchanges and the auxiliary lanes can operate safely. This was the configuration proposed for Alternative 1.

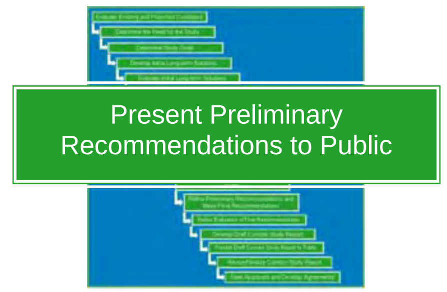
- The Laura Duncan Road intersection would be converted to a tight urban diamond interchange configuration, and US 64 would be reconstructed over Laura Duncan Road, which would remain in its existing location. Due to safety concerns; the connection from US 64 to the Villages of Apex development would be closed, the connection to US 64 from Knollwood Drive would be removed and an auxiliary lane would be constructed in both directions between the Laura Duncan Road and Lake Pine Drive. Due to the interchange proposed for Laura Duncan Road the existing CSX Railroad bridge over US 64 would need to be replaced due to the additional roadway width required under the structure. In order to reconstruct the bridge and maintain train traffic, a new bridge parallel to the existing bridge would be required, along with the relocation of the track on each side of the bridge. This was the configuration proposed for Alternative 2.

- The section of US 64 in the vicinity of Lake Pine Drive includes upgrading the facility to an expressway. The Lake Pine Drive intersection would become a grade separated quadrant interchange with the right-in/right-out access occurring to the west of the intersection at Shepherds Vineyard Drive and Merchant Drive, where the existing median opening would be closed. Existing Lake Pine Drive would be grade separated over US 64 at its current location. A quadrant ramp movement in the northeast quadrant is included that connects to the local frontage road that extends to the east. This is a variation of the configuration proposed for Alternative 1.

- The section of US 64 from east of Lake Pine Drive to the US 1 interchange includes upgrading the facility by separating local traffic from US 64 through traffic and is a variation of the parallel frontage road with slip ramp concept contained in Alternative 3. To accomplish the separation of through and local traffic, a pair of one-way local frontage roads would merge and diverge from the through US 64 traffic. The US 64 through traffic would be accommodated along an elevated roadway along the median of US 64 and would cross over Mackenan Drive/Chalon Drive and Edinburgh Drive before entering an upgraded interchange at US 1. The local frontage roadway in the eastbound direction would serve Autopark Boulevard (Right-in/Right-out), Mackenan Drive/Chalon Drive (Full-Movement), Gregson Drive (Right-in/Right-out) and Edinburgh Drive (Full Movement) before tying to existing eastbound Tryon Road. Traffic entering the eastbound frontage road destined for northbound US 1 would take the existing US 64 eastbound ramp, and a ramp to southbound US 1 would be provided in the vicinity of the existing location. The westbound local frontage road would begin at a point slightly west of the US 1 bridges, where westbound Tryon Road would split into two roadways: one serving US 64 through traffic and one serving local traffic. The local traffic along the westbound frontage road would also include a slip ramp merging from the US 1 southbound ramp, with the frontage road continuing west and serving Edinburgh Drive (Full Movement), Mackenan Drive/Chalon Drive (Full-Movement) and the quadrant ramp to Lake Pine Drive; before merging back into US 64 slightly west of Lake Pine Drive. The upgraded interchange at US 1 would provide a high-speed freeway to freeway connection between US 64 and US 1. The US 1 southbound to US 64 westbound ramp would be upgraded to grade separate the ramp over westbound Tryon Road traffic and making it the major through movement by carrying the lanes into the median of US 64. To provide a more direct connection between US 64 eastbound and US 1 northbound a new flyover ramp would be constructed over US 1 and would merge with US 1 northbound at the location of the existing merge point. The US 64 eastbound lanes would also include an exit with a bridge over the eastbound frontage road/Tryon Road to US 1 southbound, providing a direct connection to the south.

In addition to the improvements described in this section, the corridor was evaluated for bicycle and pedestrian accommodations. These accommodations are discussed in detail for the Final Draft Long-term Solution Recommendations in Chapter 5.

3.4.4 Further Detailed Evaluation of Long-term Concepts



Following discussions with the Corridor Study Team and the determination of the Preliminary Recommended Long-term Solution, the design plans and traffic capacity analysis were completed for Alternative 4 and the results were presented to the public at Workshop #2 on April 27-28, 2009. A Community Meeting was held on July 16, 2009 to further discuss the long-term and short-term solutions for the corridor. From the comments received at Workshop #2, comments received following the workshop and the comments received during the Community Meeting; the Corridor Study Team developed the following list of public concerns with the Long-term Concept (described from the public's perspective):

- Aesthetics along the corridor would be negatively affected by the Long-term Solution.
- The Long-term Solution would create negative effects due to noise, especially for the residential areas.
- The Long-term Solution would not preserve the community along the corridor and would divide the communities on the north and south side of the highway.
- The Long-term Solution will not fit the scale and context of the corridor and will create a "Berlin Wall" affect.
- Connectivity across US 64 would be negatively affected, especially to Apex Community Park.
- US 64 is a local road and should be treated more like a street and less like a highway.
- The Long-term Solution would have negative effects on access to neighborhoods and businesses.
- The Long-term Solution would not be safe due to the traffic patterns and higher speeds.
- There is no need for the improvements.
- The Long-term Solution would have a negative effect on access to the library.
- The Long-term solution would not provide adequate connections to greenways and pedestrian facilities.
- The proposed NC 540 Triangle Expressway and US 1 would provide a bypass of the area in Cary and Apex and US 64 wouldn't require the magnitude of changes proposed.
- Access to Jordan Lake would be negatively affected and an expressway across Jordan Lake would create a bottleneck.
- The Long-term Solution did not include enough consideration for mass transit.
- The cost of implementing the Long-term Solution will be too high and is not a good investment.
- The size of the interchange at NC 751 is concerning.
- The Long-term Solution does not allow for safe bicycle travel along US 64 or for bicyclists crossing US 64.
- The Long-term Solution would not adequately address pedestrians crossing US 64.
- An interchange at Laura Duncan Road would compromise the safety of students crossing US 64 from Apex High School.
- The Long-term Solution is confusing and would be difficult for young drivers to understand.
- The Long-term Solution would not be safe for school buses.
- The Long-term Solution would reduce property values in the area.

3.4.5 Recommended Draft Long-term Solution Evaluation

Following the Community Meeting, the Corridor Study Team decided to re-evaluate the corridor for both the short-term and long-term solution based on the community input. The Corridor Study Team evaluated the US 64 corridor on an intersection by intersection basis to determine the most appropriate long-term solution. For each location, the unique circumstances and context of the intersection were evaluated and a preferred method selected. The Corridor Study Team determined that, based on the potential impacts associated with freeway and expressway facilities, signalized intersection alternatives could be considered, where appropriate, as a means to minimize the effects on the adjacent areas. The Corridor Study Team determined that the only location where a signalized intersection alternative may be appropriate is the section of US 64 from east of Lake Pine Drive to the US 1 interchange. A description of the design of the Recommended Draft Long-term Solution is presented in the following sections.

<u>West of Haw River</u>

The intersection of US 64 from the US 64 Pittsboro Bypass to the bridges over the Haw River would be converted to a freeway with the intersection at Firefox Trace being closed and new service roads being constructed, re-routing access to US 64 Business. This was the configuration proposed for Alternative 4.

<u>Mt. Gilead Church Road/North Pea Ridge Road Intersection</u>

The intersection with Mt. Gilead Church Road/North Pea Ridge Road would be converted to a compressed urban diamond interchange. The existing Mt. Gilead Church Road/North Pea Ridge Road would be relocated slightly to the west and grade separated over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64. This was the configuration proposed in Alternative 4.

<u>Big Woods Road/Seaforth Road Intersection</u>

The intersection with Big Woods Road/Seaforth Road would be converted to a partial cloverleaf interchange configuration with all ramps and loops on the western side of Big Woods/Seaforth Road. The configuration was determined to be the optimal configuration because it did not impact the USACE property or the North Carolina Department of Forest Resources Demonstration Forest Area. However, the interchange would impact the New Hope Rural Historic Archeological District. It was determined by NCDOT that the impact was not likely to be considered an impact to a resource identified as resource under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources. The existing Big Woods Road/Seaforth Road will be relocated slightly to the west and grade separated over US 64. Service roadways will also be constructed to eliminate the existing direct access to US 64. This was the configuration proposed for Alternative 4.

Jordan Lake Area

The section of US 64 in the vicinity of Jordan Lake would be upgraded to an expressway facility by converting the existing full movement intersections to right-in/right-out intersections due to the traffic volumes and safety concerns associated with the existing full movement intersections. The ability to make U-turns would be accommodated at the interchange with Big Woods Road/Seaforth Road to the west and Farrington Road/Beaver Creek Road to the east. The concerns with this location becoming a bottleneck were considered and it was determined that, with adequate acceleration and deceleration lanes at the right-in/right-out intersections, the traffic operations would be adequate. This was the configuration proposed for Alternative 4.

Farrington Road/Beaver Creek Road Intersection

The intersection with Farrington Road/Beaver Creek Road would be converted to a compressed diamond interchange with US 64 being constructed over Farrington Road/Beaver Creek Road due to the existing location of Farrington Road and the narrow right-of-way through the USACE property. Service roadways would also be constructed to eliminate the existing direct access to US 64. The ability to connect the service roads to the east of the interchange back to Farrington Road was evaluated and determined not to be feasible because it would require crossing USACE property to make the connection. On the south side of US 64, the service road would be continuous from Beaver Creek Road to New Hill Road. This was the configuration proposed for Alternative 4.

NC 751/New Hill Road Intersection

The intersection with NC 751/New Hill Road was discussed by the Corridor Study Team due to comments on Alternative 4 and concerns that the footprint of the interchange was too large. It was determined that the recommended configuration would be a tight urban diamond interchange. Due to the presence of a historic property on the south side of US 64, the interchange would need to be constructed with US 64 being relocated to the north and constructed over NC 751/New Hill Road. Service roadways would also be constructed to eliminate the existing direct access to US 64. Access to the west would be provided along parallel service roads and access to the east would be provided by continuous service roads that parallel US 64 between NC 751/New Hill Road and Jenks Road. This was the configuration proposed for Alternative 1.

The configuration at this location was selected because it would avoid a historic property protected by federal law. A different configuration would likely have been recommended if the historic property were not protected. The law does not protect the property from private development. Prior to the approval of any development in this area that could affect the historic designation of this property; the Corridor Study Team recommends coordination and a detailed analysis to determine the optimal interchange based on the new circumstances.

Jenks Road Interchange

The intersection with Jenks Road would be converted to an interchange and would include a future extension of Jenks Road to the south of US 64, creating a four-leg interchange. The interchange would be a combination of a diamond interchange and a partial cloverleaf interchange with two diamond ramps on the north side of US 64 and a partial cloverleaf configuration with a ramp and loop in the southwest quadrant and a ramp in the southeast quadrant. Jenks Road would be relocated slightly to the west and would have Jenks road crossing over US 64. Service roadways would also be constructed to eliminate the existing direct access to US 64. This is the configuration proposed for Alternative 4.

Kelly Road/NC 540/Green Level Church/NC 55 Area

The section of US 64 in the vicinity of Kelly Road, NC 540 and Green Level Church Road would be upgraded beyond the improvements proposed under the Triangle Expressway project being constructed by the NC Turnpike Authority. The proposed design includes introducing a two-lane C-D roadway in both directions beginning between Jenks Road and Kelly Road. The C-D roadway in the eastbound direction would include a right-in/right-out intersection with Kellyridge Road, would reconnect to the quadrant interchange at Kelly Road, would tie to the NC 540 cloverleaf interchange and re-enter US 64 prior to the bridge carrying Creekside Landing Drive over US 64. In the westbound direction, the C-D roadway would begin east of the NC 55 interchange, extend through the NC 55 interchange, include Green Level Church Road as a right-in/right out intersection, and reconnect to the NC 540 cloverleaf interchange and the Kelly Road quadrant interchange before re-entering US 64 east of Jenks Road. Also, a service road connection to Jenks Road would be constructed to provide access to properties along US 64 to the west of Kelly Road. The interchange at NC 55 would maintain its existing configuration with several improvements, including, adding additional through lanes on NC 55 and turn lanes. The existing connections to US 64 from Fern Valley Drive would be eliminated and a service road from Thorn Hollow drive to NC 55 would provide the access to the property that currently accesses US 64 via Fern Valley Drive. The connection to Blackburn Road would be maintained as a right-in/right-out intersection with a continuous auxiliary lane between the NC 55 interchange and the Davis Drive interchange. This was the configuration proposed for Alternative 4.

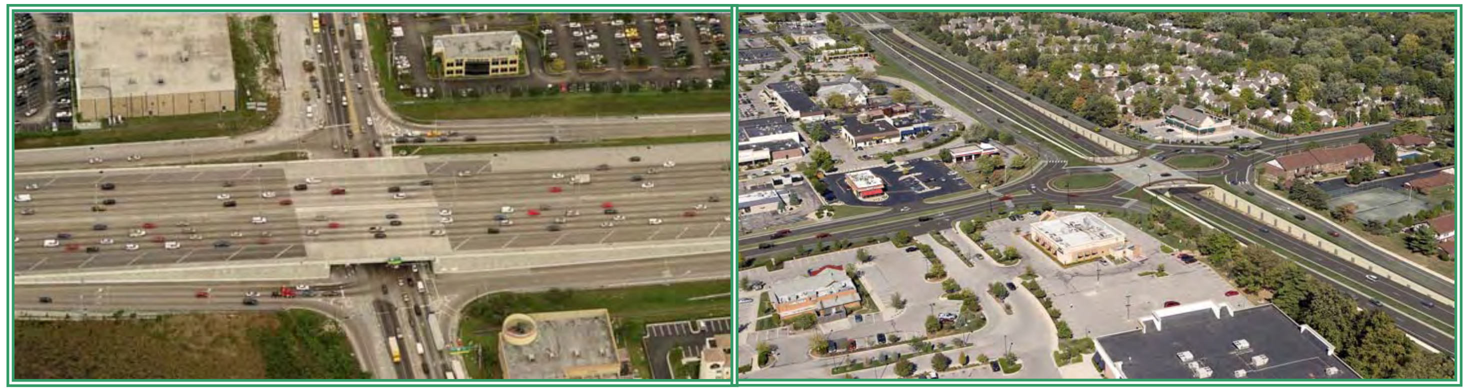
Davis Drive Interchange Area

The section of US 64 in the vicinity of the Davis Drive interchange would be upgraded to provide a higher level of access control as an expressway facility. An auxiliary lane is included between the C-D to the west of NC 55 and the Davis Drive interchange. The Davis Drive interchange would maintain its existing configuration but would be expanded to include additional through lanes on Davis Drive through the interchange and additional turn lanes would be provided. Due to the width of the existing bridge opening along Davis Drive, under US 64 the bridges would need to be reconstructed. An additional service road parallel to US 64 on the north and south side, west of Davis Drive, is proposed to eliminate direct connections to US 64 such that the existing interchanges and the auxiliary lanes can operate safely. This was the configuration proposed for Alternative 4.

The Corridor Study Team also discussed the existing right-in/right-out intersection at the Villages of Apex that was to be closed as a part of the Alternative 4 design. This location was identified by the public, Town of Apex staff and elected officials as a major concern. NCDOT had concerns with safety due to the speeds and limited sight distance in the area. It was determined that the Recommended Long-term Solution would not definitively show the location closed but would include a note that the location would be subject to closure or turn restrictions (eliminating right turn out) if safety problems arise. If a pattern of accidents develops in the future, a more detailed review of access options will be completed, including an auxiliary lane on US 64 eastbound from Davis Drive to Laura Duncan Road in the event that the railroad bridge over US 64 is eventually replaced.

Laura Duncan Road Intersection

The Long-term solution at the intersection with Laura Duncan Road was discussed extensively by the Corridor Study Team based on the numerous concerns expressed by the public. The main concerns related to the safety of the roadway in close proximity to Apex High School and the crossing of US 64 by pedestrians for both the high school and Apex Community Park. The Corridor Study Team concluded that the safest way to accommodate pedestrians would be by creating a grade separation between Laura Duncan Road and US 64, thus eliminating the conflict with US 64 through traffic for pedestrians crossing US 64. Access to and from Apex High School is essential to the corridor; therefore a grade separation alone at this location (with no connections between the roadways) is not feasible, and an interchange must be included to provide access. Including an appropriately designed interchange at this location would provide for a pedestrian crossing of US 64 that is substantially safer than the existing crossing and would improve traffic operations to an adequate level. The most appropriate interchange type for this location was discussed by the Corridor Study Team and would require additional analysis beyond what can be developed at this time. The recommended long-term solution for this intersection will be to provide a tight interchange with a configuration to be determined at a later date after additional design, analysis and public input. The ability to potentially lower the US 64 roadway was discussed by the Corridor Study Team and, based on the depth of the groundwater and rock layers at this location, it was concluded that it was possible to lower US 64, but would need to be more fully evaluated as a part of a future study to determine with certainty. The most likely interchange configurations (with samples shown below) at this location are likely to be a Tight-Urban Diamond configuration (left), similar to the Alternative 4 configuration or a Modern Roundabout Interchange (right) similar to the concept developed in Carmel, Indiana. The modern roundabout configuration would be the preferred design at this stage.



Lake Pine Drive Intersection

The long-term solution at the intersection with Lake Pine Drive was also discussed extensively by the Corridor Study Team because of the numerous concerns expressed by the public. The main concerns were related to crossing of US 64 by bicyclists and pedestrians, especially to Apex Community Park; to the safety of the roadway in close proximity to the library and to the barrier and negative effects on business that would be created. Similar to Laura Duncan Road, the Corridor Study Team concluded that the safest way to accommodate pedestrians and the projected future traffic would be by creating an appropriately designed interchange at this location. The most appropriate interchange type for this location was discussed by the Corridor Study Team, but would require additional analysis beyond what can be developed at this time. The recommended long-term solution for this intersection would be to provide a tight interchange with a configuration to be determined at a later date, after additional design, analysis and public input. The ability to potentially lower the US 64 roadway was also discussed for this location and, based on the depth of the groundwater and rock layers at this location, it was concluded that it was possible to lower US 64, but would need to be more fully evaluated as a part of a future study to determine with certainty. The most likely interchange configurations at this location are likely to be a Tight-Urban Diamond configuration or a modern roundabout interchange similar to those shown above for Laura Duncan Road, with the modern roundabout interchange being the preferred configuration at this stage. The inclusion of an interchange at Lake Pine Drive would potentially result in the intersection of US 64 with Shepherds Vineyard being closed; however, this will need to be evaluated as a part of the future study.

East of Lake Pine Drive to US 1 Interchange

The section of the project from east of Lake Pine Drive to the US 1 interchange was the most controversial and generated the most comments and concerns from the public. This portion of the corridor was evaluated by the Corridor Study Team both on an intersection by intersection basis and as a system of closely related intersections (due to their proximity to one another). Many of the concerns from the community for this portion of the corridor are very similar and have a common theme of balancing the desire for mobility with other community desires. This section is characterized by residential neighborhoods on the north side of US 64 and commercial development on the south side of US 64. The Corridor Study Team decided that the entire range of solutions would be considered along this stretch of US 64, including expressway, freeway and signalized intersection concepts. The following section includes a description of the potential solutions discussed by the Corridor Study Team for this section and the results of the evaluation of each concept. Following the description of the alternatives, a comparison table of the feasible options is included.

Signalized Intersection Concepts

- Recommended Short-term Solution with Widening – This alternative would include utilizing the configuration for the Recommended Short-term Solution and providing an additional through lane in each direction of US 64 to accommodate the future increase in traffic volumes with the widening most likely occurring outside the existing lanes.

Expressway Concepts

- Grade Separation of Minor Streets with Right-in/Right-Out Connections – This scenario would include grade separating some of the minor streets over or under US 64. Under this scenario, some of the minor streets would become grade separations and some would be maintained as right-in/right-out intersections. For this scenario to be feasible, parallel roadways would be needed that connect each of the minor streets. This is a viable concept south of US 64 because Old Raleigh Road provides the connectivity; however, to the north of US 64, a service road would be needed. This concept is generally what was included in Alternative 1 and was revisited by the Corridor Study Team to determine if modifications could be made to allow it to function adequately and address the community's concerns. The Corridor Study Team evaluated the corridor to see if it would be possible to function without a parallel frontage road on the north side of US 64, and concluded that it would not be feasible. The team also evaluated which minor streets could be converted to grade separations, and evaluated if the US 64 roadway could be depressed below its existing grade, allowing for the minor streets to remain at their existing elevation. Based on the elevation of the groundwater in the area, it was concluded that US 64 at the intersection with Gregson Drive could be lowered, while it was not feasible to lower US 64 at the intersections with Mackenan Drive/Chalon Drive and Edinburgh Drive. Edinburgh Drive also was problematic in crossing over US 64 because the elevation on the south side is much lower that the north side, which would result in a substantial amount of the roadway on the south side that would need to be elevated. This increase in length and height would sever the access to the shopping center and the hotel at the intersection. The conclusion of the evaluation was that the only non-signalized scenario that was feasible at Edinburgh Drive would be for US 64 to be grade separated over Edinburgh Drive. For these reasons, the Corridor Study Team decided that this concept was not reasonable and feasible and it was therefore eliminated from further consideration.

- Parallel Frontage Road Concept – This scenario was discussed in general. It would include constructing parallel frontage roads along US 64 to serve local traffic and grade separating the US 64 through movements to create a vertical bypass of the section. This concept is generally what was included in Alternative 4, which was not well received by the community. The concept was re-evaluated to determine if changes could be made to improve the concept and address the concerns raised. The Corridor Study Team discussed the possibility of depressing the US 64 traffic below the existing grade, which would improve the aesthetics and noise impacts over the elevated US 64 roadway in Alternative 4. Like the concept above, the US 64 roadway could only be lowered at Gregson Drive, making this suggestion not feasible. After further efforts to improve or minimize the negative effects, it was determined by the Corridor Study Team that no major revisions could be made to the design. While this concept is feasible and meets the overall goals of the study it was determined by the Corridor Study Team to be unreasonable due to the public concerns. Because it was determined to be feasible it was included in the evaluation in the following section as a means of comparison.

- Elevated Roundabout with Frontage Roads – In an effort to seek an unconventional solution to the complex constraints along the corridor, the Corridor Study Team considered a technique used in Vail, Colorado that includes a roundabout interchange that connects directly to a parallel frontage road system along the highway (shown at right). The concept was discussed, and a variation with a single larger roundabout, similar to a rotary interchange, emerged for consideration. Upon further discussion, the Corridor Study Team determined that it would likely require a very large footprint, have aesthetic effects and would have difficulty accommodating the turning volumes at the intersections along the corridor. The Corridor Study Team concluded that this configuration was neither reasonable nor feasible and it was eliminated from further consideration.

Freeway Concepts

- Freeway with Tight Urban Diamond Interchange – This scenario would include converting US 64 to a freeway with one or more of the minor streets becoming a Tight Urban Diamond Interchange. This concept is generally what was included in Alternative 2, where it included an interchange at Gregson Drive. The three main minor streets were evaluated to determine if they would be good candidates for an interchange. The intersection with Edinburgh Drive was determined to not be feasible due to the close proximity to the US 1 interchange. The intersection with Gregson Drive would be a candidate for an interchange and with the groundwater level being more than 25 feet below the existing elevation of US 64, it would allow the through traffic on US 64 to be depressed and the interchange constructed at the elevation of the existing roadway. The intersection with Mackenan Drive/Chalon Drive is a potential location for an interchange but US 64 could not be lowered due to the groundwater elevation and would require US 64 to be elevated over Mackenan Drive/Chalon Drive. Based on this, the most likely location for an interchange would be at Gregson Drive; however, the concept would still require that US 64 cross over both Mackenan Drive/Chalon Drive and Edinburgh Drive, which would not address many of the public concerns. While this concept is feasible and meets the overall goals of the study, it was determined by the Corridor Study Team to be unreasonable due to the public concerns. Because it was determined to be feasible it was included in the evaluation in the following section as a means of comparison.

- Freeway with Modern Roundabout Interchange – This scenario would include converting US 64 to a freeway with one or more of the minor streets being converted to modern roundabout interchanges. The evaluation of this concept by the Corridor Study Team resulted in a nearly identical analysis to that of the Tight Urban Diamond Interchange, with the exception that the modern roundabout would most likely be more aesthetic. While this concept is feasible and meets the overall goals of the study, it was determined by the Corridor Study Team to be unreasonable due to the public concerns. Because it was determined to be feasible, it was combined with the tight urban diamond concept into a single alternative due to the common features and included in the evaluation in the following section as a means of comparison.

Comparison of Concepts from East of Lake Pine Drive to US 1

A summary of the concepts discussed above is shown in Table 3.7. Each of the three concepts that were considered to be feasible were compared across the following attributes:

- Aesthetics
- Noise
- Community Preservation
- Scale/Footprint (property required to construct concept)
- Cross Connectivity
- Access
- Safety
- Bicycle/Pedestrian
- Construction Cost
- Traffic Operations

The table provides a description of the potential benefits and potential limitations for each concept, as well as a qualitative rating for how well it addresses each individual attribute. The qualitative rating system includes the following measures:

★★★★★ - Favorable

★★★★ - Slightly Favorable

★★★ - Average

★★ - Slightly Unfavorable

★ - Unfavorable

It should also be noted that these qualitative evaluations are for each individual attribute and that the weight of each of the attributes is not equal. Different individuals are likely to prioritize certain attributes higher than other individuals would. For example, a property owner who lives in close proximity to US 64 may prioritize noise with much greater weight, while a commuter may prioritize traffic operations. The challenge in evaluating the concepts and developing a solution is that a balanced approach must be taken as no one concept is superior for all attributes. When applied to the US 64 corridor, it is important that the individual context for each location be considered when evaluating the potential options.

Table 3.7: Comparison of Concepts from East of Lake Pine Drive to US 1

Concept Type		Short-term Solution with Widening	Parallel Frontage Road Concept	Freeway with Urban Interchanges
Aesthetics		★★★★	★	★
	Potential Benefits	Most similar to the existing roadway	Aesthetics treatments could be incorporated in design	Aesthetics treatments could be incorporated in design
	Potential Limitations	May result in some trees being removed	Includes substantial change in elevation of US 64	Includes substantial change in elevation of US 64
Noise		★★★★	★	★★
	Potential Benefits	Construction will not increase elevation of roadway	Noise walls may be provided to reduce noise impacts	Noise walls may reduce noise impacts and smaller footprint moves noise further away
	Potential Limitations	May remove some trees and noise walls not likely to be provided	Increased elevation may increase noise impacts	Increased elevation may increase noise impacts
Community Preservation		★★★★	★★	★
	Potential Benefits	Maintains the existing access with some re-routing of traffic	Provides for access to all existing access points	Maintains existing access with substantial re-routing of traffic
	Potential Limitations	Cross access and minor street access is reduced	Scale may have negative effect on community	Scale may have negative effect on community
Scale/ Footprint		★★★★	★	★★★★★
	Potential Benefits	Compact footprint will likely fit within existing right-of-way	None	Narrower footprint than Frontage Road concept
	Potential Limitations	Wider than the existing roadway	Substantially wider footprint and increased elevation of roadway	Wider footprint than existing and increased elevation of roadway
Cross Connectivity		★	★★★★	★★
	Potential Benefits	None	Provides cross access except at Gregson Drive	Provides grade separated crossings at minor streets
	Potential Limitations	Does not provide direct cross connectivity	Does not provide cross access at Gregson Drive	Only provides direct cross access to US 64 at Gregson Drive
Access		★★★★	★★★★	★
	Potential Benefits	Provides access to all existing roadways	Provides access to all locations with minor re-routing of traffic	Provides access to all locations with re-routing of traffic
	Potential Limitations	Re-routes minor street through and left turn movements	Re-routes left turn to and from Gregson Drive	Re-routes traffic substantially from existing routes
Safety		★★★	★★★★	★★★★
	Potential Benefits	Reduces conflict points from existing configuration	Reduces conflict points substantially	Reduces conflict points substantially
	Potential Limitations	Signalized intersections still create moderate number of conflict points	None	None
Bicycle/ Pedestrian		★★	★★★★★	★★★★★
	Potential Benefits	Provides crossing without direct vehicle conflicts	Provides safe crossings and separates out through movements	Provides safe crossings and separates out through movements
	Potential Limitations	Two-stage crossing and does not separate through traffic. Concerns with bicycles	None	None
Construction Cost		★★★★★	★	★★
	Potential Benefits	Low cost solution	None	None
	Potential Limitations	None	High cost due to compact footprint	High cost due to compact footprint
Traffic Operations		★★	★★★★★	★★★
	Potential Benefits	Improves traffic operations over existing configuration	Improves traffic operations substantially	Improves US 64 operations substantially, but increase traffic on parallel routes
	Potential Limitations	Limited by capacity of signalized intersections	None	Parallel routes may become overloaded

Based on the comparison in Table 3.7 and the discussion above, the Corridor Study Team determined that the recommended long-term solution for the section of US 64 from east of Lake Pine Drive to US 1 would be the short-term solution with widening to six through lanes (three in each direction) on US 64. The Corridor Study Team still had some concerns with the ability of the recommended solution to accommodate the future traffic volumes and determined that, in the event the Recommended Long-term Solution is not able to operate at an acceptable level in the future additional studies will be undertaken to determine the appropriate solution.

3.4.6 Determination of Final Draft Long-term Solution Recommendations

The results of the long-term corridor evaluation for the intersections within Wake County were presented to a select group of stakeholders at the Stakeholder Meeting held on October 22, 2009 for review and comment. Comments on the long-term solution included the following:

- Implement the recommended design at Laura Duncan Road and Lake Pine Drive
- Ensure improved pedestrian walkability for crossing US 64, especially to businesses
- Do not focus on through mobility at the expense of local access
- Maintain medians for safety and aesthetics
- Re-open Fern Valley Lane access point as full movement intersection
- Add additional through lanes to US 64 in the median from Autopark Boulevard to US 1 and maintain traditional intersections instead of a superstreet
- Do not implement the superstreet at Edinburgh Drive
- Lower speed limit to 45 miles per hour east of railroad bridges
- Hold off implementing Superstreets as long as possible
- Make Gregson a superstreet with indirect left turns to minimize pavement
- Consider the superstreet and aesthetics as it relates to community feel and look
- Safety is more important than mobility and should be the primary concern
- Look at parallel routes to US 64 and improve them to increase safety
- Sign US 64 along US 1 and NC 540 and convert existing roadway to US 64 Business/Tryon Road
- Lower speed limit to 45 miles per hour east of Kellyridge Road and include design features that signal to the driver that the context of the corridor has changed
-
- Consider a pedestrian bridge for future greenway at Mackenan/Chalon
- Consider a ramp from US 1 directly into the back side of the MacGregor office park
- Design aesthetically pleasing structures for the long-term solution
- Further consider transit and other options for the long-term solution

Based on the comments and discussion at the Stakeholders Workshop, the Corridor Study Team met and developed the Draft Final Recommendations for the Long-term Solution. The only design change that was implemented following the Stakeholder Meeting was to remove the connection to NC 55 via Thorn Hollow and include a new connection to Old Jenks Road by extending Sandy Hill Court as is shown in the Apex Transportation Plan. In addition to the new connection to Old Jenks Road, the Corridor Study Team decided to extend the westbound C-D roadway further east and maintain the existing connection to Fern Valley Lane as a right-in/right-out intersection onto the C-D.

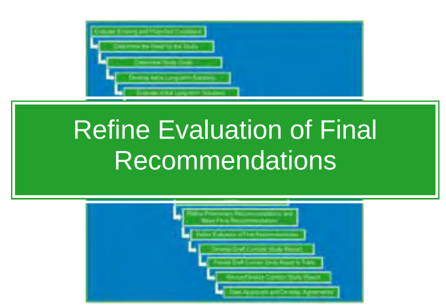
3.4.6.1 Summary of Final Draft Long-term Solution Recommendations

A summary of the Final Draft Long-term Solution Recommendations is included in Table 3.8.

Table 3.8: Final Draft Long-term Solution Recommendations

Intersection/Interchange	Final Draft Long-term Solution
Firefox Trace	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business
Mt. Gilead Church/Pea Ridge Road	Compact Diamond Interchange
Big Woods/Seaforth Road	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
Farrington/Beaver Creek Road	Compact Diamond Interchange
NC 751/New Hill Road	Tight Diamond Interchange with US 64 relocated to the north
Jenks Road	Partial Cloverleaf Interchange with loop in southwest quadrant
Kellyridge Road	Right-in/Right-out connecting to eastbound collector-distributor road
Kelly Road	Configuration constructed as part of NC 540 project with revised connections to collector-distributor roads in both directions along US 64
NC 540	Configuration constructed as part of NC 540 project with revised connections to collector-distributor roads in both directions along US 64
Green Level Church Road	Configuration constructed as part of NC 540 project with revised connections to westbound collector-distributor road
NC 55	Improvements to NC 55, new bridge over US 64, improvements to US 64 ramps and connects to westbound collector-distributor road
Fern Valley Lane	Right-in/Right-out connecting to westbound collector-distributor road and new connection to Old Jenks Road by extending Sandy Hill Court
Davis Drive	Improvements to Davis Drive and US 64 Ramps
Laura Duncan Road	No change from Short-term (Tight Interchange)
Knollwood Drive	Right-in/Right-out subject to interchange design at Laura Duncan Road and Lake Pine Drive
Lake Pine Drive	Tight Interchange with modern roundabout configuration preferred
Autopark Boulevard	6-lane US 64 and Left-in/Right-in/Right-out
Mackenan/Chalon	6-lane US 64 and Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Gregson Drive	6-lane US 64 and Superstreet with Direct Major Street Left Turn
Edinburgh Drive	6-lane US 64 and Superstreet with Direct Major Street Left Turn
US 1 Interchange	No change from existing configuration except for additional lane on ramp from US 1/64 Southbound

The detailed design of the Final Draft Long-term Solution Recommendations is presented in Section 3.6. In addition to the detailed recommendations on the design of the long-term solution, recommendations are being made for the corridor by the Corridor Study Team and are included in Section 4.2.4.



3.4.7 Long-term Solution Traffic Volumes and Traffic Operations

3.4.7.1 Future Traffic Volume Projections

The determination of the future traffic volumes for the Final Draft Long-term Solution Recommendations in 2035 were developed by using the Triangle Regional Travel Demand Model and the data collected for the 2007 existing conditions. The proposed changes to US 64 were included in the travel demand model, including upgrading portions of the corridor to a freeway and included each of the proposed interchanges. The model results showed an increase in traffic volumes for the 2035 Long-term Solution Build versus the 2035 No-Build volumes presented in Section 2.3.2. The reason for the increase in volumes for the build alternative, is due to the facility having adequate capacity to allow for traffic to flow more freely. The 2035 No-Build volumes showed that the US 64 corridor would have a substantial level of congestion, causing drivers to take alternate routes. For the 2035 Build scenario those vehicles that originally would have taken US 64, but were diverted, return to their natural path along US 64, thus increasing the traffic volumes. A summary of the 2035 Long-term Solution traffic volumes for each of the major roadways along the corridor is shown in Figure 3.12.

3.4.7.2 Long-term Solution Level of Service

The analysis of traffic operations for the long-term solution included evaluating the LOS for the unsignalized and signalized intersections, as well as for the freeway elements of the design. The LOS for freeway elements includes; basic freeway segments, which are the area of freeway between interchanges; ramp junctions, which are the point where ramps tie to the freeway; and weaving segments, which are where two or more traffic streams are required to cross each other along a freeway. The LOS is defined with letter designations from A to F as shown in Table 3.9. LOS A represents the best operating conditions along a road or at an intersection, while LOS F represents the worst conditions. The LOS results for the long-term solution are shown on Figure 3.13 and in Table 3.10.

Table 3.9: Level of Service Definitions

Level of Service	Signalized Intersections	Road Segment/Ramps
A	Very low delay (<10.0 seconds per vehicle). Most vehicles do not have to stop at all.	Free flow. Individuals are unaffected by other vehicles and operations are constrained only by roadway geometry and driver preferences. Maneuverability is good. Comfort level and convenience are excellent.
B	10.0-20.0 second delay. Good progression and short cycle length.	Free flow, but the presence of other vehicles begins to be noticeable. Average travel speeds are the same as in LOS A, but there is a slight decline in freedom to maneuver and level of comfort.
C	20.1 to 35.0 second delay. Fair progression and/or longer cycles. The number of vehicles stopping is significant.	Influence of traffic density on operations becomes marked. The ability to maneuver within the traffic stream is clearly affected by other vehicles. Minor disruptions can cause serious local deteriorations and queues will form behind any significant traffic disruption.
D	35.1 to 55.0 second delay. Many vehicles stop. Individual cycle failures are noticeable.	The ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing volume. Only minor disruptions can be absorbed without extensive queues forming and service deteriorating.
E	55.1 to 80.0 second delay. Individual cycle failures are frequent.	Operating conditions at or near the capacity level, usually unstable. Vehicles are operating with the minimum spacing for maintaining uniform flow. Disruptions cannot be dissipated readily.
F	Delay in excess of 80.0 seconds. Considered unacceptable to most drivers.	Breakdown flow. Traffic is over capacity at points. Queues form behind such locations, which are characterized by extremely unstable stop-and-go waves. Travel speed within queues are generally less than 30 mph.

Figure 3.12: 2035 Long-term Solution Daily Traffic Volumes

LEGEND

2035 — 2035 Long-term Solution Daily Traffic Volumes

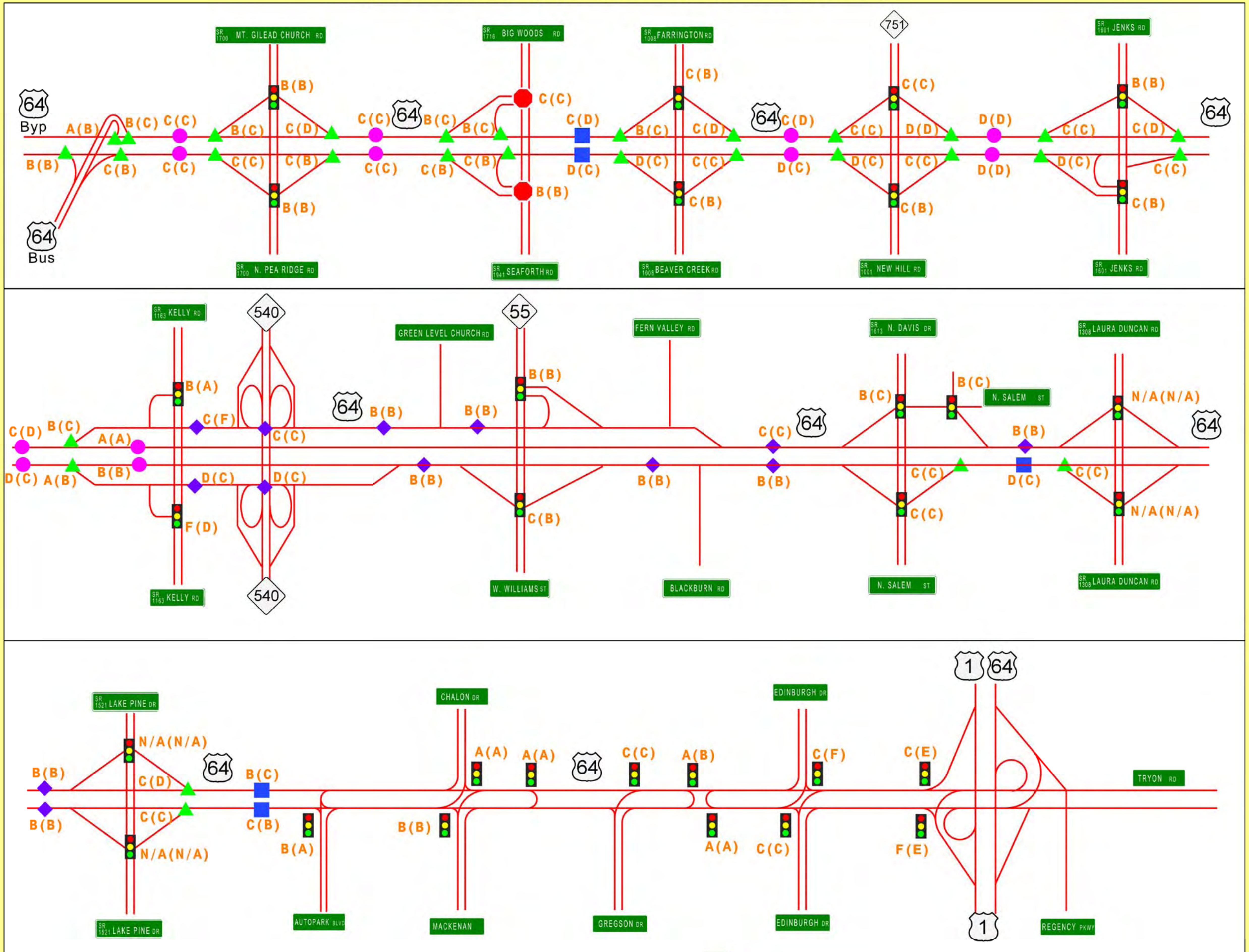
Long-term Solution Design

2035 Long-term Solution

Daily Traffic Volumes

US 64 Corridor Study
Wake & Chatham Counties

Figure 3.13: 2035 Long-term Solution Level of Service Summary



LEGEND

- Basic Freeway Segment
- Freeway Ramp Junction
- Freeway Weaving Segment
- Multilane Highway Segment
- Unsignalized Intersection
- Signalized Intersection
- C(C) Level of Service - AM(PM)

Long-term Solution
2035 Build

Level of Service

US 64 Corridor Study
Wake & Chatham Counties

Table 3.10: Long-term Solution Level of Service Summary

Basic Freeway Segments	2035 Long-term Solution AM/PM Peak Hour LOS
US 64 EB - US 64 Business to Mt. Gilead Church Road	C/C
US 64 WB - Mt. Gilead Church Road to US 64 Business	C/C
US 64 EB - Mt. Gilead Church Road to Big Woods Road	C/C
US 64 WB - Big Woods Road to Mt. Gilead Church Road	C/C
US 64 EB - Farrington Road to NC 751	D/C
US 64 WB - NC 751 to Farrington Road	C/D
US 64 EB - NC 751 to Jenks Road	D/D
US 64 WB - Jenks Road to NC 751	D/D
US 64 EB - Jenks Road to NC 540 C/D Roadway	D/C
US 64 WB - NC 540 C/D Roadway to Jenks Road	C/D
US 64 EB - Within the NC 540 C/D Roadway	B/B
US 64 WB -Within the NC 540 C/D Roadway	A/A
US 64 EB - Exit to US 64 Business	B/B
US 64 EB - Enter from US 64 Business	C/B
US 64 WB - Enter from US 64 Business	A/B
US 64 WB - Exit to US 64 Business	B/C
US 64 EB - Exit to Mt. Gilead Church Road	C/C
US 64 EB - Enter from Mt. Gilead Church Road	C/B
US 64 WB - Enter from Mt. Gilead Church Road	B/C
US 64 WB - Exit to Mt. Gilead Church Road	C/D
US 64 EB - Exit to Big Woods Road	C/B
US 64 EB - Enter from Big Woods Road	C/B
US 64 WB - Enter from Big Woods Road	B/C
US 64 WB - Exit to Big Woods Road	B/C
US 64 EB - Exit to Farrington Road	D/C
US 64 EB - Enter from Farrington Road	C/C
US 64 WB - Enter from Farrington Road	B/C
US 64 WB - Exit to Farrington Road	C/D
US 64 EB - Exit to NC 751	D/C
US 64 EB - Enter from NC 751	C/C
US 64 WB - Enter from NC 751	C/C
US 64 WB - Exit to NC 751	D/D
US 64 EB - Exit to Jenks Road	D/C
US 64 EB - Enter from Jenks Road	C/C
US 64 WB - Enter from Jenks Road	C/C
US 64 WB - Exit to Jenks Road	C/D
US 64 EB - Exit to NC 540 C/D Roadway	B/A
US 64 WB - Enter from NC 540 C/D Roadway	A/B
US 64 WB C/D Roadway - Exit to NC 55	B/C
US 64 EB - Enter from Davis Drive	C/C
US 64 EB - Exit to Laura Duncan Road	C/C
US 64 EB - Enter from Lake Pine Drive	C/C
US 64 WB - Exit to Lake Pine Drive	C/D
Freeway Weaving Sections	**2035 Long-term Solution AM/PM Peak Hour LOS**
US 64 EB C/D Roadway - Kelly Road to NC 540	D/C
US 64 WB C/D Roadway - NC 540 to Kelly Road	C/F
US 64 EB C/D Roadway - NC 540 Loops	D/C
US 64 WB C/D Roadway - NC 540 Loops	C/C
US 64 WB C/D Roadway - Green Level Church Road to NC 540	B/B
US 64 EB - NC 540 C/D Roadway to NC 55	B/B
US 64 WB C/D Roadway - NC 55 to Green Level Church Road	B/B
US 64 EB - NC 55 to Blackburn Road	B/B
US 64 WB - Davis Drive to NC 540 C/D Roadway	C/C
US 64 EB - Blackburn Road to Davis Drive	B/B
US 64 WB - Laura Duncan Road to N. Salem Street/Davis Drive	B/B
US 64 EB - Laura Duncan Road to Lake Pine Drive	B/B
US 64 WB - Lake Pine Drive to Laura Duncan Road	B/B
Multilane Roadways	**2035 Long-term Solution AM/PM Peak Hour LOS**
US 64 EB - Across Jordan Lake	D/C
US 64 WB - Across Jordan Lake	C/D
US 64 EB - Davis Drive to Laura Duncan Road	D/C
US 64 EB - Lake Pine Drive to Autopark Boulevard	C/B
US 64 WB - Autopark Boulevard to Lake Pine Drive	B/C
Signalized Intersections	**2035 Long-term Solution AM/PM Peak Hour LOS**
US 64 EB Ramps at Mt. Gilead Church Road	B/B
US 64 WB Ramps at Mt. Gilead Church Road	B/B
US 64 EB Ramps at Farrington Road	C/B
US 64 WB Ramps at Farrington Road	C/B
US 64 EB Ramps at NC 751	C/B
US 64 WB Ramps at NC 751	C/C
US 64 EB Exit/Entrance Ramps at Jenks Road	C/B
US 64 WB Ramps at Jenks Road	B/B
US 64 EB Kelly Road Ramp at Kelly Road	F/D
US 64 WB Kelly Road Ramp at Kelly Road	B/A
US 64 EB Ramps at NC 55	C/B
US 64 WB Ramps at NC 55	B/B

Table Continued on Page 70

US 64 EB Ramps at Davis Drive	C/C
US 64 WB Ramp/N. Salem Street at Davis Drive	B/C
US 64 WB Ramp at N. Salem Street	B/C
US 64 EB at AutoPark Boulevard	B/A
US 64 EB at Mackenan/Chalon Drive	B/B
US 64 WB at Mackenan/Chalon Drive	A/A
US 64 U-turn East of Mackenan/Chalon Drive	A/A
US 64 EB at Gregson Drive	C/C
US 64 U-turn East of Gregson Drive	A/B
US 64 U-turn West of Edinburgh Drive	A/A
US 64 EB at Edinburgh Drive	C/C
US 64 WB at Edinburgh Drive	C/F
US 64 EB at US 1 SB Ramp	F/E
US 64 WB at US 1/64 SB Ramp	C/E

The analysis indicates that all basic freeway segments, ramp junctions, and multi-lane segments, as well as a majority of the freeway weaving sections and signalized intersections are projected to operate at an acceptable LOS D or better in 2035. The following locations will not have a LOS of D or better in 2035:

- Kelly Road - One weaving section and one signalized intersection are projected to operate at LOS F in 2035. The North Carolina Turnpike Authority is evaluating potential solutions at this location that may be implemented in the future, as needed, to improve the operations at this location.

- Edinburgh Drive - One signalized intersection at this location is projected to operate at LOS F in 2035. The ability to improve this intersection to an acceptable level in the future would likely require grade separation and was not considered reasonable at this time.

- US 1 Interchange - Both of the signalized intersections at the US 1 southbound ramps are projected to operate at LOS E or F in 2035. It is likely that US 1, south of US 64 will require widening in the future and improvements to the US 64 interchange should be evaluated at that time to improve traffic operations.

An additional measure to show the traffic operations along the corridor is through the use of travel time. Table 3.11 shows the approximate travel time for the 19-mile US 64 corridor from the US 64 Bypass west of Pittsboro to the US 1 interchange in Cary for each direction of US 64 in the AM and PM peak periods for the 2007 existing timeframe, the 2035 No-Build scenario, the 2025 Short-term scenario and the 2035 Long-term scenario.

Table 3.11: Travel Time Summary

Roadway	2007 Existing AM/PM Travel Time	2035 No-Build AM/PM Travel Time	2025 Short-term AM/PM Travel Time	2035 Long-term AM/PM Travel Time
US 64 Eastbound	29 /26 minutes	54 /40 minutes	39/31 minutes	20/20 minutes
US 64 Westbound	27 /27 minutes	39 /51 minutes	28/36 minutes	20/23 minutes

Based on Table 3.11, it is shown that the Short-term and Long-term Solutions improve the mobility of the US 64 to a substantial degree. The implementation of the Short-term solution will provide immediate benefits by reducing the delay along the US 64 corridor. The 2025 travel time for the corridor is slightly longer than the 2007 existing conditions, but shows an improvement over the 2035 No-Build conditions. For the 2035 Long-term Solution, the implementation of the recommendations is projected to reduce the travel time along US 64 by as much as 34 minutes over the 2035 No-Build scenario.

3.4.8 Long-term Solution Concerns and Unresolved Issues

The concerns with the long-term solution that were provided by the public have been considered and accommodated in the recommendations above to the greatest extent possible. It is understood that not all comments and concerns could be completely addressed by the design. The determination of the recommended alternative was based on balancing the effects, both positive and negative, at each intersection along the corridor to provide a solution that would best address the needs of those both using and living around the corridor.

There were some concerns that were raised as a part of the public involvement process that could not be addressed in this study or included in the long-term solution, including the flowing:

- A new interchange was requested along US 1 between US 64 and Ten-Ten Road to provide additional access to the MacGregor Office Park. This recommendation was evaluated by the Corridor Study Team and determined to not be reasonable because providing the interchange would require either a C-D roadway or braided ramps (grade separation of on ramps from one interchange with off ramps from other interchange) which would have substantial negative impacts to MacGregor Downs Subdivision, the MacGregor Office Park and Waterford Green Subdivision and require the reconstruction of the US 64 interchange at US 1.

- Construction of a pedestrian bridge over US 64 at Laura Duncan Road was requested in some comments. The Corridor Study Team evaluated this recommendation and determined that the pedestrian bridge would not be a cost effective measure for improving the pedestrian crossing based on the limited funding available and recommended that the interchange be constructed as soon as possible to improve the safety at this location. If there are expansion plans developed for Apex High School, improved pedestrian amenities, including a pedestrian bridge, should be evaluated as a part of the expansion.

- It was recommended that either no improvements be made or that traditional widening to six-lanes be implemented from US 1 to Autopark Boulevard. The Corridor Study Team evaluated this recommendation and determined that the congestion and delays for these scenarios would not be reasonable for the US 64 corridor.

There were still some items that remain unresolved with regard to the long-term solution and will require additional analysis to determine the best way to address these concerns. The additional analysis of the following concerns is needed prior to implementing the long-term solutions but is considered outside the scope of this study.

- The interchange configurations at the intersections with Laura Duncan Road and Lake Pine Drive will need additional analysis and evaluation prior to determining the recommended configurations at these locations, although the modern roundabout design is the preferred design based on initial evaluation and community input.

- The determination of a safe method of travel for advanced bicyclists at the superstreet configuration is needed. It is understood that advanced bicyclists do not desire to dismount their bicycle and act as pedestrians at the superstreet intersection, which is the preferred method for crossing at a superstreet intersection. There needs to be additional evaluation of the superstreet concept to determine how to best allow bicyclists to act as vehicles and navigate the configuration in a safe manner.

- The determination of a method for crossing US 64 for the future Swift Creek Greenway in the vicinity of Mackenan Drive/Chalon Drive is needed. A grade separated pedestrian crossing should be studied at this location as a part of the planning and design for the greenway.

Chapter 4: Implementation Plan

US 64 at
Creekside Landing Drive
(October 2009)

CHAPTER 4. IMPLEMENTATION PLAN

This chapter of the study includes developing a plan for implementing the recommended short-term and long-term solutions for the corridor. The Implementation Plan includes several key elements to help guide the transition of the corridor from the existing conditions, through the short-term solution, to the long-term solution and includes the following information:

- segmenting the corridor into smaller pieces to allow for incremental development
- determining the priority and life-span of the short-term improvements
- determining the priority of the long-term improvements

This chapter also describes the process for implementing the solutions after this study is completed that would have to occur prior to construction of any project.

4.1 DEVELOPING CORRIDOR INTERSECTIONS AND SEGMENTS

For the purposes of determining how the recommended solutions will be implemented it was determined that a measured approach would be taken and the corridor would be evaluated on an intersection by intersection basis for the short-term solution. The recommended Short-term solution includes revisions to 14 intersections along the corridor. Because the recommended improvements are individual solutions at each of the intersection locations, they can be implemented either individually or as a part of a larger corridor project to upgrade multiple locations. Due to public concerns with the Short-term solutions it is recommended that initially the improvements be taken incrementally and only when needed. If following the implementation of several of the recommendations a consensus emerges that the improvements are beneficial, then the combination of multiple intersections into a single project may be beneficial from a cost standpoint. A listing of the intersections to be upgraded as a part of the Short-term solution is included in Figure 4.1 and summarized as follows:

- Intersection 1 – Firefox Trace
- Intersection 2– Mt. Gilead Church/North Pea Ridge Road
- Intersection 3 – Big Woods Road/Seaforth Road
- Intersection 4 – Farrington Road/Beaver Creek Road
- Intersection 5 – NC 751/New Hill Road
- Intersection 6 – Jenks Road
- Intersection 7 – Kellyridge Road
- Intersection 8 – Knollwood Road
- Intersection 9 – Shepherds Vineyard Drive
- Intersection 10 – Lake Pine Drive
- Intersection 11 – Autopark Boulevard
- Intersection 12 – Mackenan Drive/Chalon Drive
- Intersection 13 – Gregson Drive
- Intersection 14 – Edinburgh Drive

The partitioning of the corridor for the Long-term solution is a less straight forward endeavor than for the Short-term solution as several of the recommended improvements would require multiple portions of the corridor be upgraded as a part of a single project. This is because some segments of the corridor are tied together with a common improvement that would need to be constructed as a single project in order to be effective. In general, many of the intersections that are recommended as future interchanges can be implemented individually if necessary, or as a part of a larger project to upgrade a longer section of the corridor. Each segment could be developed as a stand alone project and provide benefits to the overall US 64 Corridor. The segments were developed in a manner such that they would eliminate bottlenecks along the corridor and address any potential safety issues of converting the corridor to a higher level of access control while maintaining driver's expectations.

The evaluation of the corridor resulted in the development of 12 segments beginning at US 64 Business in Chatham County and extending east to the US 1 interchange in Cary. The segments are shown in Figure 4.2 and are summarized as follows:

- Segment A – West of Haw River
- Segment B – Mt. Gilead Church/North Pea Ridge Interchange
- Segment C – Big Woods Road/Seaforth Road Interchange
- Segment D – Jordan Lake Area
- Segment E – Farrington Road/Beaver Creek Road Interchange
- Segment F – NC 751/New Hill Road Interchange
- Segment G – Jenks Road Interchange
- Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area
- Segment I – Davis Drive Interchange Area
- Segment J – Laura Duncan Road/CSX Railroad Crossing Area
- Segment K – Lake Pine Drive Interchange
- Segment L – East of Lake Pine Drive to US 1 Interchange

4.2 DEVELOPING IMPLEMENTATION TIMEFRAME AND PRIORITY OF IMPROVEMENTS

For planning purposes it is important to anticipate when projects will likely be needed. Therefore, based on the current information known along the corridor, the projected timeframe and priorities will be developed to aid in the planning process. The first step in the development of the implementation plan is to determine when the existing intersections along US 64 are no longer functioning in an acceptable manner and need to be upgraded to the short-term improvements. The second step is to determine when each of the short-term solutions will no longer be functioning in an acceptable manner and require upgrading to the long-term improvements. The timeframes being considered for the implementation plan coincide with the timeframes used in the CAMPO Long Range Transportation Plan and include 2015, 2025 and 2035. 2015 projects are projects already underway that will occur between 2010 and 2015 with an expected completion date by 2015. The 2025 projects are programmed to occur between 2015 and 2025 while the 2035 projects are for programmed for the time period between 2025 and 2035 and include sections of roads forecasted to be beyond capacity by 2025 or 2035 and that can potentially be funded with existing revenue streams or reasonably foreseeable new revenue streams. A fourth timeframe (post 2035) will also be included for those improvements that will not be over capacity in 2035 but will eventually need to be upgraded to fulfill the Strategic Highway Corridor vision and accommodate traffic volumes beyond 2035.

The evaluation of both the existing conditions along the corridor and the proposed short-term improvements is directly tied to the operations of the signalized intersections. For a corridor, such as US 64, the element that has the greatest effect on the traffic operations is the signalized intersections. The determination of when a signalized intersection fails is not a direct quantitative evaluation where the point of failure can be identified definitively. The primary measure used in determining the operation of a signalized intersection is the Level of Service (LOS). The LOS for an intersection ranges from LOS A (nearly free flowing) to LOS F (failure of the intersection) and can be reported on an overall intersection basis or by each individual movement. Determining when an intersection will fail requires that a more qualitative analysis be undertaken. An intersection will typically fail in stages, with the first stage being a minor turning movement experiencing excessive delays which do not have a major effect on the overall intersection operation and is usually tolerated by most drivers. The second stage of failure is when a major movement begins to experience excessive delays, followed by the third stage which occurs when the entire intersection is over capacity and all

Figure 4.1: Short-term Solution Corridor Intersections

LEGEND

Short-term Solution Intersections

Corridor Intersection Number

Short-term Solution

Corridor Intersections

US 64 Corridor Study
Wake & Chatham Counties

Figure 4.2: Long-term Solution Corridor Segments

LEGEND

Long-term Solution Segments

Corridor Segment Number

Long-term Solution

Corridor Segments

US 64 Corridor Study
Wake & Chatham Counties

movements operate at an unacceptable level. Because the onset of the second stage of failure is where drivers are less tolerant of the delays it was determined that at this point the intersection would be considered to be failing.

The existing corridor also includes three major intersections that are currently unsignalized. The unsignalized intersections were evaluated and considered to be failing when the side street volumes exceeded the volumes that would warrant a signal being installed. It was also assumed that once an unsignalized intersection failed that the short-term improvement would be implemented instead of a standard signal.

The implementation plan for the US 64 corridor includes recommendations based on what is currently known along the corridor and what is expected to occur in the future. If a substantial safety or traffic operations problem develops along the corridor, NCDOT may implement solutions to improve safety and mobility along the corridor outside of what is included in this study.

One item that was clear from the public involvement efforts of the study was that the public wanted to see what effect the construction of NC 540 would have on the corridor, prior to implementing any of the improvements. The assumption is that once completed, NC 540 would allow some regional and statewide traffic to bypass the section of US 64 through Cary and Apex and allow the existing configuration to operate at an acceptable level. The Corridor Study Team considered this effect and agreed that the implementation of any of the Short-term solutions for the US 64 Corridor, from NC 540 to the US 1 interchange should be delayed until the time that NC 540 is open to traffic and the effects of the change in travel patterns can be evaluated.

4.2.1 Implementation Timeframe

The traffic operations analysis for the corridor was used to determine when each of the improvements would need to be implemented. Once it was determined when each of the improvements would be needed, the timeframe for implementation was developed. The selected timeframe for each of the improvements also includes other more qualitative considerations, such as the availability of funding and includes the consideration of the concerns from the public. For example, the highest priority along the corridor would be to upgrade Laura Duncan Road to an interchange; however due to the cost and the need to develop an environmental document for the improvement, it was moved to the 2015-2025 timeframe. Conversely, the intersection improvement at Jenks Road may not have the highest volumes along the corridor, but as an unsignalized intersection it became a higher priority because it will need to become a signalized intersection soon. Additionally, due to development in the area of Jenks Road, the recommended improvements may be included in the development plans and constructed by private entities.

The recommendations included in this section are based on the best available data and assumptions about the future growth in this area, are in no way to be seen as definitive measures for when the improvements should be implemented. Ongoing review of the safety and mobility along the corridor is essential to ultimately meeting the goals of the study. It is recommended that the Agreements signed as a part of this study include a working group that meets periodically to coordinate planning efforts along the corridor and monitor the changes along the corridor compared to the assumption made as a part of this study. It is likely that through ongoing coordination that the plans included in this study will be refined and improved as better data becomes available.

Prior to implementing any project along the corridor, the following two conditions need to be met: (1) a well defined need for the improvement based on empirical analysis including, traffic studies and/or crash analysis and safety studies; (2) an identified funding source.

The availability of funding may play a major role in the timeframe for implementation of the improvements along the corridor and is discussed in further detail in Section 4.2.3.

The results of the analysis for when improvements are anticipated to be implemented are shown in Table 4.1.

Table 4.1: Implementation Timeframe

Short-term Solution Intersections	Implementation Timeframe	Final Draft Short-term Solution
Intersection 1 – Firefox Trace	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 2– Mt. Gilead Church/North Pea Ridge Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 3 – Big Woods Road/Seaforth Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 4 – Farrington Road/Beaver Creek Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 5 – NC 751/New Hill Road	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 6 – Jenks Road	2010-2015	Superstreet with Direct Major Street Left Turn
Intersection 7 – Kellyridge Road	2015-2025	Left-in/Right-in/Right-out
Intersection 8 – Knollwood Road	2015-2025	Left-in/Right-in/Right-out
Intersection 9 – Shepherds Vineyard Drive	2015-2025	Included in Median U-turn Crossover at Lake Pine Drive
Intersection 10 – Lake Pine Drive	2015-2025	Median U-turn Crossover
Intersection 11 – Autopark Boulevard	2015-2025	Left-in/Right-in/Right-out
Intersection 12 – Mackenan Drive/Chalon Drive	2015-2025	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
Intersection 13 – Gregson Drive	2015-2025	Superstreet with Direct Major Street Left Turn
Intersection 14 – Edinburgh Drive	2015-2025	Superstreet with Direct Major Street Left Turn
Long-term Solution Segments	**Implementation Timeframe**	**Final Draft Long-term Solution**
Segment A – West of Haw River	Post 2035	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business
Segment B – Mt. Gilead Church/North Pea Ridge Interchange	Post 2035	Compact Diamond Interchange
Segment C – Big Woods Road/Seaforth Road Interchange	Post 2035	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
Segment D – Jordan Lake Area	2025-2035	Convert to right-in/right-out access
Segment E – Farrington Road/Beaver Creek Road Interchange	Post 2035	Compact Diamond Interchange
Segment F – NC 751/New Hill Road Interchange	2025-2035	Tight Diamond Interchange with US 64 relocated to the north
Segment G – Jenks Road Interchange	2025-2035	Partial Cloverleaf Interchange with loop in southwest quadrant
Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area	2025-2035	Kellyridge Road -Right-in/Right-out connecting to eastbound collector-distributor road. US 64 with collector-distributor roads in both directions along US 64.
Segment I – Davis Drive Interchange Area	2025-2035	Improvements to Davis Drive and US 64 Ramps
Segment J – Laura Duncan Road/CSX Railroad Crossing Area	2015-2025	Tight Interchange with modern roundabout configuration preferred
Segment K – Lake Pine Drive Interchange	2025-2035	Tight Interchange with modern roundabout configuration preferred
Segment L – East of Lake Pine Drive to US 1 Interchange	2025-2035	Upgrade short-term solution to 6-lane roadway along US 64 and add additional ramp lane to US 1 SB to US 64 WB ramp

4.2.2 Prioritization of Improvements

The priority of the projects was developed for the 2010-2015, 2015-2025, 2025-2035 and post 2035 timeframes using a similar process to the one used to determine the implementation timeframe. The prioritization is based on both the projected traffic operations and more qualitative measures such as community input and projected growth trends. The project priority for each implementation timeframe are included in Table 4.2 and shown on Figure 4.3 through Figure 4.6.

Table 4.2: Prioritization of Improvements Summary

2010-2015 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Intersection 6 – Jenks Road Intersection	Superstreet with Direct Major Street Left Turn
2015-2025 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment J – Laura Duncan Road/CSX Railroad Crossing Area	Tight Interchange with modern roundabout configuration preferred
2	Intersection 10 – Lake Pine Drive Intersection 9 – Shepherds Vineyard Drive	Median U-turn Crossover
3	Intersection 5 – NC 751/New Hill Road	Superstreet with Direct Major Street Left Turn
4	Intersection 3 – Big Woods Road/Seaforth Road	Superstreet with Direct Major Street Left Turn
5	Intersection 14 – Edinburgh Drive	Superstreet with Direct Major Street Left Turn
6	Intersection 13 – Gregson Drive	Superstreet with Direct Major Street Left Turn
7	Intersection 11 – Autopark Boulevard Intersection 12 – Mackenan Drive/Chalon Drive	Superstreet with Direct Major Street Left Turn with U-turn to eastbound US 64 at Autopark Boulevard
8	Intersection 7 – Kellyridge Road	Left-in/Right-in/Right-out
9	Intersection 4 – Farrington Road/Beaver Creek Road	Superstreet with Direct Major Street Left Turn
10	Intersection 2– Mt. Gilead Church/North Pea Ridge Road	Superstreet with Direct Major Street Left Turn
11	Intersection 8 – Knollwood Road	Left-in/Right-in/Right-out
12	Intersection 1 – Firefox Trace	Superstreet with Direct Major Street Left Turn
2025-2035 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment K – Lake Pine Drive Interchange	Tight Interchange with modern roundabout configuration preferred
2	Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area	Kellyridge Road -Right-in/Right-out connecting to eastbound collector-distributor road. US 64 with collector-distributor roads in both directions along US 64.
3	Segment L – East of Lake Pine Drive to US 1 Interchange	Upgrade short-term solution to 6-lane roadway along US 64 and add additional ramp lane to US 1 SB to US 64 WB ramp
4	Segment I – Davis Drive Interchange Area	Improvements to Davis Drive and US 64 Ramps
5	Segment F – NC 751/New Hill Road Interchange	Tight Diamond Interchange with US 64 relocated to the north
6	Segment G – Jenks Road Interchange	Partial Cloverleaf Interchange with loop in southwest quadrant
7	Segment D – Jordan Lake Area	Convert to right-in/right-out access

Post 2035 Implementation Timeframe		
Priority	**Intersection/Segment**	**Recommended Solution**
1	Segment E – Farrington Road/Beaver Creek Road Interchange	Compact Diamond Interchange
2	Segment C – Big Woods Road/Seaforth Road Interchange	Partial Cloverleaf Interchange with ramps and loops on west side of Big Woods/Seaforth Road
3	Segment B – Mt. Gilead Church/North Pea Ridge Interchange	Compact Diamond Interchange
4	Segment A – West of Haw River	Access Closed and new roadway constructed to provide access to Hanks Chapel Road and US 64 Business

4.2.2.1 2010-2015 Projects

The only project recommended for completion prior to 2015 is at Jenks Road (Intersection 6). The existing intersection is unsignalized and the traffic volume is increasing rapidly. The need for a signal at this location is rapidly approaching and with NC 540 under construction, the growth in the area is likely to increase. Several development plans are being considered in the Jenks Road vicinity and it is possible that the recommended improvements could be constructed as a part of the approval process for a large development in the area.

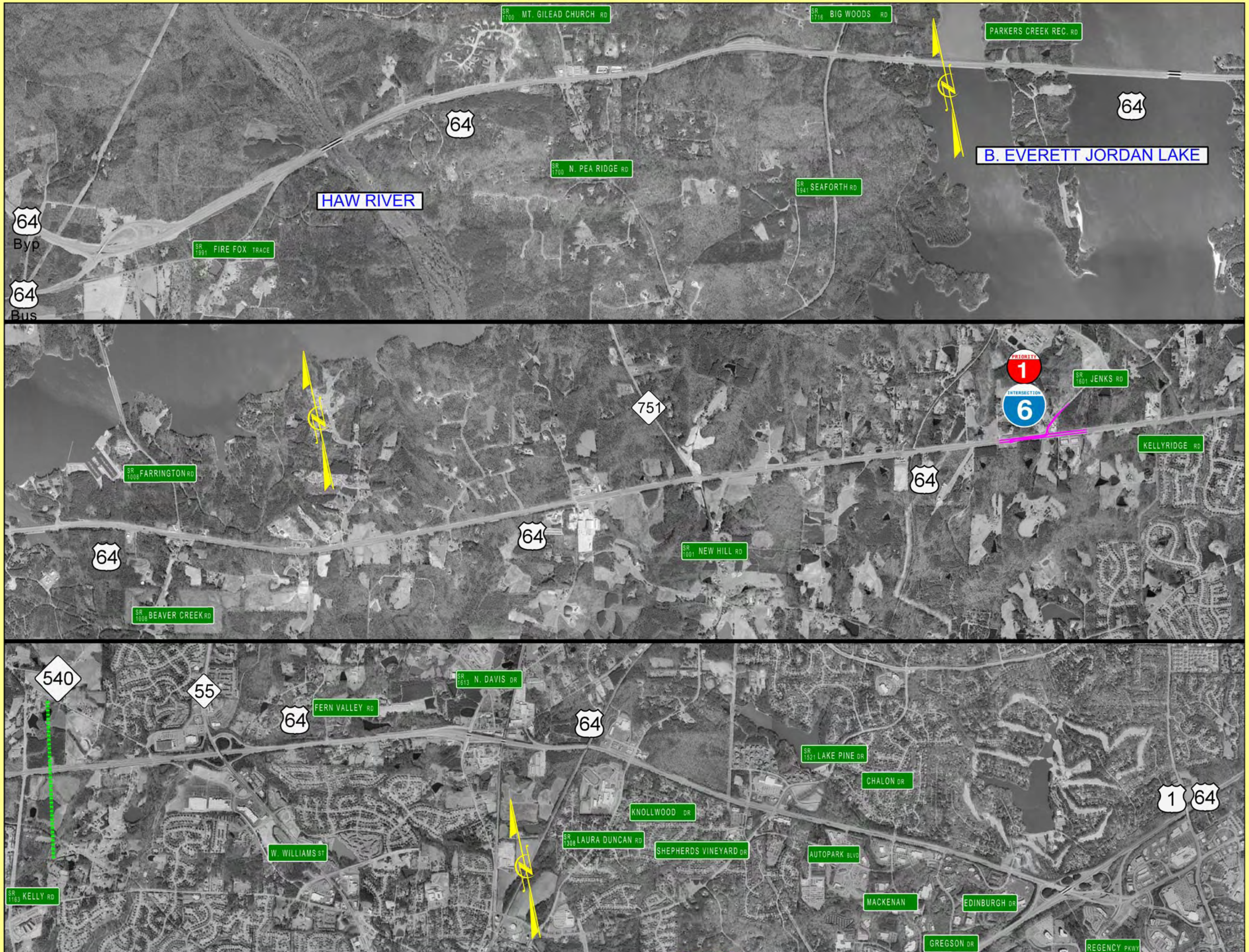
4.2.2.2 2015-2025 Projects

The projects that are recommended for implementation between 2015 and 2025 are generally the short-term solutions for the corridor, with one notable exception. The highest priority project will be to construct the interchange at Laura Duncan Road (Segment J) due to the high traffic volumes and the pedestrian traffic associated with Apex High School. This project was supported by the public and it was clear from the public outreach effort that improvements were need to this area to address safety concerns. The second highest priority along the corridor will be to implement the short-term improvements at Lake Pine Drive (Intersection 10), which also includes the changes to Shepherds Vineyard Drive (Intersection 9) due to its proximity to Lake Pine. The Lake Pine intersection is the highest volume intersection along the corridor and is the location that is currently causing the most congestion in the area. The third priority will be to implement the short-term solutions at NC 751/New Hill Road (Intersection 5) which is ranked at this level due to the high left turn volumes. The next priority will be to implement the short-term solution at Big Woods Road/Seaforth Road (Intersection 3) due to the likely need that a signal will be needed at this location. Priorities 5 through 7 include implementing the short-term solution at Edinburgh Drive (Intersection 14), Gregson Drive (Intersection 13), Mackenan Drive/Chalon Drive (intersection 12), and Autopark Boulevard (Intersection 11). Based on similar experiences, the traffic volumes in this area may temporarily drop when NC 540 is completed and eventually build to a level that will require the recommended improvements. It is assumed that the travel patterns associated with NC 540 will be well established and 3 or 4 other similar improvements will be in place along the corridor prior to implementing this series of improvements. The improvements for Intersections 11 through 14 can be implemented individually or as a part of a single project, and are dependent on the results of public involvement during the future study. It is likely that the improvements for Mackenan Drive/Chalon Drive and Autopark Boulevard will be completed as a single project due to their proximity and shared features. Priorities 8, 9, 10 and 12 include implementing the short-term solutions beginning at NC 540 and working to the west. Priority 11, Knollwood Road (Intersection 8) is a relatively minor change and will likely be based on traffic operations and safety associated with the interchange at Laura Duncan Road.

4.2.2.3 2025-2035 Projects

The projects that are recommended for implementation between 2025 and 2035 are generally implementing the long-term solution from just west of the Wake County line to US 1. Similar to with the short-term solution, the highest priority long-term solution (with the exception of the Laura Duncan interchange constructed prior to 2025) will be at Lake Pine Drive (Segment K) due to the heavy traffic volumes and pedestrian and bicycle access. The second priority will be to upgrade the area from Kelly Road to east of NC 55 by installing the

Figure 4.3: Implementation Plan - 2010-2015 Projects



LEGEND

Intersection/Segment Implemented by 2015

Corridor Intersection Number

Corridor Segment Number

2010-2015 Priority

Implementation Plan

2010-2015 Projects

US 64 Corridor Study
Wake & Chatham Counties

Figure 4.4: Implementation Plan - 2015-2025 Projects

LEGEND

Intersection/Segment Implemented by 2025

Intersection/Segment Implemented Prior to 2015

Corridor Intersection Number

Corridor Intersection Implemented Prior to 2015

Corridor Segment Number

Corridor Segment Implemented Prior to 2015

2015-2025 Priority

Implementation Plan

2015-2025 Projects

US 64 Corridor Study
Wake & Chatham Counties

Figure 4.5: Implementation Plan - 2025-2035 Projects

LEGEND

Intersection/Segment Implemented by 2035

Intersection/Segment Implemented Prior to 2025

Corridor Intersection Number

Corridor Intersection Implemented Prior to 2025

Corridor Segment Number

Corridor Segment Implemented Prior to 2025

2025-2035 Priority

Implementation Plan

2025-2035 Projects

US 64 Corridor Study
Wake & Chatham Counties

Figure 4.6: Implementation Plan - Post 2035 Projects

LEGEND

Intersection/Segment Implemented Prior to 2035

Corridor Intersection Implemented Prior to 2035

Corridor Segment Implemented Prior to 2035

Intersection/Segment Implemented after 2035

Corridor Intersection Number

Corridor Segment Number

Post 2035 Priority

Implementation Plan

Post 2035 Projects

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collector–distributor roadways as recommended for Segment H. The heavy traffic volumes to and from NC 540 and the close proximity of the quadrant interchange at Kelly Road will eventually degrade to a point where this section needs to be upgraded. The third priority will be to add the additional through lane in each direction from east of Lake Pine Drive to the US 1 interchange (Segment L) as it is likely that the heavy traffic volumes in this location will require the additional capacity within this timeframe. The fourth priority will be to upgrade the interchange at Davis Drive (Segment I) due to the high traffic volumes requiring additional capacity to Davis Drive and the US 64 ramps. The fifth and sixth priorities, similar to with the short-term, begin upgrading the area west of NC 540 to interchanges based on the increase in projected traffic volumes, with NC 751 (Segment F) being constructed prior to the interchange at Jenks Road (Segment G) due the higher projected traffic volumes on NC 751. The final improvement recommended for the 2035 timeframe will be to modify the area along Jordan Lake (Segment D) due to the increased traffic volumes not allowing adequate gaps to make left turns along US 64.

4.2.2.4 Post 2035 Projects

The improvements recommended for the period beyond 2035 are those that are projected to see increased traffic volumes soon after the 2035 planning horizon for this study that will require improvements. In general the post 2035 improvements will be upgrading the corridor from west of NC 751/New Hill Road to the US 64 Bypass interchange, working from east to west.

4.2.3 Funding

The ability to fund any of the improvements along the corridor is subject to the availability of funds. Currently, transportation funding is not able to keep pace with the growing need for improvements and the rapid inflation in construction costs. North Carolina's Long-Range Statewide Multimodal Transportation Plan, completed in 2004 identified the need for over $84 billion over the next 25 years with a projected $55 billion in revenues, generating a $29 billion shortfall. A 2006 update to this report showed that the gap had expanded to $65 billion over the next 25 years. Locally, the CAMPO Long Range Transportation Plan identifies $13.6 billion in needs over the next 25 years with only $8.2 billion in expected revenue, generating a $5.4 billion shortfall.

As shown above, the competition for the limited amount of project funding is very high and it is likely that the timeframes shown in this plan may be optimistic with the actual implementation lagging behind due to a growing number of unmet needs. The current CAMPO Long Range Transportation Plan allocates approximately $11 million of the nearly $430 Million estimated to upgrade the entire corridor included in this plan to the long-term solution in the next 25 years. The priorities in the Long Range Transportation Plan are updated every four years, but it is unlikely that, due to the competitive nature of funding situation, any major improvements needed to improve mobility along US 64 will be undertaken without strong community support. It should be noted that any safety needs that arise along the corridor will be undertaken by NCDOT in order to provide a safe roadway for the traveling public.

4.2.4 Study Recommendations

In addition to the detailed recommendations on the design of the short-term and long-term solutions, several additional recommendations are being made for the corridor by the Corridor Study Team, including the following:

- Conduct a speed study for the purpose of setting an appropriate speed limit along US 64 from Kellyridge Road to US 1 before NC 540 opens and after NC 540 opens.
- Place landscaping in the median and fencing along US 64 to encourage students to use the crosswalk at the Laura Duncan Road intersection.
- Make any improvements as aesthetically pleasing as possible (keep the green/boulevard feel along the corridor).
- Consider lowering the speed limit between Laura Duncan Road and US 1 when short-term solutions are implemented.
- Recommend the towns of Cary and Apex consider developing a no compression braking ordinance to reduce noise concerns.
- The Corridor Study Team recommends that NCDOT pursue the signing of US 64 along NC 540.
  - This recommendation would request that NCDOT consider a formal recommendation to designate the NC 540/US 1 roadways as US 64 Bypass and re-designate existing US 64 as US 64 Business by submitting an application to the American Association of State Highway and Transportation Officials (AASHTO) for approval. If approved by both NCDOT and AASHTO there may also be some legislative issues that would need to occur to allow the signing of a US route along a toll road.
- Recommend Town of Cary study extending Mackenan Drive to Regency Parkway over US 1 via a new bridge as part of next Comprehensive Transportation Plan.
- Recommend that the Long-term Solution be coordinated with the CAMPO Triangle Regional Intelligent Transportation System (ITS) Strategic Deployment Plan. The plan includes recommendations for the use of network surveillance through detectors and cameras and Dynamic Message Signs along US 64. The plan also recommends Emergency Management including a roadway service patrol vehicle for the portion of the corridor between NC 540 and US 1.
- Recommend that Chatham County review their land use policies and develop land use controls that would not allow the portion of the corridor within Chatham County to develop with strip mall type developments. Additionally, Chatham County and the Town of Pittsboro should consider the recommendations in this report as they evaluate emergency response times and provide additional fire stations as needed to accommodate the population growth.
- Recommend that the study partners take an active role in the development of local and regional transit efforts and take a proactive role in identifying park and ride facilities to enhance transit operations.

4.3 COST ESTIMATES

The primary goal of the implementation plan is to give stakeholders along the corridor a guide to not only what improvements will be needed along the corridor, but how much they are likely to cost and when they will be needed. The funding for the improvements included in this plan is uncertain and depends on many variables that are difficult to predict. The recommendations included in this plan are intended to be used by NCDOT, the Capital Area Metropolitan Planning Organization, Chatham and Wake Counties and the Towns of Pittsboro, Apex and Cary in the decision making process of planning and programming improvements throughout their individual organizations.

The preliminary construction costs of each of the recommended short-term and long-term improvements are included in Table 4.3. The right-of-way cost estimates are currently being developed and will be included in the Final report.

Table 4.3 : Cost Estimates

Short-term Solution Intersections	Construction Cost	Right-of-way Cost	Total Cost
Intersection 1 – Firefox Trace	$1,700,000	$0	$1,700,000
Intersection 2– Mt. Gilead Church/North Pea Ridge Road	$2,200,000	$927,000	$3,127,000
Intersection 3 – Big Woods Road/Seaforth Road	$2,100,000	$613,500	$2,713,500
Intersection 4 – Farrington Road/Beaver Creek Road	$2,900,000	$1,940,500	$4,840,500
Intersection 5 – NC 751/New Hill Road	$3,400,000	$913,500	$4,313,500
Intersection 6 – Jenks Road Interchange	$2,300,000	$786,000	$3,086,000
Intersection 7 – Kellyridge Road	$1,000,000	$309,000	$1,309,000
Intersection 8 – Knollwood Road	$625,000	$0	$625,000
Intersection 9 – Shepherds Vineyard Drive	$75,000	$313,500	$388,500
Intersection 10 – Lake Pine Drive	$3,600,000	$318,000	$3,918,000
Intersection 11 – Autopark Boulevard	$500,000	$313,500	$813,500
Intersection 12 – Mackenan Drive/Chalon Drive	$2,200,000	$313,500	$2,513,500
Intersection 13 – Gregson Drive	$1,550,000	$313,500	$1,863,500
Intersection 14 – Edinburgh Drive	$2,450,000	$313,500	$2,763,500
TOTAL	**26,600,000**	**$7,375,000**	**$33,975,000**
Long-term Solution Segments	**Construction Cost**	**Right-of-way Cost**	**Total Cost**
Segment A – West of Haw River	$3,300,000	$1,115,000	$4,415,000
Segment B – Mt. Gilead Church/North Pea Ridge Interchange	$27,600,000	$11,030,000	$38,630,000
Segment C – Big Woods Road/Seaforth Road Interchange	$14,800,000	$5,055,000	$19,855,000
Segment D – Jordan Lake Area	$15,000,000	$155,000	$15,155,000
Segment E – Farrington Road/Beaver Creek Road Interchange	$19,800,000	$9,250,000	$29,050,000
Segment F – NC 751/New Hill Road Interchange	$72,000,000	$9,760,000	$81,760,000
Segment G – Jenks Road Interchange	$25,900,000	$12,350,000	$38,250,000
Segment H – Kelly Road/NC 540/Green Level Church/NC 55 Area	$41,500,000	$6,555,000	$48,055,000
Segment I – Davis Drive Interchange Area	$23,800,000	$6,970,000	$30,770,000
Segment J – Laura Duncan Road/CSX Railroad Crossing Area	$33,300,000	$4,335,000	$37,635,000
Segment K – Lake Pine Drive Interchange	$33,900,000	$4,745,000	$38,645,000
Segment L – East of Lake Pine Drive to US 1 Interchange	$11,800,000	$795,000	$12,595,000
TOTAL	**$322,700,000**	**$72,115,000**	**$394,815,000**

Combining the prioritization of the short-term and long-term improvements with the costs included above, the funding needed for each implementation timeframe is summarized in Table 4.4.

Table 4.4: Implementation Funding Needs

Implementation Timeframe	Funding Needs
2010-2015	$3,086,000
2015-2025	$68,524,000
2025-2035	$265,230,000
Post 2035	$91,950,000
Total	**$428,790,000**

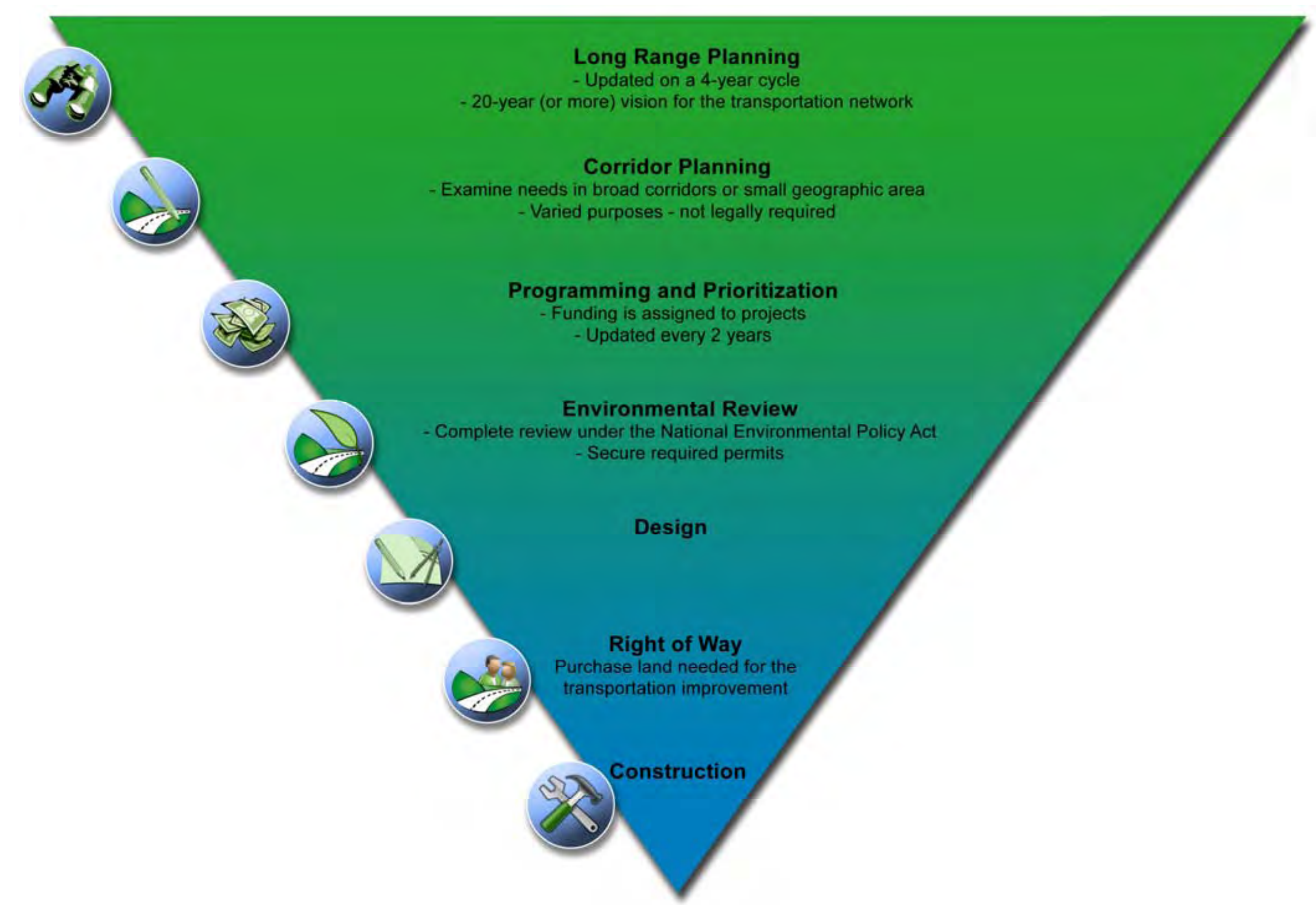
4.4 HOW ROADS ARE BUILT IN NORTH CAROLINA

Generalized, the process for building roads in North Carolina includes seven to eight phases (not all roads go through corridor planning):

- Long Range Planning
- Corridor Planning
- Prioritization and Programming
- Environmental Analysis
- Permitting
- Design
- Right-of-Way
- Construction

A brief description of these eight phases and an explanation of where the improvements to US 64 are in the decision-making process are provided in this section. The phases are not all conducted consecutively; environmental analysis, right-of-way, permitting and design all overlap to some extent. The graphic in Figure 4.7 depicts the general order of the major phases. The NCDOT also provides a good overview of the transportation decision making process in North Carolina on their website at: http://www.ncdot.gov/projects/roadbuilt/default.html.

Figure 4.7: Major Phases in Transportation Decision Making in North Carolina



4.4.1 LONG RANGE PLANNING

States and urbanized areas with populations over 50,000 are required by federal law to develop long range transportation plans. These plans describe the goals for an area's transportation system (including the road network, transit, bicycle and pedestrian facilities, etc.) 20 or more years in the future and are updated every four years (on average). Long range transportation plans are developed with input from the public and balance the planning area's goals and transportation needs. They are fiscally constrained and must address certain air quality requirements. The section of US 64 between Apex and Pittsboro is included in two long range transportation plans:

- North Carolina's statewide plan: *Charting a New Direction for NCDOT: North Carolina's Long-Range Statewide Multimodal Transportation Plan*, lists this section of US 64 as a Strategic Highway Corridor, as described in Section 1.1 of this report.
- The Capital Area Metropolitan Planning Organization's (CAMPO's) *2035 Long Range Transportation Plan* also addresses this section.

4.4.2 CORRIDOR PLANNING

Since there is no legislation that requires or guides corridor planning; corridor plans vary in their method and purpose. In general, corridor plans take a more detailed look at transportation issues at a smaller geographic scale than long range plans, but do not reach the level of detail of environmental analysis. The subject section of the US 64 corridor between Apex and Pittsboro has been studied in two corridor plans:

- The *US 64-NC49 Corridor Study* (also known as the Phase I Study)
- The current study documented in this report, *US 64 Corridor Study Phase IIA*

The Phase I study established the vision for the US 64 and NC 49 corridor from Charlotte and Statesville to Raleigh. An explanation of how it is related to the current study is provided in Section 1.5. The approach used in the Phase IIA study was described in detail in Section 1.4.

4.4.3 PRIORITIZATION AND PROGRAMMING

Programming refers to the process of assigning funds to projects in the long range transportation plan. The result of programming is a Statewide Transportation Improvement Program (STIP) listing the funded projects along with a brief description, location, estimated costs, funding source(s) and unfunded portion. While long range transportation plans are generally updated on a four-year cycle, the STIP is updated every two years, therefore, the long range transportation plan includes both funded and unfunded projects. Improvements to US 64 between Apex and Pittsboro are unfunded in the long range transportation plan – they have not yet gone through programming and are not included in the STIP. Likewise, the planned improvements to US 64 have not gone through any of the subsequent phases described in the remainder of this section.

Transportation projects can be paid for using federal, State, municipal, or private funds. The transportation decision making process varies depending on the source(s) of funds. The following sections briefly describe the processes of environmental analysis, design, right-of-way and construction for each funding source.

To improve project programming, NCDOT has established a new strategic planning process, which is built on professional, transparent and strategic decision making. This new process will use facts about pavement condition, traffic congestion and road safety, as well as input from local governments and NCDOT staff to determine the department's priorities. This data-driven approach will put projects for all modes of transportation in priority order, based on the department's goals (Safety, Mobility, Infrastructure Health), and serve as the primary input source for the STIP.

4.4.4 FEDERALLY FUNDED PROJECTS

4.4.4.1 Environmental Analysis (NEPA) and Permitting

Transportation projects that are built using federal funds are required to comply with the National Environmental Policy Act (NEPA). The NEPA requires agencies to assess the effects of their plans before making decisions and taking action. Public involvement is a required component of the NEPA process. The Council on Environmental Quality, which oversees NEPA at a national level, developed a guide to help citizens understand NEPA and is a good source of information for those who want to become involved in the decision making process.[1] According to NCDOT:

> The process [of environmental analysis] includes specialized environmental studies and coordination with the environmental regulatory agencies to ensure appropriate consideration is given to environmental matters. Specialists in such fields as noise and air quality, archaeology, architectural history, biology, land-use planning and sociology provide evaluations regarding the environmental impacts of proposed highway projects. The process also involves design and traffic engineering studies, which provide an analysis of highway alternatives to safely, efficiently and economically meet future travel demands.
>
> Citizens are encouraged to participate in this process by attending informational workshops and hearings held to obtain public comment and input on proposed highway projects. Public input is evaluated and addressed during the development of highway improvements.

In addition to going through the NEPA analysis, transportation projects must be approved by agencies with authority over sensitive resources in the vicinity and issued a permit. In North Carolina, one of the permits typically needed for transportation projects is a Section 404 permit, which is issued by the US Army Corps of Engineers and relates to impacts to waters of the United States (including wetlands). North Carolina uses a "Section 404/Merger 01 Process" (Merger Process) to concurrently address the requirements of NEPA and Section 404 of the Clean Water Act.[2] The Merger Process incorporates steps in the design and right-of-way phases and depending on the type of projects includes at least two opportunities for public involvement and often times more. During the process there are multiple points of coordination with resource agencies and with public stakeholders. Typical outreach methods include newsletters, small group meetings, open houses, telephone hotlines and web-based materials.

4.4.4.2 Design

Typical section options (number of lanes, curb and gutter, shoulder, median section, etc.), hydraulic structure requirements (bridge or culvert and length of bridge), and preliminary designs (horizontal and vertical alignments, edge of pavements, slope stakes, turn lanes, superelevation and right of way limits) are developed in the course of environmental analysis (see steps 12 through 15). Once a preferred alternative is selected (Step 22), further refinement of the preliminary design takes place to avoid and minimize impacts to sensitive resources (Step 23). All of this information is included in the environmental document issued as part of environmental analysis.

After the final environmental document is issued, final surveys are requested in order to develop right of way plans, finalize horizontal and vertical alignment, begin drainage design, identify utility locations and conduct geotechnical investigations. A meeting is held among all agencies involved in the Merger 01 Process when the

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[1] Council on Environmental Quality Executive Office of the President. "A Citizen's Guide to the NEPA: Having your Voice Heard." December 2007. Available: http://ceq.hss.doe.gov/nepa/Citizens_Guide_Dec07.pdf

[2] North Carolina Department of Transportation. "The Merger Process." Available: http://www.ncdot.gov/doh/preconstruct/pe/MERGER01/PIDProcessII.html#SBS19.

drainage design is 30% complete (Step 29). Several more steps are required until final designs are completed, including the rendering of a permit decision and development of right-of-way plans. According to NCDOT:

> During the course of the right of way acquisition, the Design Engineers will begin to develop the final plans for the project. The final design is a very detailed design that also includes computing and summarizing the contract quantities required for the project, incorporating right of way revisions, compiling plans from various units (Mobility and Safety Division, Roadside Environmental Unit, Utilities Section, etc) and incorporating them in the project. NCDOT will make sure that all environmental commitments and permit conditions are incorporated. NCDOT will ensure that construction drawings match the permit plan drawings and permit conditions, including any permit modifications.

4.4.4.3 Right-of-Way

On their website, NCDOT provides a good summary of the right-of-way process:

> Right-of-way is the process NCDOT goes through to obtain the land needed to complete highway projects. This is the last major activity to occur between the completion of design and the release of the project to bidders for construction.
>
> In many cases, it is inevitable that a certain amount of private property must be acquired. The displacement of homes and businesses is minimized to the extent practicable. In the acquisition of right-of-way, the NCDOT must treat all property owners with impartiality, fully explain all legal rights, pay just compensation in exchange for property rights, furnish relocation assistance and initiate legal action should a settlement not be reached.

4.4.4.4 Construction

A brief description summarizing construction is also provided:

> Once the road design is complete, bids are received for construction on the identified date and are publicly disclosed. The Board of Transportation awards the contract to the lowest responsible bidder. The bidder (private contractor) is then obligated to construct the project in accordance with plan requirements and specifications upon which the bid was received.
>
> NCDOT staff in the Division of Highways administer the contract and provide inspection and testing functions to assure the project is properly constructed. An NCDOT resident engineer and his/her staff interpret plan details and contract requirements, test for quality, check for conformity with contractual requirements and document the quantity of work performed so the contractor can be paid on a monthly basis. The resident engineer and staff also make certain the environment is protected, manage traffic flow along the project, work with adjacent property owners, observe work zone safety and oversee coordination with state and federal agencies.
>
> Once the project is complete, a final inspection is made by an engineer not involved in the project's construction to verify it has been completed properly. The highway is then opened to traffic.

4.4.5 State-Funded Projects

The legislation guiding the environmental analysis of state-funded projects is called the North Carolina State Environmental Policy Act (SEPA). The SEPA was modeled after NEPA and has very similar requirements and procedures. Any action that has gone through the federal NEPA process automatically meets the requirements of SEPA, so that projects that receive both federal and state funding only need to go through NEPA. There are slight variations between NEPA and SEPA, for example SEPA does not require a public hearing; however, public hearings are considered a priority for controversial projects that go through SEPA.

4.4.6 Locally-Funded Projects

Locally funded projects along US 64 would be those taken on by the towns of Pittsboro, Apex and Cary. Coordination with town staff indicates that because US 64 is owned and maintained by NCDOT that the local governments were not likely to include improvements on US 64 as a part of the Capital Improvements Program (CIP). It is recommended that in the event that a locally-funded improvement project be developed along the corridor, that the local municipality work with the US 64 Corridor working group that is recommended to be formed at the completion of this study, to ensure that adequate public involvement occurs during the planning phase of the project.

4.4.7 Privately-Funded Projects

Each of the local governments along the corridor have development standards that require private developers who are making a substantial increase in traffic volumes generate a traffic study. If the standards for traffic operations are not met then the developer would be required to make improvements to the transportation system in order to mitigate the negative effects associated with the proposed development. Privately funded projects along US 64 are not uncommon and it is likely that as development increases that additional improvements along US 64 will be required by private developers. There is no set procedure for public involvement regarding privately funded projects; however they typically involve approval by the Town Council. Driveway Permits would be required from NCDOT and may require improvements be made to mitigate impacts to traffic operations and safety. Due to the controversy surrounding this study, it is recommended that the local municipalities work with the US 64 Corridor working group that is recommended to be formed at the completion of this study, to ensure that adequate public involvement occurs during the development phase for any improvements along US 64.

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Chapter 5: System Linkage Evaluation

CHATHAM 64 WAKE

CHATHAM COUNTY NORTH CAROLINA

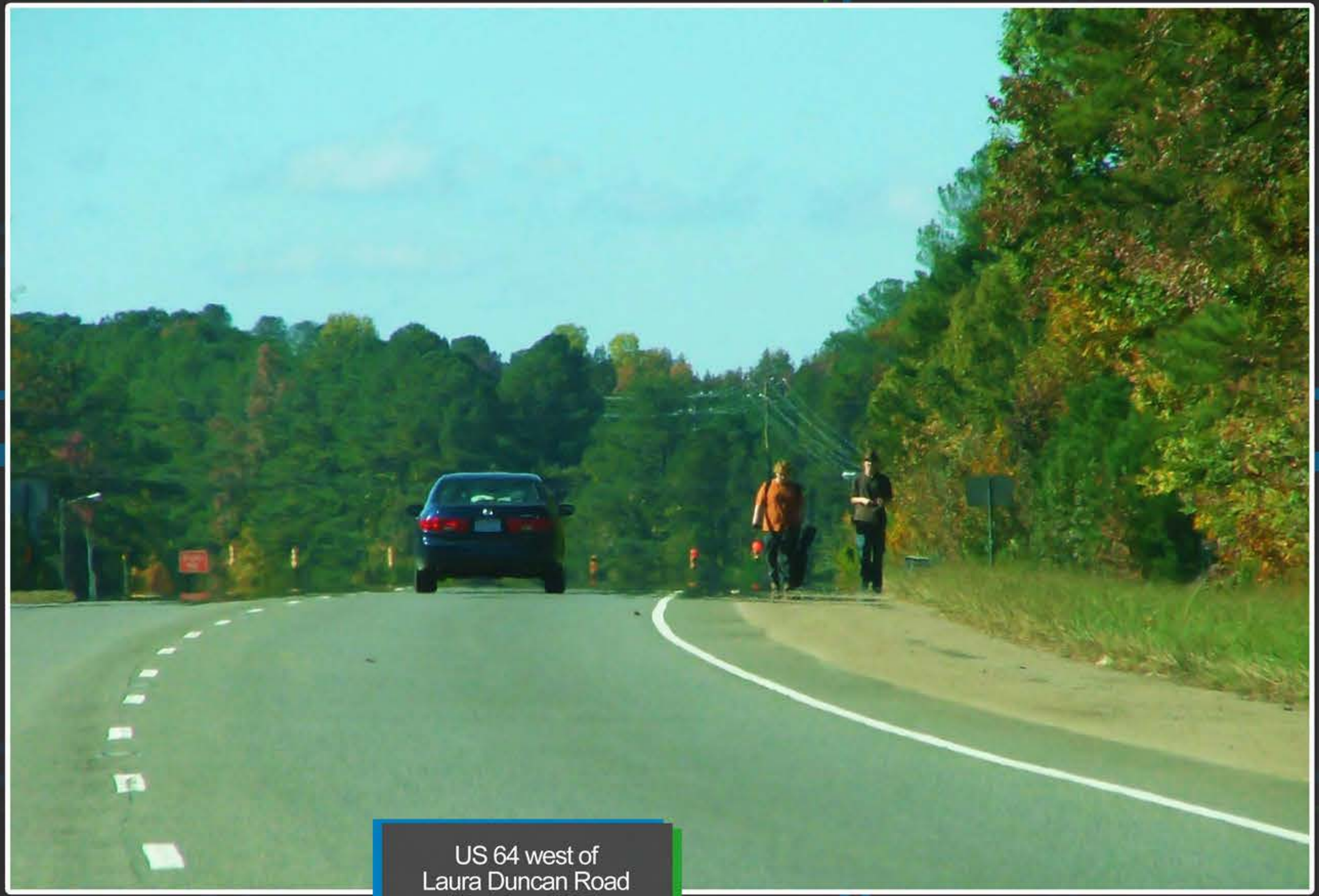
WAKE COUNTY NORTH CAROLINA

STATE OF NORTH CAROLINA · DEPARTMENT OF TRANSPORTATION

APEX 1873 NORTH CAROLINA

TOWN OF PITTSBORO, NORTH CAROLINA 1787

Capital Area Metropolitan Planning Organization



US 64 west of
Laura Duncan Road
(October 2009)

CHAPTER 5. SYSTEMS LINKAGE EVALUATION

An evaluation of the multi-modal systems along the US 64 corridor is the focus of this chapter. The primary means of transportation along US 64 is by motor vehicle; however, there is a substantial need to provide for improved connectivity for all modes of transportation, including transit, bicycles and pedestrians.

5.1 MULTI-MODAL PLANS

There are a number of plans along the corridor that discuss providing multi-modal systems throughout the study area. The following section provides summaries of the current plans.

5.1.1 Town of Pittsboro Pedestrian Transportation Plan (2009)

The Town of Pittsboro Pedestrian Transportation Plan was completed in 2009 and includes recommendations for pedestrian improvements within the planning jurisdiction of the Town. The plan includes a proposed greenway along the west side of the Haw River that would pass beneath the existing US 64 bridges over the Haw River. The plan does not include any other proposed pedestrian improvements within the study area.

5.1.2 Town of Apex Bicycle, Pedestrian and Equestrian Plan (2002, Amended 2009)

The Town of Apex developed the Apex Transportation Plan in 2002, since this time the maps included in the plan have been updated and reflect the currently approved plans for bicycle, pedestrian and equestrian facilities within the Town of Apex planning jurisdiction. The plan includes the following information for locations within the study area:

- US 64 – proposed multi-use path for bicycles and pedestrians along US 64 from the Chatham County line to east of Lake Pine Drive
- New Hill Road – proposed wide outside lanes for bicycles and sidewalks on both sides of the road
- Jenks Road/Jenks Road Extension – proposed wide outside lanes for bicycles and sidewalks on both sides of the road
- Kelly Road - proposed wide outside lanes for bicycles and sidewalks on both sides of the road
- Creekside Landing Drive – existing multi-use path across US 64
- Green Level Church Road - proposed wide outside lanes for bicycles and sidewalks on both sides of the road
- NC 55 – proposed sidewalk on one side of the road and proposed greenway beginning on the north side of US 64
- Davis Drive/North Salem Street (through US 64 interchange area) - proposed wide outside lanes for bicycles and sidewalks on both sides of the road
- North Salem Street (north of US 64) – proposed wide outside lanes for bicycles
- Laura Duncan Road – proposed wide outside lanes for bicycles, sidewalks on both sides of the road and a proposed multi-use path north of US 64
- Shepherd's Vineyard Drive – proposed sidewalk on south side of US 64, proposed pedestrian bridge over US 64
- Lake Pine Drive – proposed wide outside lanes for bicycles and sidewalks on both sides of the road

5.1.3 Town of Apex Transit Plan (2002, Amended 2009)

The Town of Apex developed the Apex Transportation Plan in 2002, since this time the maps included in the plan have been updated and reflect the currently approved plans for transit within the Town of Apex planning jurisdiction. The plan includes the following information for locations within the study area:

- An existing Triangle Transit bus route along US 64 from the eastern edge of the planning jurisdiction to NC 55
- An existing Triangle Transit bus route along NC 55
- Two existing railroads running in the north-south direction between Davis Drive and Laura Duncan Road
- A future Cary Transit bus corridor along Lake Pine Drive between Cary and downtown Apex
- A proposed future regional light rail corridor running in the north-south direction along the existing rail corridor slightly west of Laura Duncan Road

5.1.4 Town of Apex Parks, Recreation, Greenways and Open Space Master Plan (2001)

The Town of Apex developed the Parks, Recreation, Greenways and Open space Master Plan in 2001. The plan includes the following information for locations within the study area:

- US 64 – proposed multi-use path for bicycles and pedestrians along US 64 from the Chatham County line to east of Lake Pine Drive
- American Tobacco Trail – existing multi-use path
- New Hill Road – proposed sidewalks on both sides of the road
- Jenks Road/Jenks Road Extension – proposed sidewalks on both sides of the road
- Kelly Road - proposed sidewalks on both sides of the road
- Creekside Landing Drive – existing multi-use path across US 64
- Green Level Church Road - existing sidewalks on both sides of the road
- NC 55 – proposed sidewalk on one side of the road and proposed greenway beginning on the north side of US 64
- Davis Drive/North Salem Street (through US 64 interchange area) - proposed sidewalks on both sides of the road and designated as an existing bicycle route
- Laura Duncan Road – existing sidewalks on west side of road and proposed sidewalk on east side of road with an at-grade crossing of US 64
- Lake Pine Drive – proposed sidewalks on both sides of the road with an at-grade crossing of US 64

5.1.5 Town of Cary Comprehensive Pedestrian Plan (2007)

The Town of Cary developed the Town of Cary Comprehensive Pedestrian Plan in 2007 and it was subsequently included as the pedestrian element of the Town of Cary Comprehensive Transportation Plan that was completed in 2008. The plan includes the following information for locations within the study area: a funded sidewalk project along Mackenan Drive, south of US 64. In addition to the above improvement, sidewalks have previously been approved along Queensferry Road and Glasgow Roads to the north of US 64.

5.1.6 TOWN OF CARY COMPREHENSIVE TRANSPORTATION PLAN (2008)

The Town of Cary adopted their Comprehensive Transportation Plan in September 2008 and it included bicycle element and a transit element, as well as the incorporation of the Comprehensive Pedestrian Plan as the pedestrian element. The bicycle element of the Comprehensive Transportation Plan includes the following information for locations within the study area: proposed Swift Creek Greenway that follows Mackenan Drive to US 64, crosses US 64 and runs parallel to US 64 before turning to the northwest and intersecting with Lake Pine Drive.

The transit element of the Comprehensive Transportation Plan includes the following information for locations within the study area: a future Cary Transit route from downtown Cary to NC 55 slightly south of US 64, via downtown Apex, which is proposed to travel along the Lake Pine Drive and NC 55 corridors.

5.1.7 TOWN OF CARY PARKS, RECREATION AND CULTURAL RESOURCES FACILITIES MASTER PLAN (2003)

The Town of Cary adopted the Parks, Recreation and Cultural Resources Master Plan in December 2003. The plan includes the following information for locations within the study area: proposed Swift Creek Greenway that follows Mackenan Drive to US 64, crosses US 64 and runs parallel to US 64 before turning to the northwest and intersecting with Lake Pine Drive.

In addition to the Master Plan, the Town of Cary also published a *Bike&Hike Map* that includes the Swift Creek Greenway following the same path, but includes a future pedestrian tunnel or bridge across US 64.

5.1.8 WAKE COUNTY TRANSPORTATION PLAN (2003)

The Wake County Transportation Plan was adopted in 2002 and includes a portion of the US 64 near the western edge of the county. The plan includes the following information for locations within the study area:

- NC 751 – proposed wide outside lanes for bicycles
- American Tobacco Trail – existing multi-use path
- Kelly Road - proposed wide outside lanes for bicycles

5.1.9 CAPITAL AREA METROPOLITAN PLANNING ORGANIZATION – 2035 LONG RANGE TRANSPORTATION PLAN (2009)

The Capital Area MPO Long Range Transportation Plan was adopted in May 2009. The plan includes the following information related to regionally significant off-road and on-road facilities for locations within the study area:

- US 64 corridor from the Chatham County line to US 1 identified as a significant on-road facility for bicycle accommodations
- NC 751 and Kelly Road identified as significant on-road bicycle –pedestrian facilities
- NC 55 identified as a state bicycle route

The Long Range Transportation Plan also includes recommendations for future transit service including the following:

- Express bus service along NC 540/I-540 corridor and along NC 55 corridor
- Light rail line from Apex to Cary crossing US 64 between Laura Duncan Road and Davis Drive

5.1.10 NORTH CAROLINA DEPARTMENT OF TRANSPORTATION CHATHAM COUNTY BICYCLE MAP

NCDOT developed a bicycle map for Chatham County in the 1990's that designated the bicycle routes within the county. The map includes the following information for locations within the study area: bicycle connector routes along Hanks Chapel Road, Mt. Gilead Church/North Pea Ridge Road, and Farrington Road/Beaver Creek Road.

5.1.11 OTHER FACILITIES WITHIN THE STUDY AREA

In addition to the approved plans within the study area, two major existing facilities and one proposed facility are important features for systems linkage along the US 64 Corridor.

American Tobacco Trail

The American Tobacco Trail is a 22-mile long Rails-to-Trails project, running along an abandoned railroad bed originally built for the American Tobacco Company in the 1970s. The route crosses through the City of Durham, Durham County, Chatham County, the Town of Apex, the Town of Cary and Wake County. The American Tobacco Trail is part of the East Coast Greenway and is open to pedestrians, cyclists, equestrians (in non-urban sections), and other non-motorized users. The American Tobacco Trail crosses the US 64 corridor in western wake county through a culvert under US 64.

Jordan Lake State Recreation Area

The Jordan Lake State Recreation Area is located in Chatham County and is maintained by the North Carolina Division of Parks and Recreation and includes a 14,000 acre reservoir and nine recreation areas, including: Crosswinds Campground, Ebenezer Church, Parker's Creek, Poplar Point, Seaforth, Vista Point, Robeson Creek, New Hope Overlook, and White Oak Recreation Area. In addition to the State Park, the Crosswinds Marina is maintained by a private concessionaire, Farrington Point is maintained by the North Carolina Wildlife Resources Commission and the US Army Corp of Engineers maintains Poe's Ridge.

Mountains to Sea Trail

The Mountains to Sea Trail, an effort to link Clingman's Dome in the Great Smoky Mountains National Park to Jockey's Ridge State Park on the outer banks, is the flagship project of the North Carolina State Trails Program. Today, over 450 miles of the 1,000 mile route are open for use. Partners across North Carolina are helping to plan and build the trail to link communities together and to serve as the backbone of a growing system of land and water trails. The Mountains-to-Sea Trail primary route is planned to cross substantially north of the US 64 corridor through Orange, Durham and Wake Counties; however, the Draft map for the Piedmont Section of the trail includes an alternative route that will cross US 64 along the west side of the Haw River (similar to the location shown in the Pittsboro Pedestrian Plan) and along Big Woods Road/Seaforth Road.

5.2 EVALUATION OF SYSTEM LINKAGE

The following section will include developing an inventory of the existing conditions along the corridor and evaluating the recommended short-term and long-term solutions to provide adequate systems linkage along the corridor.

5.2.1 EXISTING SYSTEM LINKAGE

An inventory of the existing system linkage within the study area was completed and is **shown in** Figure 5.1**.**

Figure 5.1: Systems Linkage - Existing Conditions

LEGEND

Existing Pedestrian Facilities

Existing Transit Stops

System Linkage

Existing Conditions

US 64 Corridor Study
Wake & Chatham Counties

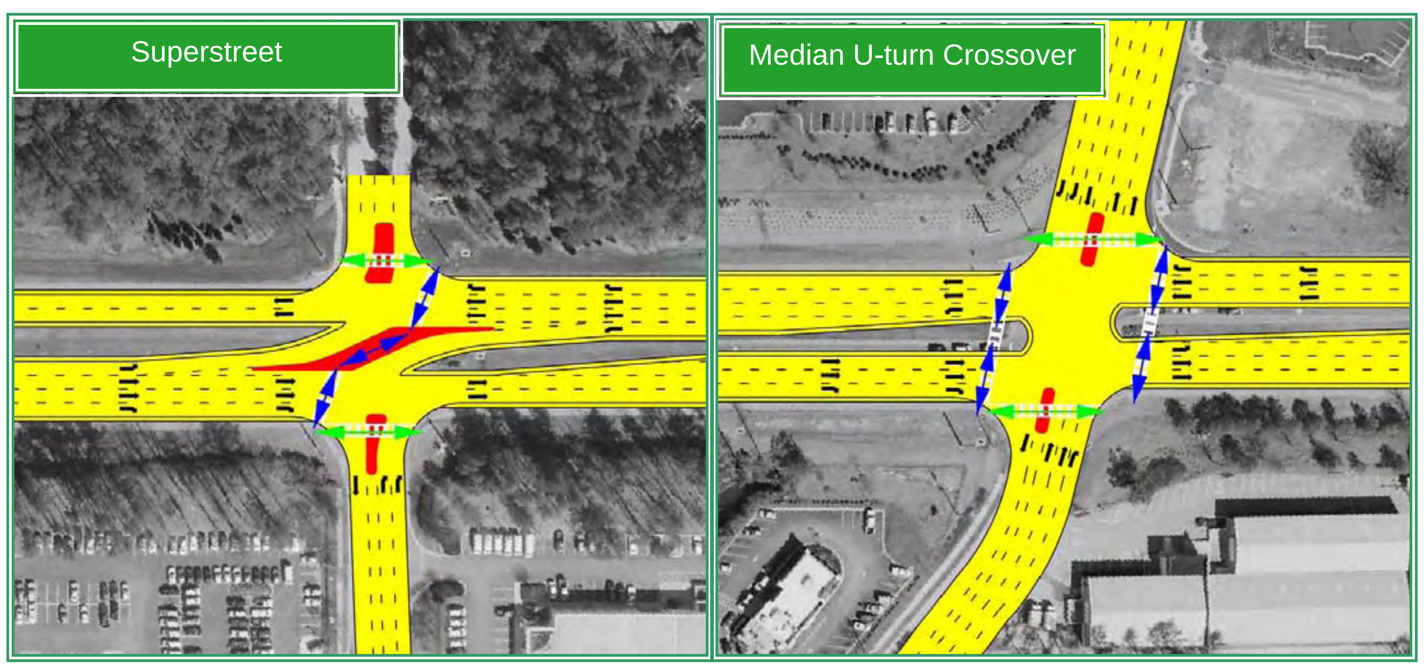
5.2.2 Evaluation of Short-term Alternative

The evaluation of the system linkage for the short-term solution included assessing the short-term solution for bicycle and pedestrian connectivity. Transit was also evaluated; however, due to the changing nature of routing for buses, the routes for buses were not included in the detailed assessment. None of the current bus routes would be substantially affected by the design of the short-term solution. Any future transit improvements will need to be evaluated in the future to determine if they are compatible with the design.

The primary goal of the short-term solution is to improve the safety and mobility along the existing corridor; therefore, the evaluation of system linkage concentrates on maintaining the connectivity along the US 64 corridor to a level that is compatible with the existing system linkage. More extensive system linkage, that would provide full connectivity along the corridor, is included for the long-term solution and may be implemented during the time period that the short-term solution is implemented. The main solutions that are included in the short-term solution are the use of Superstreet and Median U-turn Crossover designs.

The pedestrian connectivity provided by the Superstreet and Median U-turn Crossover configurations includes a two-stage crossing of US 64 and is shown (in blue) in Figure 5.2. The two-stage pedestrian crossing for the Superstreet utilizes a diagonal crossing of US 64 that allows for pedestrians to cross without any directly conflicting traffic. The Superstreet crossing requires pedestrians to cross from the northeast quadrant of the intersection to the southwest quadrant of the intersection, or vice versa. The diagonal crossing would require pedestrians who originate or are destined for locations in the northwest and southeast quadrants to first cross the side street to utilize the diagonal crossing. The two-stage pedestrian crossing for the Median U-turn Crossover would utilize a standard pedestrian crossing pattern with crosswalks on all four approaches to the intersection. The need for a two-stage crossing is to allow for improved traffic operations by allowing the signals along the corridor to be coordinated in each direction.

Figure 5.2: Pedestrian and Bicycle System Linkage – Short-term Solution



The bicycle connectivity provided by the Superstreet and Median U-turn Crossover configurations is substantially different depending on which configuration is included in the recommended short-term solution. The bicycle connectivity for the Superstreet would require the cyclist to choose to either act as a pedestrian and utilize the crosswalks, in the same manner as described above, or act as a vehicle and follow the same path as a driver would. If the cyclist acts as a vehicle they would be required to turn right at the intersection, travel to the downstream u-turn location and return in the opposite direction to the intersection to complete their crossing. There is a safety concern where cyclists act as vehicles as they must travel a longer distance and mix with weaving vehicular traffic. The bicycle connectivity for the Median U-turn Crossover configuration allows for bicyclists to act as vehicles and cross the intersection in the same manner as they would a standard signalized intersection.

Due to this safety concern the Corridor Study Team evaluated the corridor and determined that the intersections with Laura Duncan Road and Lake Pine Drive would be the two locations that would have the highest cross traffic for cyclists. The recommended short-term solution at Laura Duncan Road is a tight modern roundabout interchange, which will provide the cross connectivity. The recommended short-term solution at Lake Pine Drive is the Median U-turn Crossover which allows for cross connectivity for cyclists.

The Corridor Study Team also evaluated each of the intersections along the corridor to determine if striped pedestrians crosswalks should be provided. The Corridor Study Team determined that crosswalks would be provided at each of the intersections east of the Davis Drive interchange. In addition to the crosswalks at the intersections, a signalized pedestrian crossing with crosswalk is included in the plan slightly west of the U-turn movement located west of Lake Pine Drive. This location will improve pedestrian access to the library and to Apex Community Park. The development of the plans for the pedestrian connections to this crossing will be undertaken by the Town of Apex Planning Department. To accommodate the future Swift Creek Greenway a signalized pedestrian crossing with crosswalk is included in the plan slightly west of the U-turn movement located at Autopark Boulevard. This location will provide improved pedestrian access to Apex Community Park and the development of the plans for the pedestrian connections, including evaluating a pedestrian overpass or tunnel for this crossing will be undertaken by the Town of Cary Parks and Recreation Department.

A summary of the proposed system linkage within the study area for the short-term solution is shown in Figure 5.3.

Figure 5.3: Systems Linkage - Short-term Solution

LEGEND

Existing Pedestrian Facilities

Proposed Pedestrian Facilities

System Linkage

Short-term Solution

US 64 Corridor Study

Wake & Chatham Counties

5.2.3 EVALUATION OF LONG-TERM ALTERNATIVE

The evaluation of the system linkage for the long-term solution included a full assessment of the bicycle and pedestrian connectivity for the long-term solution. Transit was also considered; however, due to the evolving nature of mass transit options being considered within the Triangle region, the full implementation of transit in this section was not included. Any future transit improvements will need to be evaluated in the future to determine if they are compatible with the recommended design for the long-term solution.

The first step in evaluating the system linkage for the long-term solution was to determine if the recommended design would be compatible with the recommendations included in the multi-modal plans described in Section 5.1. Based on the evaluation it was determined that the recommended long-term design could be made consistent with the following multi-modal plans:

- Town of Pittsboro Pedestrian Transportation Plan
- Town of Apex Transit Plan
- Town of Cary Comprehensive Pedestrian Plan
- Town of Cary Comprehensive Transportation Plan
- Town of Cary Parks, Recreation and Cultural Resources Facilities Master Plan
- Wake County Transportation Plan
- NCDOT Chatham County Bicycle Map
- American Tobacco Trail
- Jordan Lakes State Recreational Area
- Mountains to Sea Trail

The proposed long-term solution would not be completely consistent with the following three multi-modal plans:

- Town of Apex Bicycle, Pedestrian and Equestrian Plan
- Town of Apex Parks, Recreation, Greenways and Open Space Master Plan
- CAMPO 2035 Long Range Transportation Plan

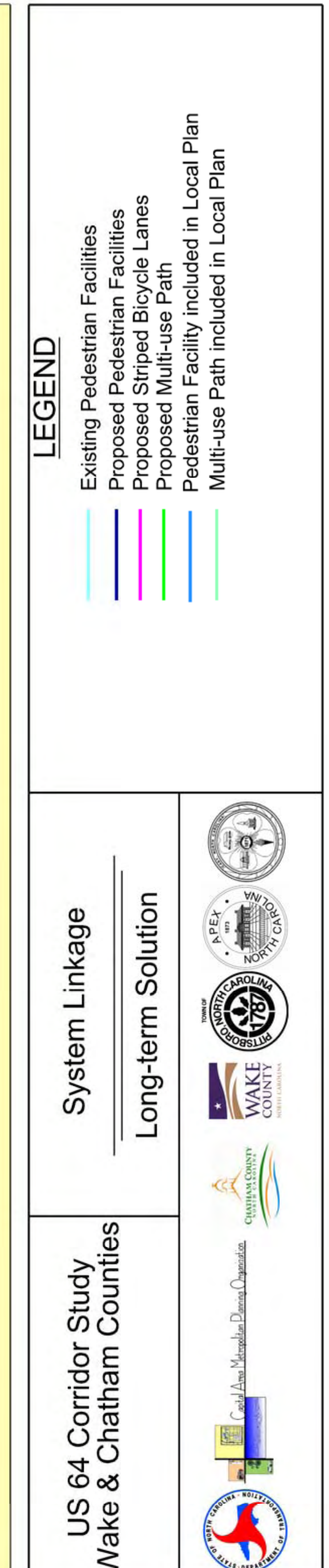
The inconsistency with the two plans developed by the Town of Apex relates to the inclusion of a multi-use path along US 64 from the Chatham County line to east of Lake Pine Drive. The recommended design from Kelly Road to east of Laura Duncan Road is not conducive to a multi-use path due to safety concerns relating to the interaction between free flowing vehicular traffic along US 64 and bicyclists and pedestrians along the multi-use path. The recommended long-term solution does not include any signalized intersections from NC 540 to Laura Duncan Road. Similarly, the inconsistency with the CAMPO Long Range Transportation Plan is due to the designation of US 64 as a significant on-road facility for bicyclists.

The inconsistencies with the local plans were discussed with the Corridor Study Team members representing the Town of Apex and the CAMPO to determine if the inconsistencies could be addressed by providing alternate connectivity or by modifying the design to be consistent with the local plan. It was determined that alternative means of connectivity that provide comparable pedestrian and bicycle access would be the best means of addressing the inconsistency. The Town of Apex stated that the existing or proposed pedestrian and bicycle connectivity through the subdivisions adjacent to US 64 would provide similar access and connectivity to the multi-use path proposed on their plans.

Once it was determined that the long-term solution could be made compatible with all of the multi-modal plans or adequate alternative connectivity could be utilized, the next step was to develop a comprehensive set of measures to address the system linkage. The results of the evaluation of system linkage for the long-term solution are shown on Figure 5.4 and summarized as follows:

- A 12-foot wide multi-use path would be constructed along the south side of US 64 from slightly west of the Haw River to slightly east of Jenks Road with a portion of the eastbound US 64 lanes being shifted to the median in the vicinity of the Haw River and Jordan Lake.
- The multi-use path crossings at major roadways will be accommodated at the signalized intersections where the ramp intersects the side street.
- A multi-use path could be constructed along the west side of the Haw River, crossing under the existing US 64 bridges over the Haw River, to provide the connectivity recommended for the Mountain to Sea Trail alternative route.
- A striped bicycle lane along both directions of Mt. Gilead Church Road/North Pea Ridge Road could be incorporated to accommodate the designated bicycle route.
- A multi-use path along the east side of Big Woods Road/Seaforth Road that would provide access to the future Chatham County Park and the connectivity recommended for the Mountain to Sea Trail alternative route could be constructed.
- A striped bicycle lane along both directions of Farrington Road/Beaver Creek Road could be incorporated to accommodate the designated bicycle route.
- A pedestrian overpass of US 64 slightly east of the Farrington Road/Beaver Creek Road interchange could be constructed to provide cross connectivity between the service road on the north side of US 64 and the multi-use path on the south side providing improved access to Jordan Lake State Park.
- A striped bicycle lane along both directions of NC 751/New Hill Road could be incorporated to accommodate bicycle traffic and sidewalks on both sides;
- Sidewalks and bicycle lanes on both sides of Jenks Road and the Future Jenks Road Extension as recommended in the Town of Apex Bicycle, Pedestrian and Equestrian Plan could be incorporated.
- A striped bicycle lane along both directions of Kelly Road to accommodate bicycle traffic and sidewalks on both sides as recommended in the Town of Apex Bicycle, Pedestrian and Equestrian Plan could be incorporated.
- A striped bicycle lane along both directions of NC 55 to accommodate the designated bicycle route and a sidewalk on the western side of the roadway that can transition to a multi-use path north of the interchange as recommended in the Town of Apex Bicycle, Pedestrian and Equestrian Plan could be incorporated.
- Sidewalks on both sides and wide outside lanes for bicycles on North Salem Street and Davis Drive as recommended in the Town of Apex Bicycle, Pedestrian and Equestrian Plan could be incorporated.
- A safe crossing for pedestrians and bicycles at the recommended tight modern roundabout interchanges at Laura Duncan Road and Lake Pine Drive should be determined when the detailed design is undertaken.
- A signalized pedestrian crossing (as included in the short-term solution) for the Future Swift Creek Greenway slightly west of Autopark Boulevard or a pedestrian overpass/tunnel as determined by the Town of Cary could be incorporated.
- Consideration should be given to maintaining the pedestrian and bicycle connectivity included in the short-term solution from east of Lake Pine Drive to the US 1 interchange.

Figure 5.4: Systems Linkage - Long-term Solution



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Chapter 6: Environmental Analysis

Jordan Lake
(October 2009)

CHAPTER 6. ENVIRONMENTAL ANALYSIS

The human, cultural and natural environments are analyzed in this chapter of the Corridor Study Report. The section will detail the notable features along the US 64 Corridor and determine the possible effects on these features resulting from the implementation of the Short-term and Long-term Solutions for the Study.

6.1 EXISTING ENVIRONMENTS

This section describes the existing environments for the human and natural environments and the cultural resources within the Study Area for the US 64 Corridor. The information included in this section is shown on Figure 6.1

6.1.1 Human Environments

The human environment is where people live, what they use and everything around them and includes the demographics of the people in the area as well as the community services that support the people.

6.1.1.1 Community Facilities and Services

The existing community facilities within the Study Area are included in this section and consist of schools, churches, community centers, cemeteries and hospitals.

Schools

The public schools within the study area are a part of the Wake County and Chatham County Public School Systems. The Chatham County School System operates 16 schools within Chatham County and Wake County School System operates 195 schools throughout Wake County. There are currently no Chatham County Schools along the US 64 Corridor within the Study Area. There are six Wake County Schools along the corridor including the following:

- Olive Chapel Elementary School – 0.7 miles south of US 64 on Kelly Road
- Baucom Elementary School – 0.7 miles south of US 64 on Hunter Street
- Salem Elementary School – 0.5 miles north of US 64 on Old Jenks Road
- Salem Middle School – 0.5 miles north of US 64 on Old Jenks Road
- Laurel Park Elementary – 0.7 miles north of US 64 on Laura Duncan Road
- Apex High School – Southwest corner of the intersection of US 64 and Laura Duncan Road

Churches

The following churches are located within the study area:

- Ebenezer United Methodist Church – 0.7 miles south of US 64 on Beaver Creek Road
- Olive Chapel Baptist Church – 0.7 mile south of US 64 on New Hill Road
- Crossway Community Church – on the south side of US 64, 0.1 miles east of Jenks Road
- Hope Chapel – 0.3 miles north of US 64 on Old Jenks Road
- Prince of Peace Episcopal Church – 0.4 miles south of US 64 on North Salem Street
- Salem Baptist Church – 0.3 miles north of US 64 on Salem Church Road
- Faith Baptist Church – at the corner of US 64 and Shepherd's Vineyard Drive, north of US 64
- St. Andrews Catholic Church – 0.1 miles south of US 64 on Old Raleigh Road

Community Facilities and Parks

Throughout the study area of the US 64 corridor study there are several community facilities and parks. A description of these facilities is included as follows:

- Jordan Lake State Recreational Area, including the following facilities:
  - Robeson Creek - boat ramp and fishing
  - Vista Point - boat ramp, camping, dump station fishing, picnic facilities, restrooms, swimming and trails
  - Parkers Creek - boat ramp, camping, dump station, fishing, picnic facilities, restrooms, swimming and trails
  - Seaforth boat ramp, fishing, picnic facilities, restrooms, swimming and trails
  - Poplar Point - boat ramp, camping, dump station, fishing, restrooms, swimming and trails
  - Ebenezer - boat ramp, fishing, picnic facilities, restrooms, swimming and trails
  - White Oak - boat ramp, fishing, picnic facilities, restrooms, and swimming
  - Crosswinds Marina - boat ramp, boat rentals, fishing and restrooms
  - Crosswinds Campground - boat ramp, camping, dump station, fishing, restrooms, swimming and trails
- North Carolina Forest Service Educational State Forest
  - Designed to teach the public (especially school children) about the forest environment and feature self-guided trails that include exhibits, tree identification signs, a forest education center and a talking tree trail
  - Located in the northeast quadrant of the US 64 intersection with Big Woods Road
- American Tobacco Trail
  - 22-mile long rails to trails project
  - Crosses under US 64 between Jenks Road and NC 751
- Eva Perry Regional Library –
  - Part of Wake County Library System
  - Located on Shepherd's Vineyard Drive
- Apex Community Park –
  - 160-acre park including baseball fields, soccer fields, sand volleyball courts, tennis courts, basketball courts, playground, restrooms, picnic areas, fishing dock, 50-acre lake and 3-miles of developed nature and fitness trails.
  - Located north of US 64 between Laura Duncan Road and Lake Pine Drive.
- Regency Park/Koka Booth Amphitheatre –
  - 14 acre site situated next to Symphony Lake
  - Includes a 7,000 person capacity outdoor amphitheatre owned by the Town of Cary
  - Located at the eastern edge of the study area along Regency Parkway
- Hemlock Bluffs State Nature Area
  - 92 acre nature area owned by the North Carolina Parks System
  - Includes the Stevens Nature Center that provides guests with unique opportunities to learn more about wildlife, conservation, and natural history
  - Located at the eastern edge of the study area along Regency Parkway
- Greenways and Trails, including the following:
  - North Beaver Creek Greenway – partially completed, located between Kelly Road and NC 55
  - Beckett's Crossing Greenway – partially completed
  - Haddon Hall Greenway – partially completed, located between NC 55 and South Salem Street
  - Shepherd's Vineyard Greenway – completed
  - Apex Community Park Greenway - completed
  - Swift Creek Greenway – 0.9 mile greenway near Hemlock Bluffs Nature Area

Figure 6.1: Environmental Features Map

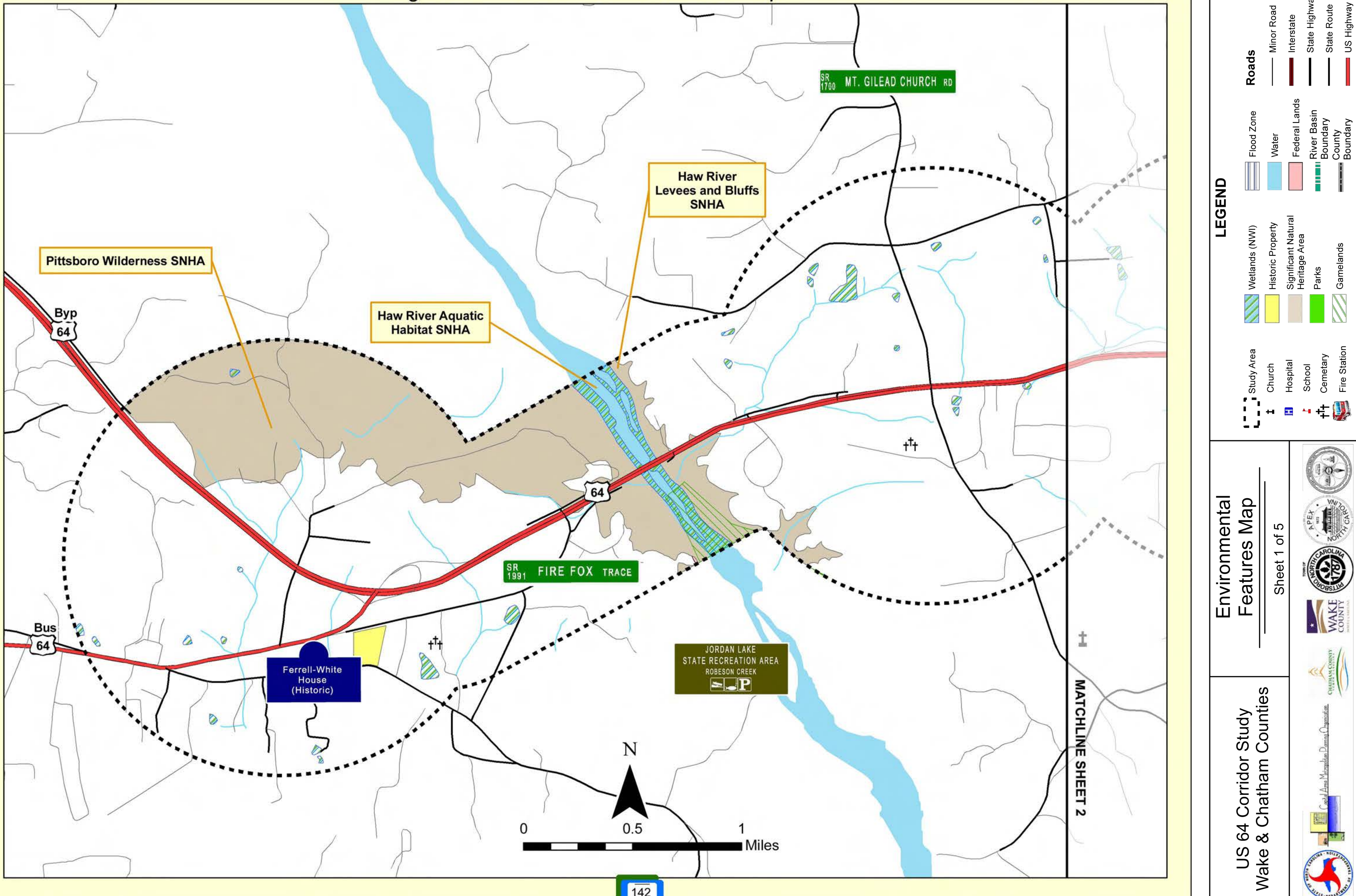


Figure 6.1: Environmental Features Map

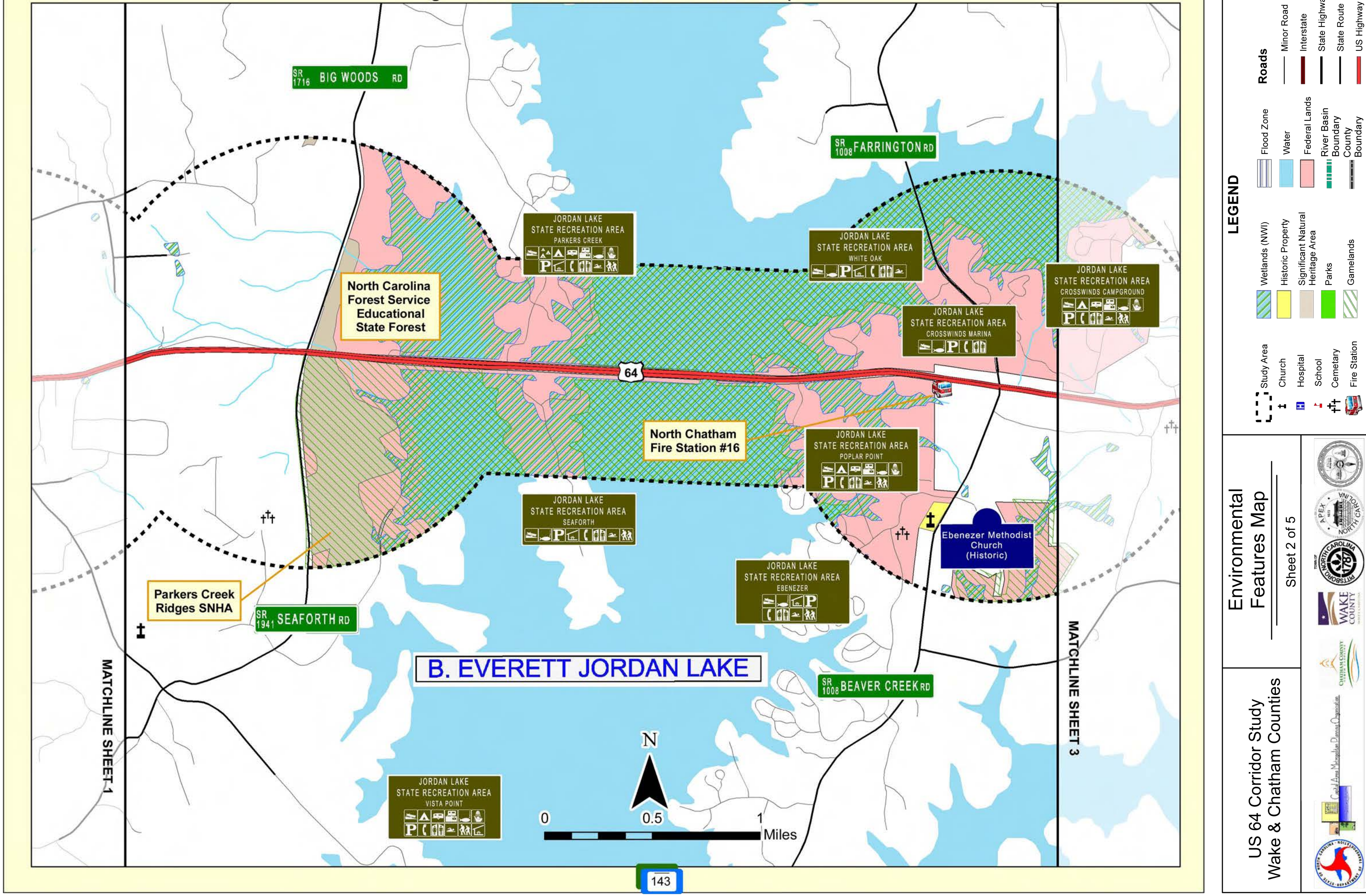


Figure 6.1: Environmental Features Map

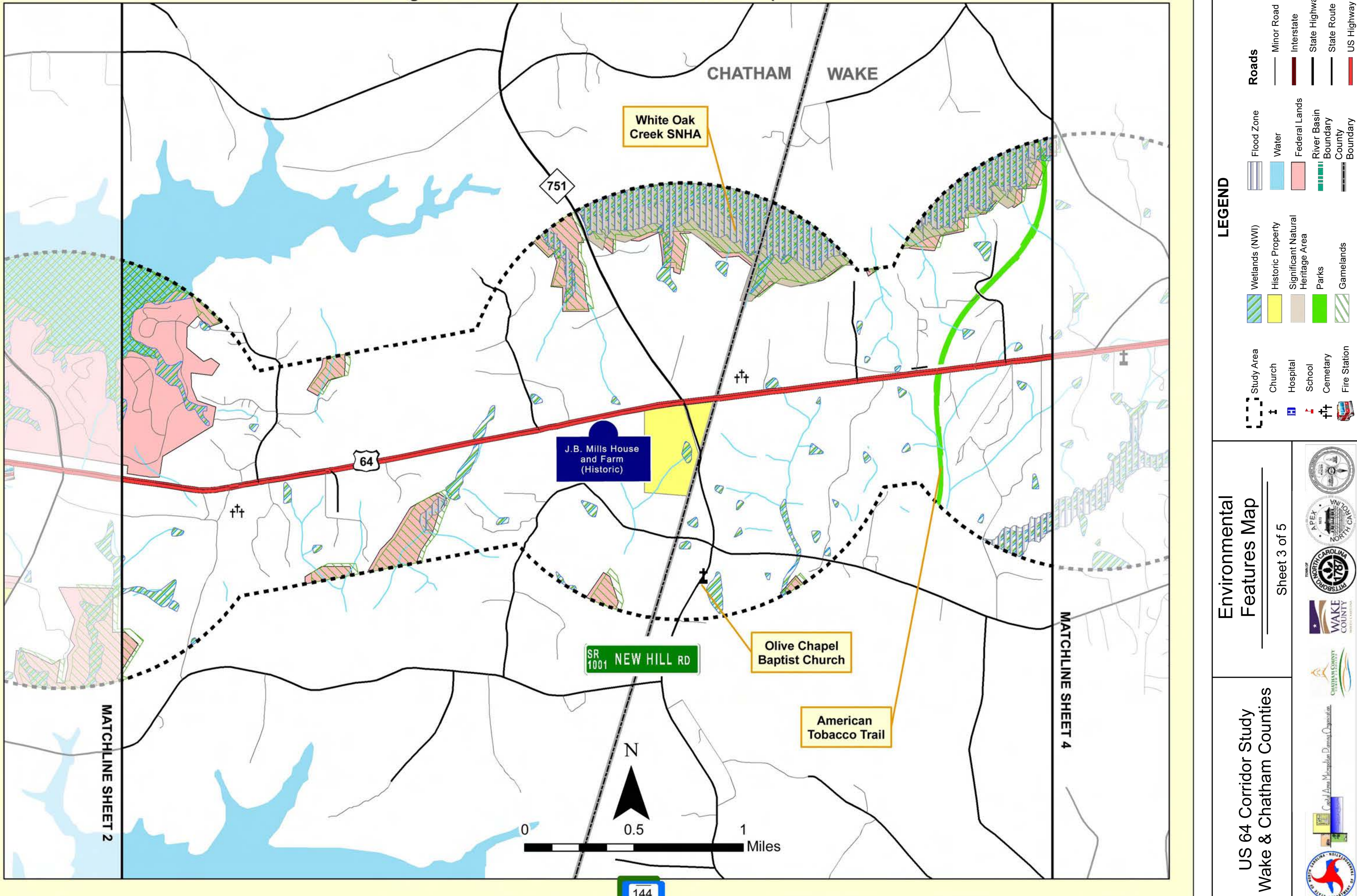


Figure 6.1: Environmental Features Map

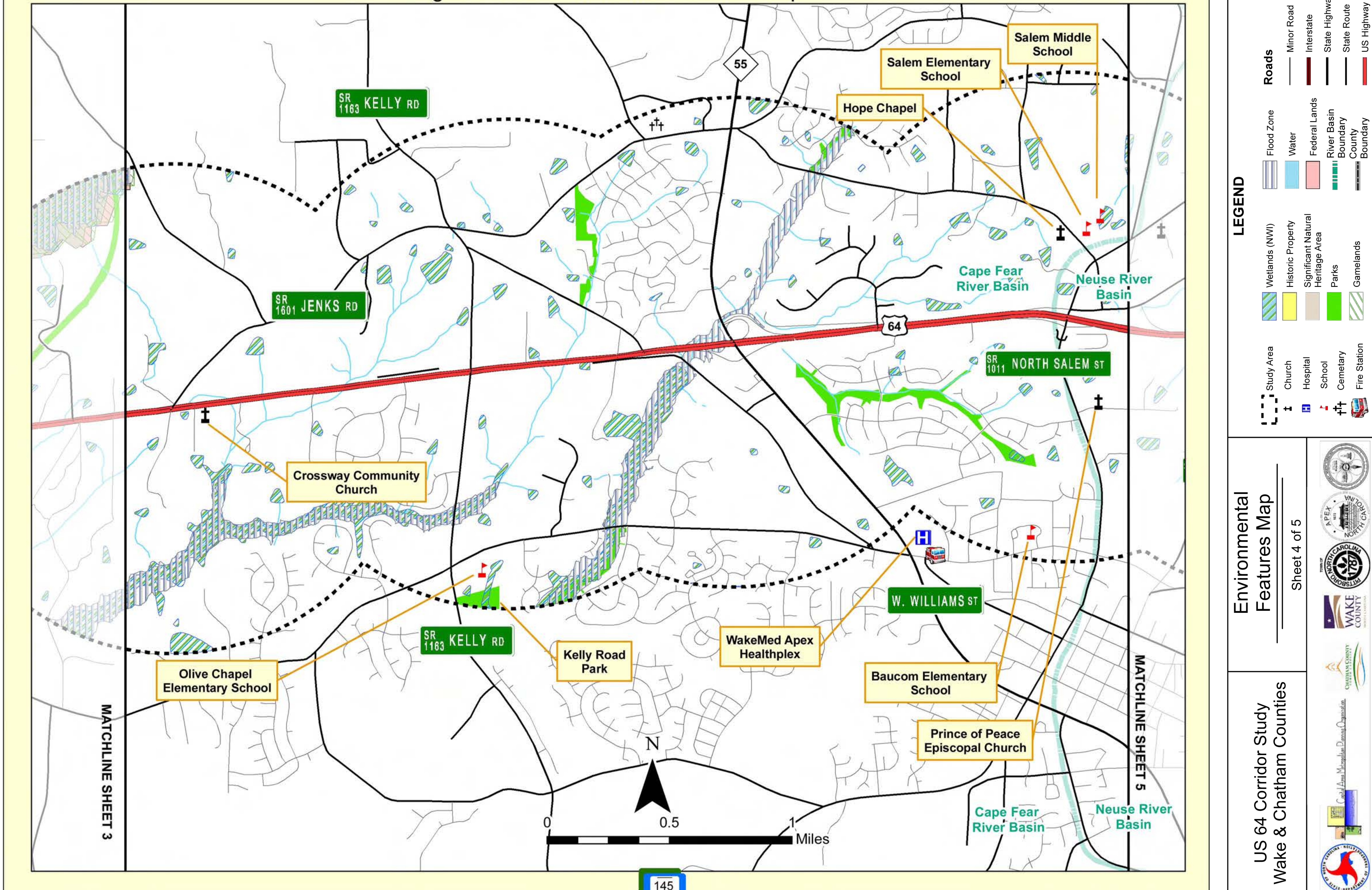
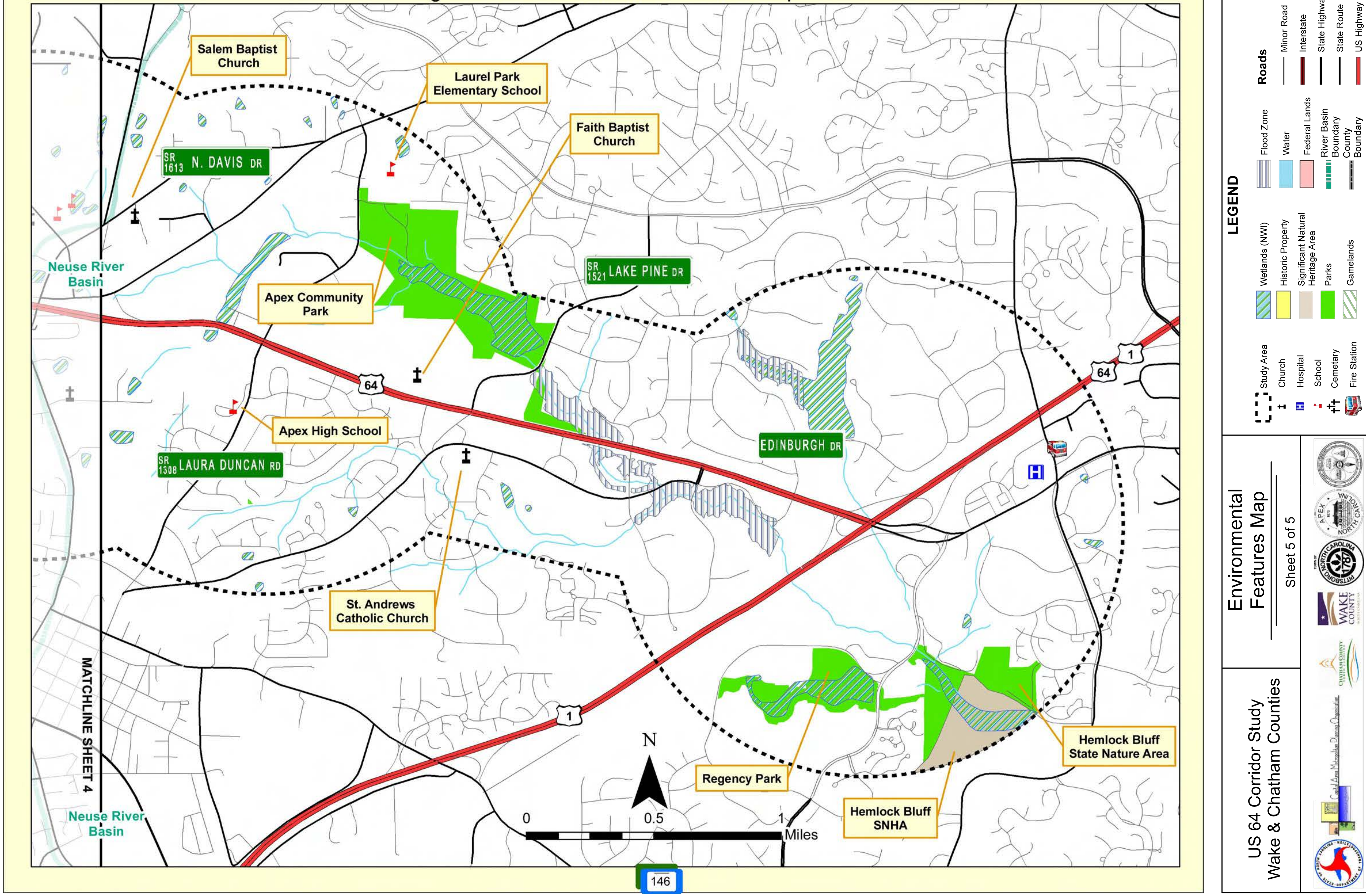


Figure 6.1: Environmental Features Map



6.1.1.2 Emergency Services

Police

Police protection is provided for the Chatham County portion of the study area by the Chatham County Sherriff's Office, which is located outside the study area, in downtown Pittsboro. Police service in the unincorporated areas of Wake County is provided by the Wake County Sherriff's Department. The Wake County Sherriff also provides support throughout the incorporated areas of Wake County, with the study area being located in Sherriff's districts 132, 134 and 136. Police protection within the town limits of Apex is provided by the Apex Police Department, located on Saunders Street approximately 1.1 miles south of US 64. Police service in the Town of Cary is provided by the Cary Police Department. The Cary Police Department has three districts, with the US 64 study area being located in the district that is served from the Cary Town Center Mall location on Walnut Street.

Fire

Fire protection in the Chatham County portion of the study area is provided by the North Chatham Station #16 located along US 64 approximately 0.3 miles west of Farrington Road. Fire protection for the study area in the western portion Wake County is provided by the Apex Fire Department. The Apex Fire Department has three response districts as follows:

- District #1 – portion of study area from Davis Drive to east of Lake Pine Drive is served by a station on South Salem Street, approximately 1.1 miles south of US 64
- District #2 – a small portion of the study area south of US 64, between the Chatham County Line and Hattie Road, is served by a station on New Hill-Olive Chapel Road, approximately 5 miles south of US 64
- District #3 – portion of the study area from Chatham County Line to Davis Drive (with the exception of the District #2 area) is served by a station on Hunter Street, approximately 1.2 miles south of US 64

Fire protection within the limits of the Town of Cary is provided by the Cary Fire Department out of Station #3 located on Kildaire Farm Road.

Emergency Medical Service

Emergency Medical Services (EMS) in Chatham County is contracted to First Health of Chatham which is a division of First Health of the Carolinas. The study area is served from an EMS station located on East Street in Pittsboro, approximately 1.8 miles west of the US 64 Bypass/US 64 Business interchange. EMS in Wake County is overseen by Wake County EMS whose system is comprised of five contracted, not-for-profit providers: Apex EMS, Cary EMS, Eastern Wake EMS, Garner EMS and Six Forks EMS. Within the study area, EMS services in the Apex area (from the Chatham County line to Laura Duncan Road) are provided by Apex EMS, located on West Williams Street, approximately 1.7 miles south of US 64. EMS services in the Cary area (from Laura Duncan Road to US 1) are provided by Cary Area EMS, located on Asheville Avenue, just north of Tryon Road.

Hospitals

Chatham County residents are served by three main hospitals, with only one being located in Chatham County. Chatham Community Hospital, located in Siler City is approximately 18 miles west of the study area. The other two hospitals that serve Chatham County residents are Central Carolina Hospital (in Sanford, 22 miles south of the study area) and University of North Carolina Hospital (in Chapel Hill, 17 miles north of the study area). The primary hospital for the Wake County portion of the study area is WakeMed Cary Hospital, located on Kildaire Farm Road, on the eastern edge of the study area. WakeMed also recently opened the WakeMed Apex Healthplex, located 0.8 miles south of US 64 on NC 55.

6.1.1.3 Cemeteries

There are several known cemeteries in close proximity to the US 64 corridor, many of which are small private cemeteries that are mostly family cemeteries. Cemeteries identified within the study area are as follows:

- South of Firefox Trace, slightly west of Dee Farrell Road
- South of US 64 on Ridgeview Road
- South of US 64 on Seaforth Road
- South of US 64 on Beaver Creek Road, behind Ebenezer Methodist Church
- South side of US 64, slightly west of John Horton Road
- North side of US 64, slightly west of Two Ponds Road
- North of US 64 on Jenks Road

6.1.1.4 Noise

Noise can be defined as any sound that is undesirable. The magnitude of noise is defined by its sound pressure level (SPL). The resulting quantities from the ratio equation are expressed in terms of decibels (dB) on the SPL scale. A dB is an interval on the SPL scale, with 0 dB as the threshold of hearing and 130 dB as the level which causes pain. A-weighted sound level quantities often correlate well with the subjective response of people to the magnitude of a sound level. For example, A-weighting takes into account the fact that humans are more sensitive to higher frequency sounds than lower frequency sounds. The term decibel is often abbreviated as dBA, meaning the sound, or noise, levels are A-weighted.

Noise descriptors have been developed to more fully describe the noise environment and its effects on human activities. The most commonly used descriptor for vehicular traffic noise is the equivalent sound level (Leq), which is defined as the steady state sound level which contains the same acoustic energy as the actual time-varying sound level occurring over the same time period.

There have not been any recent traffic noise readings taken along the US 64 corridor; however, throughout the public involvement process, numerous residents stated that noise was an existing problem along the corridor.

6.1.1.5 Air Quality

A portion of the study is located in Chatham County, which is within the Raleigh-Durham-Chapel Hill nonattainment area for ozone (O_3) as defined by the EPA. This area was designated nonattainment for O_3 under the eight-hour O_3 standard effective June 15, 2004. Section 176(c) of the 1990 Clean Air Act Amendments (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 Chatham County.

A portion of this study is located in Wake County, which is within the Raleigh-Durham-Chapel Hill non-attainment area for ozone (O_3) and the Raleigh Durham nonattainment area for carbon monoxide (CO) as defined by the EPA. The 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 September 18, 1995. This area was designated nonattainment for O_3 under the eight-hour ozone standard effective June 15, 2004. Section 176(c) of the CAAA requires that transportation plans, programs, and projects conform to the intent of the SIP. The current SIP does not contain any transportation control measures for Wake County.

6.1.1.6 Utilities

There are numerous utilities located along the US 64 corridor including electric, water, wastewater, telephone and natural gas. The only major utilities along the corridor are water mains that connect to Jordan Lake and a major gas pipeline in the vicinity of Jenks Road.

6.1.1.7 Transit Dependent Populations

An evaluation was completed for the U.S. Census block groups within the project study area to determine if any portion of the study area had populations that were heavily dependent on transit. The analysis was completed based on the population 16 years or older that is not living in group quarters compared to the aggregate number of vehicles available. This determined locations where there is a limitation on the number of vehicles available and provides indicators that the area may be dependent on transit. Based on the analysis 13 of the 19 census block groups had more vehicles than drivers. One block group, located at the eastern edge of the study area near Regency Parkway showed that nearly 12% of the driver age population did not have a vehicle. This location is currently served by the Cary Transit Route 5.

6.1.1.8 Environmental Justice Areas

An environmental justice evaluation was completed for the U.S. Census block groups within the project study area. Since the study area covers two counties, the average of the percent minority and percent below poverty were calculated to develop the thresholds for the environmental justice calculations. The threshold for minority populations is 29.3%. The threshold for individuals below poverty is 8.75%. Based on this threshold, there are no block groups that had minority populations greater than the threshold; however, there was one block group (located near the western edge of the study area in Chatham County) that had a population living below poverty that was higher than the threshold at 10.4%.

6.1.1.9 Hazardous Material

The study area along the corridor was reviewed and no superfund sites or hazardous waste facilities were found within the project study area.

6.1.2 Natural Environment

6.1.2.1 Significant Natural Heritage Areas

The North Carolina Natural Heritage Program compiles the N.C. Department of Environment and Natural Resources' list of significant "Natural Heritage Areas" (SNHA) as required by the Nature Preserves Act. The list is based on the program's inventory of the natural diversity in the state. Natural areas (sites) are evaluated on the basis of the occurrences of rare plant and animal species, rare or high quality natural communities and special animal habitats. The global and statewide rarity of these elements and the quality of their occurrence at a site relative to other occurrences determine a site's significance rating. The sites included on this list are the best representatives known of the natural diversity of the state and therefore deserve priority for protection. Inclusion on this list does not directly confer protection to a site; however, the ecological significance of a site may be taken into consideration by state or federal agencies as part of their normal operations. The list includes both protected and unprotected areas. Inclusion on this list does not mean that public access exists or is appropriate and permission of the land owner is needed for all lands not open to the public.

Natural areas are rated for their significance to protection of biodiversity. The most significant sites are those that make up a balanced set containing the best sites for all elements. North Carolina's natural areas are rated based on the value of the element occurrences – rare species and high quality natural communities – that they contain. Their significance is rated based on comparison with other sites for those same elements with a letter grading as follows:

A = Nationally significant natural areas contain examples of natural communities, rare plant or animal populations, or geologic features that are among the highest quality, most viable, or best of their kind in the nation, or clusters of such elements that are among the best in the nation.

B = Statewide significant natural areas contain similar ecological resources that are among the best occurrences in North Carolina. There are a few better quality representatives or larger populations on nationally significant sites elsewhere in the nation or possibly within the state.

C = Regionally significant natural areas contain natural elements that may be represented elsewhere in the state by better quality examples, but which are among the outstanding examples in their geographic region of the state. A few better examples may occur in nationally or state significant natural areas.

D = Other areas included in SNHA dataset

The US 64 corridor study includes six SNHA's as follows:

- Haw River Aquatic Habitat (Category A) – Chatham County
- Haw River Levees and Bluffs (Category B) – Chatham County
- Pittsboro Wilderness (Category D) – Chatham County
- Parkers Creek Ridges (Category D) – Chatham County
- White Oak Creek (Category B) – Chatham County
- Hemlock Bluffs (Category B) – Wake County

6.1.2.2 Floodplains

The Town of Pittsboro, Town of Apex, Town of Cary and Chatham and Wake Counties participate in the National Flood Insurance Program. A Flood Insurance Study (FIS) was developed for Chatham County, including the Town of Pittsboro and approved on February 2, 2007. A FIS for Wake County, including the Towns of Apex and Cary was approved on May 2, 2007.

Floodplains are present along several water bodies within the study area for the US 64 corridor including along the following locations:

- Haw River – Chatham County
- Windfall Branch – Chatham County
- B. Everett Jordan Lake – Chatham County
- Beaver Creek Tributary 1 – Chatham County
- Beaver Creek Tributary 2 – Chatham County
- White Oak Creek – Chatham and Wake Counties
- Reedy Branch – Wake County
- Reedy Branch Tributary – Wake County
- Beaver Creek – Wake County
- Swift Creek – Wake County
- Swift Creek Tributary 7 – Wake County

6.1.2.3 Wetlands

Wetland information within the study area along US 64 was taken from the National Wetlands Inventory (NWI) maps developed by the US Fish and Wildlife Service (USFWS). The USFWS is the principal Federal agency that provides information to the public on the extent and status of the Nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats. This geospatial information is used by Federal, State, and local agencies, academic institutions, and private industry for management, research, policy development, education and planning activities. Wetlands provide a multitude of ecological, economic and social benefits. They provide habitat for fish, wildlife and a variety of plants. Wetlands are nurseries for many saltwater and freshwater fishes and shellfish of commercial and recreational importance. Wetlands are also important landscape features because they hold and slowly release flood water and snow melt, recharge groundwater, act as filters to cleanse water of impurities, recycle nutrients, and provide recreation and wildlife viewing opportunities for millions of people.

The wetlands throughout the study area include numerous freshwater ponds that are typical of rural agricultural areas. There are also several more substantial wetland systems along the corridor including the following:

- Haw River (Riverine Wetland) - Chatham County
- B. Everett Jordan Lake (Lake) - Chatham County
- Beaver Creek Tributary (Freshwater Forested/Shrub Wetland) – Chatham County
- US 64 between Farrington Road and NC 751 (Freshwater Forested/Shrub Wetland) – Chatham County
- White Oak Creek (Freshwater Forested/Shrub Wetland) – Chatham and Wake Counties
- Reedy Branch (Freshwater Forested/Shrub Wetland) – Wake County
- Beaver Creek (Freshwater Forested/Shrub Wetland) – Wake County
- US 64 between Davis Drive and Laura Duncan Road (Freshwater Forested/Shrub Wetland) – Wake County

6.1.2.4 Creeks and Streams

Creeks and streams within the study area were taken from maps prepared by the United States Geological Survey (USGS). Numerous unnamed streams were shown on the map throughout the study area and seven named streams were designated within the study area as follows:

- Haw River – Chatham County
- B. Everett Jordan Lake – Chatham County
- Beaver Creek – Chatham County
- White Oak Creek – Chatham and Wake Counties
- Reedy Branch – Wake County
- Williams Creek – Wake County
- Swift Creek – Wake County

6.1.2.5 Water Supply and Critical Watersheds

Surface Water Classifications are designations applied to surface water bodies, such as streams, rivers and lakes, which define the best uses to be protected within these waters (for example swimming, fishing, drinking water supply). Classifications are developed by the North Carolina Department of Environmental and Natural Resources (NCDENR) Division of Water Quality (DWQ). Each classification has an associated set of water quality standards to protect those uses. Surface water classifications are one tool that state and federal agencies use to manage and protect all streams, rivers, lakes, and other surface waters in North Carolina. Classifications and their associated protection rules may be designed to protect water quality, fish and wildlife, the free flowing nature of a stream or river, or other special characteristics.

Water Supply Watersheds are those waters used as sources of water supply for drinking, culinary, or food processing purposes. Water Supply Watersheds that have the WS-IV designation also include protected areas. A protected area is defined as land within five miles and draining to the normal pool elevation of water supplies/reservoirs or within ten miles upstream and draining to a river intake. The Critical Area is the land adjacent to a water supply intake where risk associated with pollution is greater than from remaining portions of the watershed. Critical Area is defined as land within one-half mile upstream and draining to a river intake or within one-half mile and draining to the normal pool elevation of water supply reservoirs. Critical areas are more restrictive than areas outside this area.

The study area for the US 64 Corridor Study includes a substantial area located within water supply watersheds. The area surrounding B. Everett Jordan Lake is classified as a WS-IV watershed from beyond the western edge of the study area in Chatham County to NC 55 in Wake County. Additionally, the area along US 64 from Big Woods Road/Seaforth Road to slightly east of Farrington Road/Beaver Creek Road is designated as a Critical Area. In the Wake County portion of the study area the Water Supply Watershed associated with Swift Creek is classified as a WS-III watershed and begins slightly west of the Davis Drive interchange and continues beyond the eastern edge of the study area.

6.1.2.6 High Quality Waters and Outstanding Resource Water Management Zones

High Quality Waters (HQW) is a supplemental classification defined by the North Carolina NCDENR DWQ that are intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission.

Outstanding Resource Waters (ORW) is a supplemental classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. To qualify, waters must be rated Excellent by DWQ, and have one of the following outstanding resource values:

- Outstanding fish habitat or fisheries
- Unusually high level of water based recreation or potential for such kind of recreation
- Some special designation such as N.C. Scenic/Natural River or National Wildlife Refuge
- Important component of state or national park or forest
- Special ecological or scientific significance (rare or endangered species habitat, research or educational areas)

All ORWs are HQW by supplemental classification.

The study area for the US 64 Corridor Study does not include any designated HQW or ORW zones.

6.1.2.7 Major Water Bodies

As described in the proceeding sections, there are several major water bodies within the study area. For the intents of this section, a major water body is one that requires that any roadway crossings require a bridge over the water body. The following major water bodies are located within the study area:

- Haw River – Chatham County

- B. Everett Jordan Lake – Chatham County

6.1.2.8 River Basins and Stream Buffers

The study area for the US 64 Corridor Study is located in both the Cape Fear River and Neuse River basins. The western portion of the study area, including the entire Chatham County portion is located within the Cape Fear River basin. The eastern portion of the study area, beginning slightly west of the Davis Drive interchange, is located within the Neuse River basin. The entire study area is subject to stream buffers. The purpose of a buffer is to provide a vegetated area along streams through which stormwater runoff can flow in a diffuse manner, infiltrate into the soil, and allow filtration of pollutants.

The B. Everett Jordan Reservoir Water Supply Nutrient Strategy is a comprehensive set of rules approved in 2009, designed to address excess nutrients in Jordan Lake that can lead to algae blooms and other water quality problems. Jordan Lake is an impoundment in the central Piedmont that drains a mixture of agricultural and urbanized lands forming the upper Cape Fear River Basin, including the west side of the Triangle and much of the Triad region. The lake serves as a water supply for the Town of Apex and the Town of Cary and also has significant recreational use. The rules are similar to those already in place in the Neuse and Tar-Pamlico River Basins. The rules would require all major sources of nutrients to reduce their loading to the three arms of Jordan Lake to meet specific percent reduction goals, established through modeling, that are needed to restore water quality standards and full uses of the lake. One of the rules requires local governments to implement programs to protect existing vegetated riparian areas within 50 feet of and adjacent to intermittent and perennial streams, lakes, and ponds in the Jordan watershed. The first 30 feet adjacent to waters is largely undisturbed forest, while the outer 20 feet may be managed vegetation. Chatham County has enacted a local watershed ordinance that has requirements that are often more restrictive than the State. The Haw River is a locally designated River Corridor Watershed District. Chatham County is in the process of amending their buffer regulations to comply with the Lake Jordan rules.

The Neuse River Nutrient Sensitive Waters Management Strategy was approved in 1998 and 1999 by the NC General Assembly and established riparian buffers within the Neuse River basin. The purpose of the buffer rule was to protect and preserve existing riparian buffers in the Neuse River Basin to maintain their nutrient removal functions. The buffer rule applies 50-foot wide riparian buffers directly adjacent to surface waters in the Neuse River Basin (intermittent streams, perennial streams, lakes, ponds, and estuaries), excluding wetlands. The buffer rules enforce two zones, with Zone 1 being a 30-foot wide undisturbed vegetated area and Zone 2 being a 20-foot wide stable vegetated area.

6.1.2.9 Impaired Water/Water Quality

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. Listed waters must be prioritized, and a management strategy or total maximum daily load (TMDL) must subsequently be developed for all listed waters. In North Carolina the list is developed by NCDENR DWQ. The most recently approved list is from 2006 and includes the following:

- Haw River from 0.5 miles downstream of US 64 to 1.0 miles downstream of US 64 - Chlorophyll a and high pH
- New Hope River Arm of B. Everett Jordan Lake from Chatham County SR 1008 to Haw River Arm of B. Everett Jordan Lake – Chlorophyll a
- Williams Creek from source to Swift Creek - Impaired biological integrity
- Swift Creek from source to backwaters of Lake Wheeler - Impaired biological integrity

6.1.2.10 Wildlife Refuges and Game Lands

There are no wildlife refuges designated by the United States Fish and Wildlife Service within the study area.

The study area does include the Jordan Game Land designated by the North Carolina Wildlife Resources Commission in the vicinity of Jordan Lake State Park and along the Haw River, south of US 64.

6.1.2.11 Threatened and Endangered Species

Federally listed endangered and threatened species are legally protected under the provisions of Section 7 of the Endangered Species Act (ESA) of 1973, as amended, and any action likely to adversely affect a species afforded federal protection is subject to review by the USFWS and/or the National Marine Fisheries Service (NMFS). Species classified as Federal Species of Concern (FSC) are not protected under the provisions of Section 7 of the ESA, but are defined as species under consideration for listing as threatened or endangered. North Carolina provides limited protection to "at risk" species under the North Carolina Endangered Species Act and the North Carolina Plant Protection and Conservation Act of 1979. The NCWRC and the North Carolina Department of Agriculture (NCDA) are responsible for enforcing and administering species protection. The USFWS and the NCNHP maintain lists and location data of known occurrences of endangered, threatened, and rare species for North Carolina. The following species are included on the USFWS listing for Chatham County:

<u>Vertebrate:</u>

- American eel (*Anguilla rostrata*) - Federal Species of Concern - Current Listing
- Bachman's sparrow *(Aimophila aestivalis)* - Federal Species of Concern - Current Listing
- Bald eagle *(Haliaeetus leucocephalus*) - Bald and Golden Eagle Protection Act - Current Listing;
- Cape Fear shiner *(Notropis mekistocholas)* - Endangered - Current Listing
- Carolina darter *(Etheostoma collis lepidinion)* - Federal Species of Concern - Current Listing
- Carolina redhorse *(Moxostoma sp. 2)* - Federal Species of Concern - Current Listing
- Red-cockaded woodpecker *(Picoides borealis)* – Endangered – Historic Record

<u>Invertebrate:</u>

- Atlantic pigtoe *(Fusconaia masoni)* - Federal Species of Concern - Current Listing
- Brook floater *(Alasmidonta varicose*) - Federal Species of Concern - Current Listing
- Carolina creekshell *(Villosa vaughaniana)* - Federal Species of Concern - Current Listing
- Septima's clubtail *(Gomphus septima)* - Federal Species of Concern - Current Listing
- yellow lampmussel *(Lampsilis cariosa)* - Federal Species of Concern - Current Listing

<u>Vascular Plant:</u>

- Buttercup phacelia *(Phacelia covillei)* - Federal Species of Concern - Current Listing
- Harperella *(Ptilimnium nodosum)* - Endangered - Current Listing
- Sweet pinesap *(Monotropsis odorata)* - Federal Species of Concern - Current Listing
- Virginia quillwort *(Isoetes virginica)*- Federal Species of Concern – Historic Record

The following species are included on the USFWS listing for Wake County:

<u>Vertebrate:</u>

- American eel (*Anguilla rostrata*) - Federal Species of Concern - Current Listing
- Bachman's sparrow *(Aimophila aestivalis)* - Federal Species of Concern - Current Listing

- Bald eagle *(Haliaeetus leucocephalus)* - Bald and Golden Eagle Protection Act - Current Listing
- Carolina darter *(Etheostoma collis lepidinion)* - Federal Species of Concern - Current Listing
- Carolina madtom (Noturus furiosus) - Federal Species of Concern - Current Listing
- Pinewoods shiner (Lythrurus matutinus) - Federal Species of Concern - Current Listing
- Roanoke bass (Ambloplites cavifrons) - Federal Species of Concern - Current Listing
- Southeastern myotis (Myotis austroriparius) - Federal Species of Concern – Historic Record
- Southern hognose snake (Heterodon simus) - Federal Species of Concern – Obscure Record
- Red-cockaded woodpecker *(Picoides borealis)* – Endangered – Historic Record

Invertebrate:

- Atlantic pigtoe (Fusconaia masoni) - Federal Species of Concern - Current Listing
- Diana fritillary (butterfly) (Speyeria Diana) - Federal Species of Concern - Current Listing
- Dwarf wedgemussel (Alasmidonta heterodon) – Endangered - Current Listing
- Green floater (Lasmigona subviridis) - Federal Species of Concern - Current Listing
- Yellow lance (Elliptio lanceolata) - Federal Species of Concern - Current Listing

Vascular Plant:

- Bog spicebush (Lindera subcoriacea) - Federal Species of Concern - Current Listing
- Grassleaf arrowhead (Sagittaria weatherbiana) - Federal Species of Concern – Historic Record
- Michaux's sumac (Rhus michauxii) – Endangered - Current Listing
- Sweet pinesap (Monotropsis odorata) - Federal Species of Concern – Historic Record
- Virginia least trillium (Trillium pusillum var. virginianum) - Federal Species of Concern - Current Listing

6.1.2.12 Federal Emergency Management Agency Buyout Properties

As a means of mitigation to reduce the future losses due to flooding, the Federal Emergency Management Agency (FEMA) developed a program that would purchase properties in flood prone area to eliminate the future risk. Acquisition or Buyout projects, while 75% funded by FEMA, are administered by the State and local communities. The State and local communities work together to identify areas where buyouts make the most sense.

There are currently no known FEMA buyout sites located within the study area for the US 64 corridor study.

6.1.2.13 Federally Owned Land

When highways cross lands owned by the United States and administered by Federal Agencies (Controlling Agency), a property interest, generally by highway easement, can be conveyed to a State Department of Transportation (State DOT) or its nominee (i.e. city, county, town, public-private partnership) to grant the rights necessary to construct, operate and maintain the roadway. Authority is provided to the Secretary of Transportation, who has further delegated the authority to the FHWA to effectuate the transfer. The process is referred to as a Federal Land Transfer. Due to the complexity of the Federal Land Transfer process it is critical that federally owned land be identified as early in the planning stages as possible.

The only known federally owned property within the study area of the US 64 corridor study is the B. Everett Jordan Lake, which includes 46,768 acres, is owned by the U.S. Army Corp of Engineers.

6.1.3 Cultural Resources

6.1.3.1 Historic Districts

There is one district designated on the National Register of Historic Places within the study area for the US 64 corridor study. The 11,450 acre New Hope Rural Historical Archeological District is located in Chatham County from west of Big Woods Road across B. Everett Jordan Lake.

6.1.3.2 Historic Properties

There is one historic property designated on the National Register of Historic Places within the study area for the US 64 corridor study and two properties that have been determined to be eligible for the National Register. For purposes of planning transportation projects, properties determined to be eligible for the National Register as considered the same as a property listed on the National Register.

Ebenezer Methodist Church, located on Beaver Creek Drive, south of US 64 was added to the Federal Register in 1985 and is constructed in the Gothic Revival style popular in the late 1800's. There is a cemetery behind the church and it is historically significant due to an event, due to its architecture and for its religious significance.

The following two properties have been determined to be eligible for listing on the National Register based on previous studies along the corridor:

- Farrell-White House, located on Hanks Chapel Road south of US 64 in Chatham County
- J.B Mills House and Farm, located on US 64 at the intersection with New Hill Road

6.2 SUMMARY OF ENVIRONMENTAL EFFECTS FOR SHORT-TERM SOLUTION

The effects on the human, cultural and natural environments for the short-term solution are relatively minimal as the recommended solutions typically utilize the existing footprint, with most of the construction occurring within the median of US 64. The following sections describe the effects for elements that are evaluated qualitatively, while the quantitative effects are included in Table 6.1.

6.2.1 Human Environment Effects

The effects on the human environment would be relatively minimal. None of the proposed short-term solutions would require the relocation of any residences, churches or schools. One business would potentially be relocated at the intersection Beaver Creek Road to accommodate the additional turning lanes; however, it is possible that during the detailed design phase the business could be avoided and allowed to remain.

None of the short-term solutions would impact any community facilities, parks or cemeteries and would result in a negligible change in noise levels from what would occur under the existing conditions. The disruption to traffic during construction would be minimal. The effect on emergency services would minimal, with some movements requiring the re-routing of left-turn movements causing minor delays for vehicles turning left onto US 64. A majority of the movements for emergency response currently occurs from US 64 to the side street, which will remain unchanged for all of the short-term solution designs with the exception of at Lake Pine Drive. The Lake Pine Drive intersection would require emergency vehicles to use the U-turn locations or make a left turn movement at the intersection that is not allowed during normal traffic operations. Conversely, the improved traffic flow will allow for less congestion along the corridor and may improve response times for emergency services. The short-term solution will also have a positive effect on air quality, as the higher the speed the lower the emissions produced by cars and trucks. There would be a minimal impact on utilities in the area as a result of constructing the short-term solutions and it is anticipated that only minor utility modifications would be needed.

Table 6.1: Summary of Impacts for Short-term Solution

Resource	Implementation Plan Intersection														
	1-Firefox Trace	2-Mt. Gilead Church/North Pea Ridge Road	3-Big Woods Road/Seaforth Road	4-Farrington Road/Beaver Creek Road	5-NC 751/New Hill Road	6-Jenks Road Interchange	7-Kellyridge Road	8-Knollwood Road	9-Shepherds Vineyard Drive	10-Lake Pine Drive	11-Autopark Boulevard	12-Mackenan Drive/Chalon Drive	13-Gregson Drive	14-Edinburgh Drive	Total
Relocations															
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Business	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Church	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Community Facilities/Parks (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cemeteries (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Significant Natural Heritage Area (acres)	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**
Floodplains (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	**0.1**
Wetlands (acres)															
Freshwater Ponds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Freshwater Forested/Shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Streams (linear feet)	0	70	200	70	0	250	0	0	0	0	0	0	0	0	**590**
River Basin	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Neuse	Neuse	Neuse	Neuse	Neuse	Neuse	Neuse	
Wildlife Refuges (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Game lands (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Federally Owned Land (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Historic Archeological District (acres)	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.9**
Historic Properties (acres)	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**
Construction Cost	$1,700,000	$2,200,000	$2,100,000	$2,900,000	$3,400,000	$2,300,000	$1,000,000	$625,000	$75,000	$3,600,000	$500,000	$2,200,000	$1,550,000	$2,450,000	**$26,600,000**
Right-of-way Cost	$0	$927,000	$613,500	$1,940,500	$913,500	$786,000	$309,000	$0	$313,500	$318,000	$313,500	$313,500	$313,500	$313,500	**$7,375,000**
Total Cost	$1,170,000	$3,127,000	$2,713,500	$4,840,500	$4,313,500	$3,086,000	$1,309,000	$625,000	$388,500	$3,918,000+	$813,500	$2,513,500	$1,863,500	$2,763,500	**$33,975,000**

6.2.2 NATURAL ENVIRONMENT EFFECTS

The effects on the natural environment would also be very minimal with no wetlands being impacted and no individual stream having an impact greater than 250 linear feet. Due to the minimal increase in footprint it is likely that all of the short-term solutions could be constructed utilizing a Nationwide Permit 14 to comply with Section 404 of the Clean Water Act. The effects on floodplains would be minimal with only one intersection having a minor encroachment into a floodplain. The effect on water quality would be very similar to the existing conditions, with only minor increases in impervious area to accommodate the U-turn movements being included in the construction.

6.2.3 CULTURAL RESOURCES IMPACTS

The effects on cultural resources are likely to be the most substantial obstacle to implementing the short-term solutions at the Big Woods Road/Seaforth Road intersection and the NC 751/New Hill Road intersection. Preliminary evaluation by NCDOT determined that the additional property required at Big Woods Road/Seaforth Road would not constitute the taking of land subject to protection under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources. The impacts to the historic property at the NC 751/New Hill Road intersection will require additional design to determine if the impacts to the property can be eliminated or reduced to a level where a *De Minimis* finding could be made under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources.

6.3 SUMMARY OF ENVIRONMENTAL EFFECTS FOR LONG-TERM SOLUTION

The effects on the human, cultural and natural environments for the long-term solution are more substantial than those for the short-term solution and reflect the effects on the study area that will occur if the long-term solution is implemented. The following sections describe the effects for elements that are evaluated qualitatively, while the quantitative effects are included in Table 6.2.

6.3.1 HUMAN ENVIRONMENT EFFECTS

The following sections describe the effects on the human environment as a result of the implementation of the long-term solution.

6.3.1.1 Community Facilities and Services

The long-term solution would not impact any schools, community facilities or parks within the study area; however it would potentially require the relocation of 11 residences, 12 businesses and one church.

Table 6.2: Summary of Impacts for Long-term Solution

Resource	Implementation Plan Segment												
	A-West of Haw River	B– Mt. Gilead Church/North Pea Ridge Interchange	C– Big Woods Road/Seaforth Road Interchange	D– Jordan Lake Area	E– Farrington Road/Beaver Creek Road Interchange	F– NC 751/New Hill Road Interchange	G– Jenks Road Interchange	H– Kelly Road/ NC 540/Green Level Church/ NC 55 Area	I– Davis Drive Interchange Area	J– Laura Duncan Road/CSX Railroad Crossing Area	K– Lake Pine Drive Interchange	L– East of Lake Pine Drive to US 1 Interchange	Total
Length (miles)	1.4	2.0	1.1	2.4	1.1	3.5	1.2	2.4	1.4	0.8	0.9	1.2	**19.4**
Relocations													
Residential	0	2	0	0	2	1	4	0	2	0	0	0	**11**
Business	0	5	0	0	3	0	1	0	0	1	2	0	**12**
Church	0	0	0	0	0	0	1	0	0	0	0	0	**1**
Schools	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Community Facilities/Parks (number)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cemeteries (number)	0	0	0	0	0	1	0	0	0	0	0	0	**1**
Potential Noise Impacts (number of receptors)	0	7	0	0	2	15	8	13	14	19	7	6	**91**
Significant Natural Heritage Area (acres)	0	2.0	0	0	0	0	0	0	0	0	0	0	**2.0**
Floodplains (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.5	**1.9**
Wetlands (acres)													
Freshwater Ponds	0.0	0.1	0.0	0.0	0.0	1.3	0.4	0.4	0.0	0.0	0.0	0.0	**2.2**
Freshwater Forested/Shrub Wetland	0.0	0.0	0.0	0.0	0.6	1.1	0.3	0.0	0.0	0.1	0.0	0.0	**2.1**
Streams (linear feet)	340	2,050	2,260	0	410	880	1,560	1,190	80	210	0	150	**9,130**
Stream Buffers (square feet)													
Jordan Lake – Zone 1	20,400	78,600	135,600	0	24,600	52,800	81,700	71,400	0	0	0	0	**465,100**
Jordan Lake – Zone 2	13,600	42,400	90,400	0	16,400	35,200	53,200	47,600	0	0	0	0	**298,800**
Neuse River – Zone 1	0	0	0	0	0	0	0	0	4,800	12,600	0	3,000	**20,400**
Neuse River – Zone 2	0	0	0	0	0	0	0	0	3,200	8,400	0	2,000	**13,600**
River Basin	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear	Cape Fear/ Neuse	Neuse	Neuse	Neuse	
Wildlife Refuges (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Game lands (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Federally Owned Land (acres)	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.1**
Historic Archeological District (acres)	0.0	0.0	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**36.5**
Historic Properties (acres)	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**
Construction Cost	$3,300,000	$27,600,000	$14,800,000	$15,000,000	$19,800,000	$72,000,000	$25,900,000	$41,500,000	$23,800,000	$33,300,000	$33,900,000	$11,800,000	**$322,700,000**
Right-of-way Cost	$1,115,000	$11,030,000	$5,055,000	$155,000	$9,250,000	$9,760,000	$12,350,000	$6,555,000	$6,970,000	$4,335,000	$4,745,000	795,000	**$72,115,000**
Total Cost	$4,415,000	$38,630,000	$19,855,000	$15,155,000	$29,050,000	$81,760,000	$38,250,000	$48,055,000	$30,770,000	$37,635,000	$38,645,000	$12,595,000	**$394,815,000**

6.3.1.2 Emergency Services

Police

Police protection would remain nearly unchanged from the existing condition as the changes in access would improve response time for police; however the additional access control may require longer travel distances.

Fire

Fire protection in the Chatham County portion of the study area would be affected to the greatest extent by the recommended long-term solution. The North Chatham Station #16 currently connects directly to US 64, but will connect to a service road that accesses US 64 via the interchange at Farrington Road/Beaver Creek Road.

The Chatham County Fire Marshall has raised concerns that the re-routing may cause some homes to lose their fire rating for insurance purposes. The improved traffic operation may also improve response times for fire trucks and for volunteer firefighters, as the department is staffed by career and volunteer fire fighters. Chatham County and the Town of Pittsboro should consider the recommendations in this report as they evaluate emergency response times and provide additional fire stations as needed to accommodate the population growth.

Due to the locations of the fire stations in Apex and Cary it is unlikely that any negative effects will occur as a result of the implementation of the long-term solution and the improvement in traffic operations may improve response times.

Emergency Medical Service

Due to the locations of the EMS facilities in relation to the study area it is unlikely that any negative effects will occur as a result of the implementation of the long-term solution and the improvement in traffic operations may improve response times.

Hospitals

Due to the locations of the Hospital facilities in relation to the study area it is unlikely that any negative effects will occur as a result of the implementation of the long-term solution and the improvement in traffic operations may improve response times.

6.3.1.3 Cemeteries

The recommended long-term solution will impact one cemetery along the US 64 corridor: north side of US 64, slightly west of Two Ponds Road.

6.3.1.4 Noise

The implementation of the long-term solution will result in increased noise levels along the US 64 corridor due to the increased speed of traffic resulting from the increased control of access along the highway. Noise impacts as a result of the implementation of the long-term solution are anticipated for 91 receptors along the corridor. Noise abatement in the form of noise walls would be considered for impacted receptors along the corridor from US 64 Business to east of Lake Pine Drive during a future phase of planning for the corridor. Noise abatement would not be considered feasible from east of Lake Pine Drive to US 1 due to the breaks in control of access to allow for the at-grade signalized intersections.

6.3.1.5 Air Quality

The implementation of the long-term solution will result in improved air quality compared to the no-build condition as it would allow for traffic to travel at higher speeds and make fewer stops, both of which have a positive effect on air quality and emissions.

6.3.1.6 Utilities

The implementation of the long-term solution is not likely to result in any significant negative effects to utilities; however the design will need to coordinated with the major utilities in the area, especially the major water mains that connect to Jordan Lake and the gas pipeline in the vicinity of Jenks Road.

6.3.1.7 Transit Dependent Populations

The long-term solution would not result in any substantial impact to transit in the area and would not negatively affect the existing transit operations.

6.3.1.8 Environmental Justice Areas

The long-term solution would not disproportionately affect any minority or low-income population.

6.3.1.9 Hazardous Material

The implementation of the long-term solution is not likely to result in any significant negative effects to hazardous materials.

6.3.1.10 Construction Effects

The construction of the long-term solution will likely result in some negative effects during construction due temporary reductions in capacity or access along US 64 and the side streets. Due to the high traffic volumes along US 64 the construction of improvements would be categorized as a Level 1 Significant project during construction according to the *NCDOT Work Zone Safety and Mobility Policy.* A Level 1 or 2 project is required to have complete Transportation Management Plan (TMP) that includes a Traffic Operations Plan, Temporary Traffic Control Plan, and a Public Information Plan, per the Policy.

Traffic on US 64 will most likely need to be maintained onsite during construction due to the traffic volumes. If the road is lowered any amount or raised more than several feet, it is not possible to maintain traffic in the existing location by conventional practices. Therefore, other options, such as temporary pavement, temporary shoring, additional right of way for onsite detours, road closures, etc. will have to be considered, resulting in temporary impacts. It is recommended that temporary impacts need to be addressed early in the planning phase, as the consequences of waiting to determine how to handle traffic in the design phase could result in an increase in construction cost, traffic impacts, and construction duration.

6.3.2 Natural Environment

6.3.2.1 Significant Natural Heritage Areas

The implementation of the long-term solution is likely to impact approximately 2 acres of the Haw River Levees and Bluffs SHNA adjacent to US 64. The impact is due to the construction of a service road to access the Haw River and recreational facilities along the river. Additional evaluation of options to provide this access without impacting the SNHA should be undertaken in future planning studies to potentially avoid or minimize the impact.

6.3.2.2 Floodplains

The implementation of the long-term solution will likely result in impacts to designated floodplains at two locations along the corridor. The first floodplain impact will occur as a result of adding the C-D roadway in the westbound direction of US 64 through the NC 55 interchange. The additional widening required for the C-D roadway will place additional fill within the floodplain of Beaver Creek. The second floodplain impact will be the result of adding an additional lane to the ramp from US 1 southbound to US 64 westbound. The additional widening needed for the ramp lane will place additional fill within the floodplain to Swift Creek Tributary No. 7. A total of 1.0 acres of fill is anticipated to be placed within the existing floodplain limits under the recommended long-term solution.

6.3.2.3 Wetlands

The implementation of the long-term solution will result in impacts to designated wetlands along the US 64 corridor. The recommended long-term solutions will impact a total of 10 freshwater ponds with an impact area of approximately 2.2 acres being filled. The long-term solution is also anticipated to impact four Freshwater Forested/Shrub Wetlands with an impacted area of approximately 2.1 acres being filled. Additional measures to avoid and minimize these impacts will be undertaken in future phases of planning.

6.3.2.4 Creeks and Streams

Creeks and streams within the study area will be impacted by the construction of the recommended long-term solution. A total of 9,130 linear feet of streams shown on USGS map as perennial or intermittent will be impacted by the long-term solution. Additional measures to avoid and minimize these impacts will be undertaken in future phases of planning.

6.3.2.5 Water Supply and Critical Watersheds

The study area for the US 64 Corridor Study includes a substantial area located within water supply watersheds. The implementation of the long-term solution will require construction within these water supply and critical watersheds and will increase the impervious area. Measures should be undertaken to minimize the effects on water quality during construction through the effective use of erosion and sediment control devices and the design should incorporate Best Management Practices (BMPs) to improve water quality after the construction is complete and minimize runoff into the water supply and critical watershed areas.

6.3.2.6 High Quality Waters and Outstanding Resource Water Management Zones

The study area for the US 64 Corridor Study does not include any designated HQW or ORW zones; therefore there will be no impact to these resources.

6.3.2.7 Major Water Bodies

The only major water bodies along the corridor are the bridge crossings of the Haw River and B. Everett Jordan Lake. To accommodate the multi-use path both of these bridges will be widened (in the median) to accommodate the additional width required for the path.

6.3.2.8 River Basins and Stream Buffers

Stream buffers along the streams within the study area will be impacted as a result of the implementation of the long-term solution. The recommended long-term solution will impact 465,100 square feet of Zone 1 and 298,800 square feet of Zone 2 buffers that are subject to the B. Everett Jordan Reservoir Water Supply buffers and 20,400 square feet of Zone 1 and 13,600 square feet of Zone 2 buffers subject to the Neuse River Riparian Buffer Rules.

6.3.2.9 Wildlife Refuges and Game Lands

There are no wildlife refuges designated by the United States Fish and Wildlife Service within the study area and no game lands will be impacted by the recommended long-term solution.

6.3.2.10 Threatened and Endangered Species

Detailed investigations for threatened and endangered species were not conducted for this study. The evaluation of potential effects to threatened and endangered species will occur in future phases of the planning for the long-term solution.

6.3.2.11 Federal Emergency Management Agency Buyout Properties

There are currently no known FEMA buyout sites located within the study area for the US 64 corridor study.

6.3.2.12 Federally Owned Land

The recommended long-term solution currently shows the need to acquire property from the US Army Corp of Engineers property at B. Everett Jordan Lake. Additional steps will be taken during the more detailed design phase to determine if it is possible to avoid or minimize the impacts to the federally owned land. If it is not possible to fully avoid the property then coordination with the Corp will be initiated to determine if an easement can be acquired for a transportation use.

6.3.3 Cultural Resources

6.3.3.1 Historic Districts

The long-term solution will impact approximately 36.5 acres of the 11,450 acre New Hope Rural Historical Archeological District. Preliminary evaluation by NCDOT determined that the additional property required at Big Woods Road/Seaforth Road for the construction of the interchange recommended for the long-term solution would not constitute the taking of land subject to protection under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources.

6.3.3.2 Historic Properties

There is one historic property that has been determined to be eligible for the National Register that will be impacted by the long-term solution. The J.B Mills House and Farm, located on US 64 at the intersection with New Hill Road currently will require approximately 1.3 acres of property to construct the proposed interchange and will not directly impact the farm house located on the property. The impacts to the historic property will require additional design to determine if the impacts to the property can be eliminated or reduced to a level where a *De Minimis* finding could be made under Section 4(f) of the US Code Title 23 Section 138 that protects historic resources.

6.3.4 Description of Potentially Significant Environmental Impacts

The next step in developing the recommendations for the long-term solution is to proceed to the detailed environmental documentation stage. The recommended long-term solution may be processed as a single environmental document for the entire study area or as a series of individual environmental documents for individual segments of the corridor. The environmental documents will likely be developed to satisfy the requirements of the National Environmental Policy Act (NEPA). The first step in the NEPA process is to determine if the proposed project is likely to have a significant impact. If a project is determined to have a significant impact then an Environmental Impact Statement would be required. If a project is determined to not have a significant impact then an Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) would be prepared.

Based on the information gathered as a part of this study the potential exists for an EIS being required. Once the improvements proposed in this study are carried forward, additional study coordination with regulatory agencies should be conducted to determine if an EIS will be required. Items identified as a part of this study that should be considered when determining if an EIS is appropriate are as follows:

- Stream and buffer Impacts within the water supply and critical watershed for Jordan Lake will need to be addressed in a manner that does not impair the water quality of this vital resource
- Impacts to federally owned land at B. Everett Jordan Lake
- Impacts to J.B Mills House and Farm that is eligible for the National Register of Historic places
- Impacts to the New Hope New Hope Rural Historical Archeological District
- Public controversy relating to the section from NC 540 to US 1

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Chapter 7: Land Use Evaluation

Townhomes under construction near Beaver Creek (January 2009)

CHAPTER 7. LAND USE EVALUATION

The purpose of the land use evaluation presented in this chapter is to define a specific land use study area along the proposed corridor, analyze development trends, potential growth areas, and existing and future land use within the US 64 corridor. This evaluation will include the evaluation of land use compatibility with the proposed design concepts, and will identify long-term and short-term transportation and land development strategies for transitioning the corridor from its current state to the long-term solution.

7.1 LAND USE EVALUATION METHODOLOGY

The following section presents the methodology for completing the land use evaluation.

7.1.1 LAND USE STUDY AREA AND DATA COLLECTION

7.1.1.1 Land Use Study Area

A land use study area was defined along the study corridor based on an area within one half mile on either side of US 64 for the length of the project and increased in the vicinity of interchanges and intersections to include "catchment areas" around interchanges. The catchment area can generally be defined as an area around an interchange where land use decisions are influenced by the interchange.

7.1.1.2 Population and Development Trends

Population and development data were used to establish trends within the project study corridor. Population data was obtained from planning documents, the US Census Bureau, and State and county databases. The demographic area was defined and characterized using Traffic Analysis Zones (TAZ) that intersected the land use study area. Demographic characteristics were defined using GIS by jurisdictional boundaries and aggregated within the overall study corridor.

7.1.1.3 Land Use and Zoning

Available County and City planning documents were collected and reviewed. These documents included:

- Comprehensive Plans
- Land Use Plans
- Zoning Codes and Maps
- Development Controls
- Growth and Development Projections

The available local land use and zoning plans were identified and described based on these documents, as well as meetings with local officials.

7.1.1.4 Potential Growth/Development Area

Aerial photographs were used to review existing land use surrounding the project study area and to identify existing land use patterns. Analyses of existing land use, zoning, development trends, and population growth were conducted to identify where transportation is most likely to influence growth and development as well as where land use is likely to influence traffic and travel patterns. Likely areas of development and redevelopment were also identified.

7.1.1.5 Field Review, Meetings with Local Officials

Field reviews of the study area were conducted to observe the natural and physical environment and travel patterns, assess land use characteristics and development patterns, and identify major destinations such as employment and shopping centers and public facilities.

Meetings with local public officials, including MPO, county, and town planners, were conducted. These meetings helped to identify planning visions and goals for the study area and identify past, present, and planned development activities within the study area that should to be considered in addressing growth and land use with respect to the US 64 corridor.

7.1.2 EXISTING LAND USE MAP

A corridor-wide existing land use map was prepared using existing land use and zoning data including local land use and comprehensive plans, aerial photography, and data collected from field reviews.

7.1.3 LAND USE ASSESSMENT FOR LONG-TERM SOLUTION

Existing land use data combined with population data and analysis of development trends along the corridor was used to prepare a future land use map that reflected current and projected land use trends. This land use assessment was used to evaluate land use compatibility with proposed US 64 design concepts for the design year 2035. This effort was a corridor-wide assessment but focused on future interchange catchment areas as land use nodes.

From this comparison, recommendations were developed for changes to land use and zoning plans, growth management areas, and access management. The recommendations were focused on an integrated approach to achieving both the transportation improvement and land use / growth management objectives.

7.1.4 LAND USE ASSESSMENT FOR SHORT-TERM SOLUTION

The data collected was used to assess the potential effects of the US 64 short-term solutions on future land use in an interim year of 2018. The data was also used to evaluate potential effects of proposed short-term improvements on land uses with a focus on developing consistency and compatibility between long-term improvements and future land use plans. Effects were assessed corridor-wide but the emphasis of the assessment was focused on catchment areas at interchange and intersection land use nodes.

7.2 LAND USE PLANS AND ORDINANCES

Land use patterns are shaped by numerous factors, such as local land use and zoning regulations, accessibility, and topography. With any change in transportation and access to an area, there is a possibility that land use patterns may be impacted. It is important to develop an understanding of not only the existing land uses, but of the land use plans. The project is within the planning jurisdiction of Wake and Chatham Counties, the Town of Pittsboro, the Town of Apex, and the Town of Cary. In addition, the USACE owns land adjacent to the B. Everett Jordan Reservoir. Plans in place in the Study Area are described in this section.

7.2.1 CHATHAM COUNTY LAND CONSERVATION AND DEVELOPMENT PLAN

The *Chatham County Land Conservation and Development Plan* (Chatham County, November 2001) was developed under the general goal of balancing growth, having an adequate and diverse housing supply, conserving and protecting natural resources, and pursuing commercial endeavors. As part of its transportation policy, the plan supports the completion of the current highway construction program in the county, resulting in 4-lane highways for US 64, US 15-501 between Pittsboro and the Orange County line, US 1 and US 421.

The plan states that Chatham County's water supply watershed protection ordinance meets, and in some instances, exceeds the State's minimum requirements. The County has adopted more stringent stream buffer standards than are required by the State. In addition, the County has established protected low density rural corridors in several areas, including the Haw River corridor that passes through the project study area. Within these areas, residential development densities are generally limited to one unit per five acres, and more extensive stream buffers are required.

7.2.2 Chatham County Land Use Strategic Plan

The intent of the *Chatham County Land Use Strategic Plan* (Chatham County, December 1999) is to note specific goals for each of the eleven general goals stated in the Chatham County Land Conservation and Development Plan. Specific goals pertaining to land use include: encouraging more intensive land uses, such as commercial, high density residential, and industrial, concentrated in or near Chatham's existing towns; providing land use planning that emphasizes clustered, mixed use developments; preserving natural scenic areas; and increasing the proportion of land preserved as open space in areas under development.

7.2.3 Wake County Land Use Plan

The *Wake County Land Use Plan* (Wake County, July 2007) sets forth policies intended to influence the timing, type, location, and quality of future development within Wake County's planning jurisdiction so as to efficiently accommodate the growth of urbanized areas within or adjoining Wake County in a manner consistent with the Plan's goals and strategies. This plan is divided into five area land use plans for more extensive individual analysis and the US 64 study corridor lies within the Southwest Wake Area Land Use Plan.

Southwest Wake Area Land Use Plan

The *Southwest Wake Area Land Use Plan* (Wake County, July 2007) incorporates the recommended policies and development standards adopted by the Towns of Apex, Cary, and Holly Springs for their Urban Services Areas. The plan recommends that Wake County supports plans to reserve right-of-way along the US 64 corridor. Additionally restricting access, constructing grade separations, developing frontage roads where necessary, and revising existing access points are recommended to support the conversion of US 64 to a freeway.

7.2.4 Wake County Growth Management Strategy

The *Wake County Growth Management Strategy* (Wake County, December 2002) is a coordinated strategy to address and manage the growth in Wake County. It is a unified strategy that considers the unique characteristics of the communities within Wake County. The plan includes a transportation section that suggests increasing coordination at the county and regional level to accomplish transportation planning, design, and construction. The US 64 corridor has county-wide and regional importance and high levels of coordination will continue in order to keep the project in alignment with the Wake County Growth Management Strategy.

7.2.5 Town of Pittsboro Land Use Plan

The *Pittsboro Land Use Plan* (Town of Pittsboro, June 2002) describes the policies to direct new development in Pittsboro for the upcoming years. Transportation is identified as a key aspect to the Plan. Part of Pittsboro's vision for the future is interconnected transportation systems that promote safe access for vehicles, pedestrian, and bicycle and transit mobility to reduce congestion. The plan discusses the conversion of US 64 to a freeway as a means to reduce congestion.

7.2.6 Town of Apex Comprehensive Plan

The *Apex Comprehensive Plan* (Town of Apex, March 2004) identifies specific issues facing Apex in order to address them before they affect the quality of life for Apex residents. The vision in the Plan is intended to inform development decisions. As such, the Plan includes a transportation component. The Plan recommends freeway interchanges and grade separations that maximize vehicular access to and through Apex.

7.2.7 Town of Apex - Western Area Plan

The Town of Apex *Western Area Plan* (Town of Apex, June 2008) is the vision for the western part of Apex. The *Western Area Plan* builds off of the 2004 *Apex Comprehensive Plan* and focuses on land use. It notes the importance of several transportation projects that play a role in the study area, including the NCDOT's plan to convert US 64 to a freeway and expressway.

7.2.8 Town of Apex 2025 Land Use Plan

The *2025 Land Use Plan* (Town of Apex, August 2008) shows land use along the US 64 corridor will have varied uses. Multi-use development is proposed for areas along the corridor at the proposed Western Wake Freeway (NC 540) from US 64 to Jenks Road, just east of the NC 751 proposed interchange, and the Davis Drive interchange. Residential areas along the corridor are proposed as medium to high density.

7.2.9 Town of Cary Future Land Use Plan

The Town of Cary's *Future Land Use Plan* (Town of Cary, February 2008) shows the area at the intersection of US 1 (eastern end of study area) and US 64 as an area with high-density residential development, office/industrial, commercial areas, and parks.

7.3 EXISTING LAND USE CHARACTERISTICS

The US 64 corridor is characterized by various existing land uses shown in Figure 7.1. A common set of land use categories was developed to compare existing, interim, and future uses within the study area. These land uses include varying degrees of residential development based on parcel size (low to high density), agricultural, commercial, industrial, institutional, recreational, and utilities. Development patterns range from rural, undeveloped areas to dense suburban conditions. The general pattern of existing land use includes low density residential and agricultural uses in outlying portions of the counties with a mix of commercial, institutional, industrial, and high-density residential located in town centers and along major corridors.

Differences in land use affect mobility throughout the corridor; rural areas typically experience unobstructed travel while more developed areas experience congestion. Rural areas of the US 64 corridor include the following land uses, as described in *Land Use Policy for Mobility Protection* (NCDOT, September 2005):

- Scenic/Protected – Flanked by tree-covered areas, lakes and other natural features, these sections of highways stand the best chance of maintaining their natural, rural character. Some of these segments are protected in their undeveloped state, while others are not. Scenic/Protected areas occur along the corridor almost exclusively in Chatham County.

- Rural: Vacant or Agricultural – Clusters of large tracts of land that have never been developed or have been farmed (and continue to be farmed) are typically found in many locations along highways. The patterns that should be examined include both those that exist along highways today and those that are emerging. Rural and/or agricultural areas along the corridor exist in Chatham County for the most part.

- Rural: Low-density Residential – Over time, single family homes have been constructed on large tracts of land. Many of these structures are not visible from highways, but the private driveways that provide access to them give an indication of the number that exist within areas that otherwise appear vacant. Low-density areas along the corridor are most common in Chatham County and in Wake County near the Chatham County line.

Figure 7.1: Existing Land Use Map

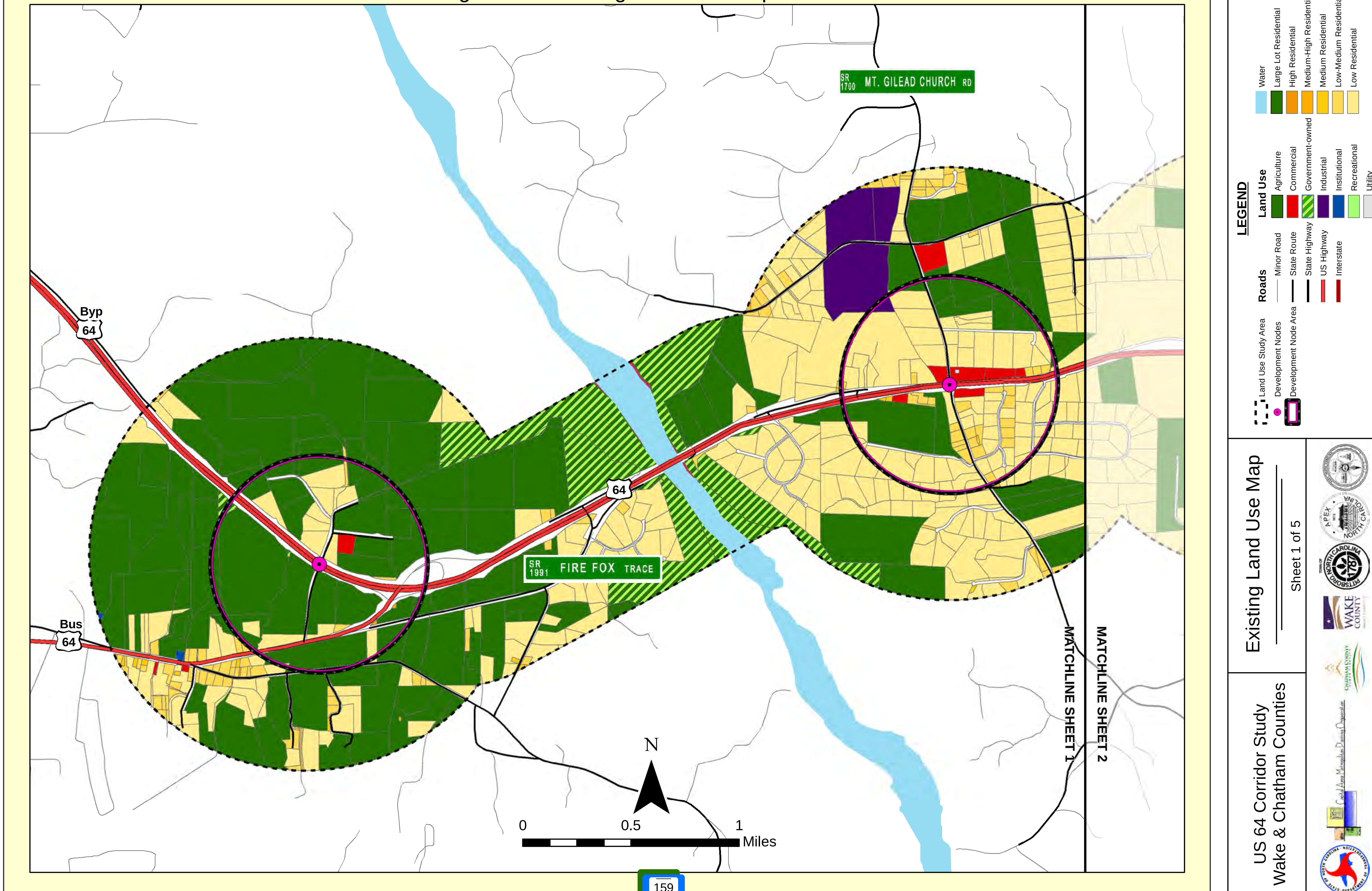


Figure 7.1: Existing Land Use Map

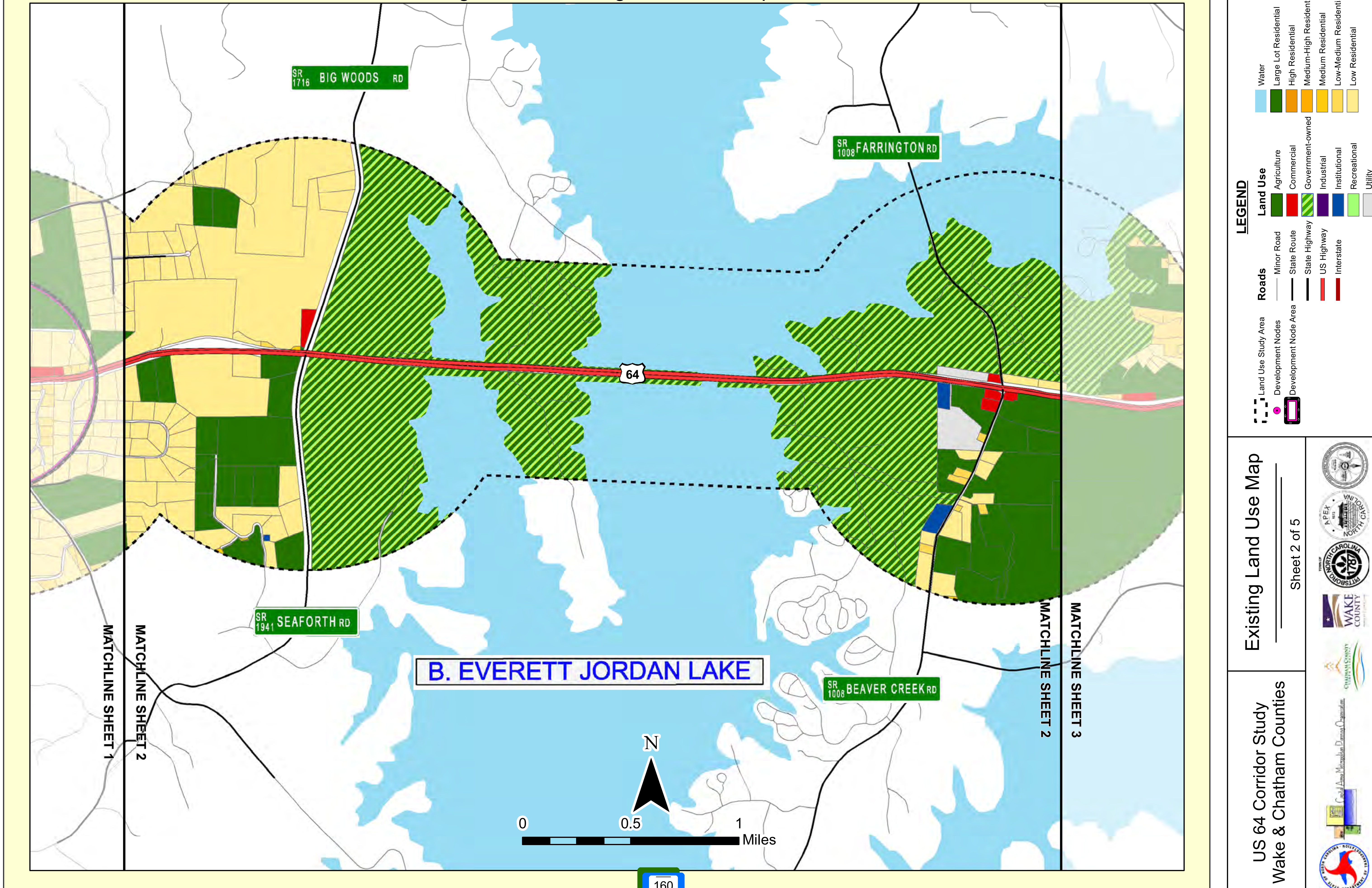


Figure 7.1: Existing Land Use Map

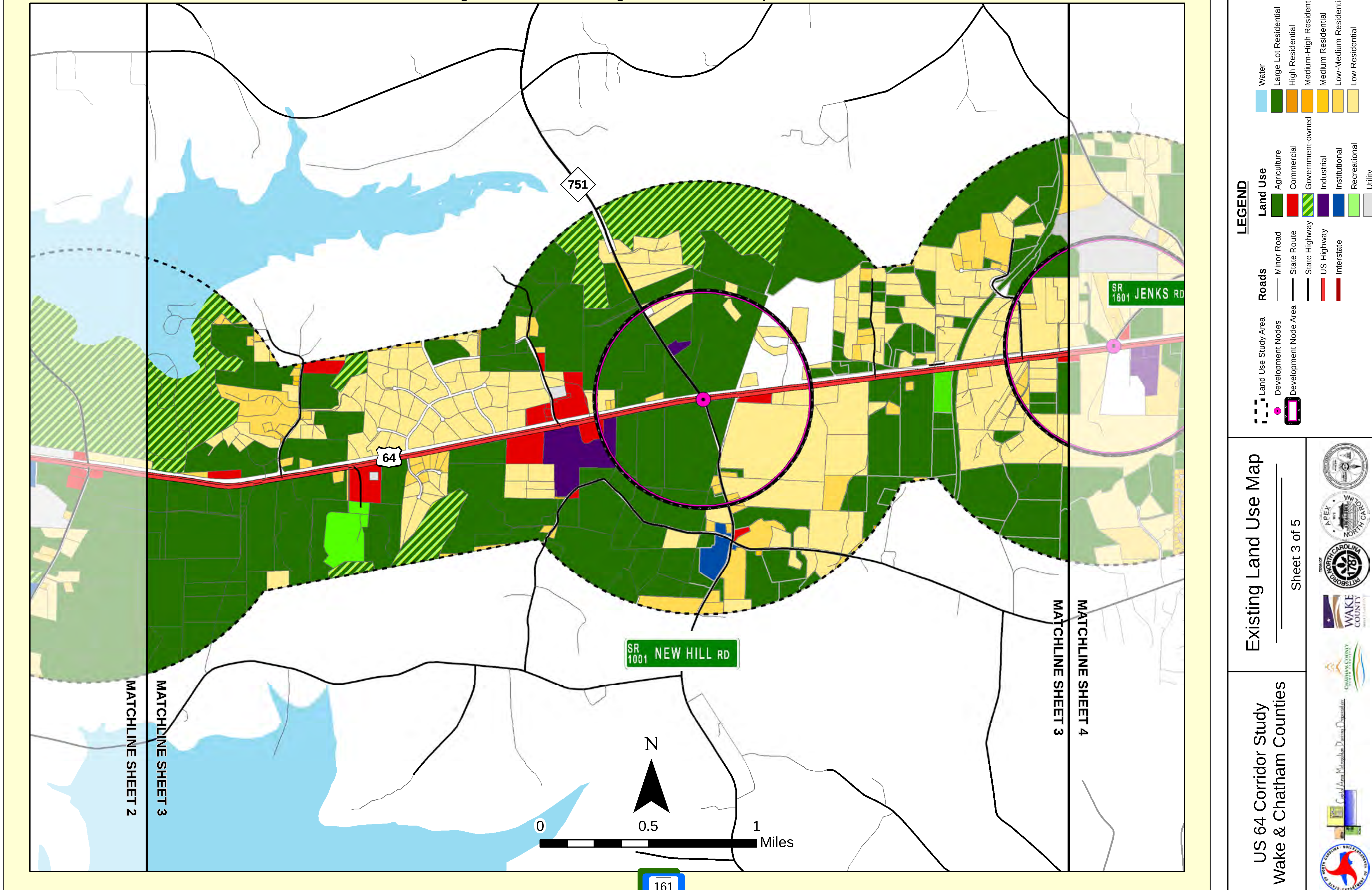
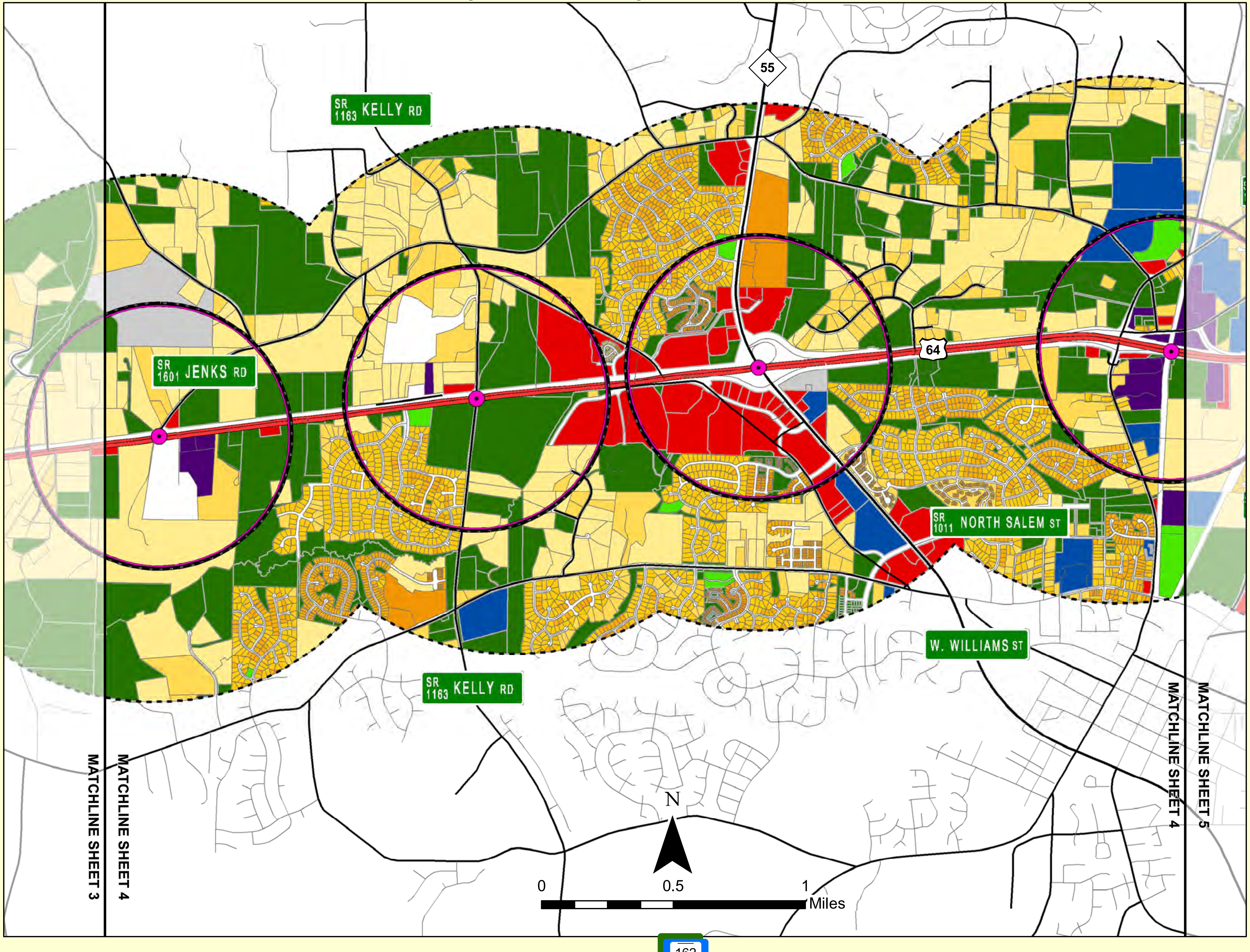


Figure 7.1: Existing Land Use Map



LEGEND

Land Use Study Area
Development Nodes
Development Node Area

Roads
Minor Road
State Route
State Highway
US Highway
Interstate

Land Use
Agriculture
Commercial
Government-owned
Industrial
Institutional
Recreational
Utility

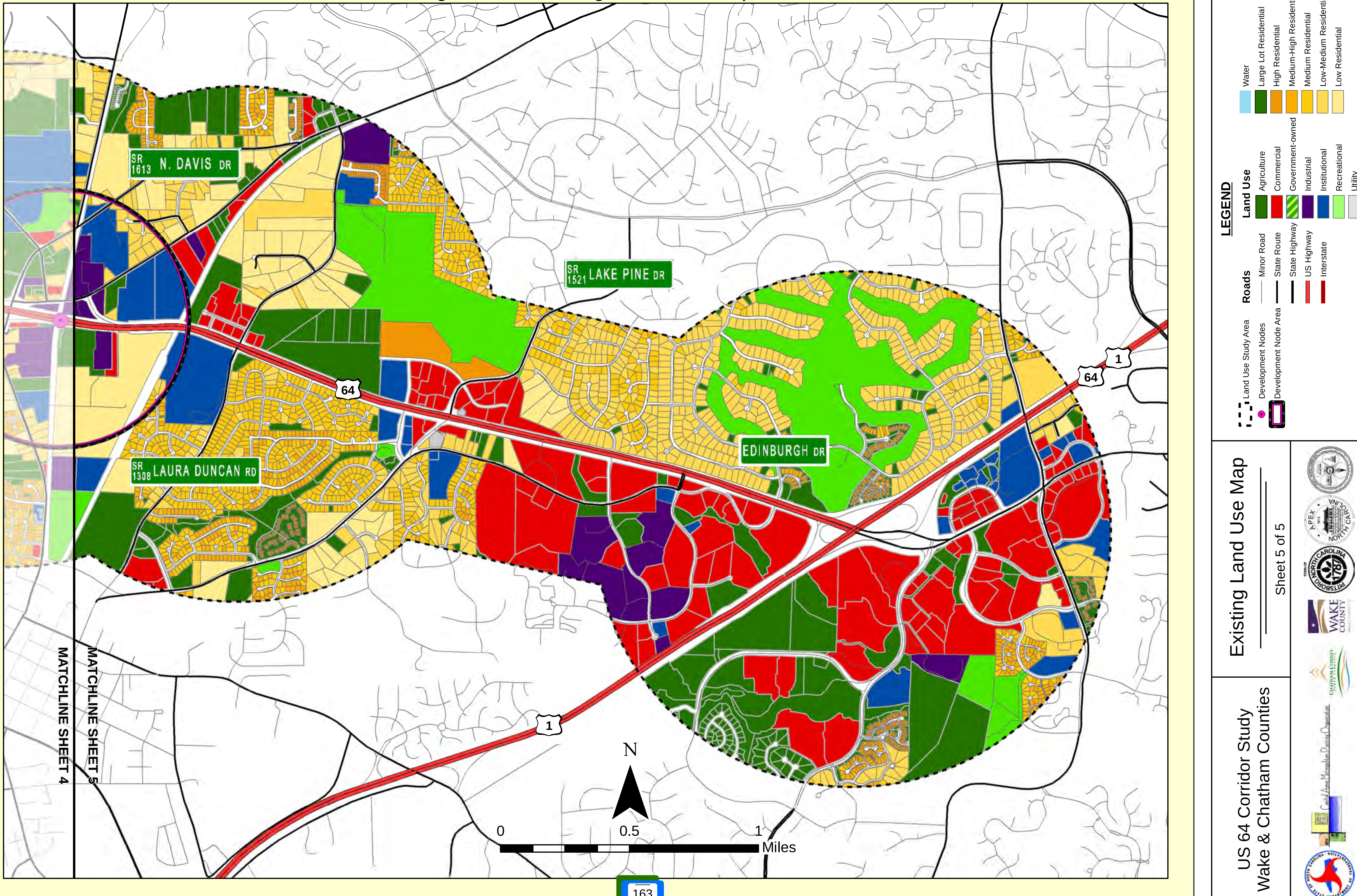
Water
Large Lot Residential
High Residential
Medium-High Residential
Medium Residential
Low-Medium Residential
Low Residential

Existing Land Use Map

Sheet 4 of 5

US 64 Corridor Study
Wake & Chatham Counties

Figure 7.1: Existing Land Use Map



Developed land that currently exists on the US 64 corridor, as well as areas emerging along the corridor are as follows:

- Conventional, Single-use Subdivisions – The subdivision of large tracts of land has occurred in multiple locations along many highways. Some have been developed for single family homes on lots of one acre or less, while others have been developed as business parks for business and/or industrial uses. Common to both are the single (or few) points of access that are directly related to traffic along highways. Also, these subdivisions rarely have direct, physical connections to adjacent development. These subdivisions are common along the Apex and Cary portions of the corridor.

- Commercial Strip – Taking advantage of the access from a highway, commercial development comprised mainly of large and small-scale retail, restaurants, gas stations, and other commercial development are common to roadways. Each commercial establishment is oriented toward the highway, and gains its access to the highway through at least one private driveway serving only that parcel. Such commercial development is typically continuous, stretching one parcel deep on each side of the highway for at least one-half mile where it occurs.

- Highway-oriented Business – An emerging development pattern is the highway-oriented business development, which is often comprised primarily of regional-scale retail, typically found at freeway interchanges. As highway improvements have been made, interchanges have been constructed that encourage a concentration of businesses that depend on the patronage of passing traffic. Such interchanges, like the Beaver Creek shopping center at NC 55 and US 64, are attracting large-scale retail and restaurant chains as well as gas stations, which are all being incorporated into conventional "power centers" (regional shopping centers of 300,000 or more square feet). While these businesses are typically not accessed by individual driveways, the centers in which they locate typically have a single point of entry near the interchange.

The most urbanized portions of the study area lie within the jurisdictions of the Towns of Apex and Cary. The largest commercial developments occur at the intersection of NC 55 and US 64 in Apex and US 1 and US 64 in Cary. At the western end of the Study Area, Chatham County remains largely rural/agricultural or undeveloped forestland, with some residential uses and small pockets of commercial development concentrated along US 64 Business as it approaches the center of Pittsboro. East of the Haw River in Chatham County, land use remains largely rural/agricultural or undeveloped forestland as well, with some commercial and low to medium-density residential land uses at the intersection of Mt. Gilead Church Road, and low-density residential areas just west of the NC 751 intersection.

7.4 FUTURE LAND USE CHARACTERISTICS

Land use changes are anticipated to occur due to increasing growth pressures from the metropolitan areas of Raleigh, Durham and Chapel Hill, as well as pressure from Research Triangle Park, the region's largest employment center. According to population projections from CAMPO, it is estimated that population within the corridor study area will increase approximately 66.2% in the next two decades (2010-2030). As the area continues to grow, it is expected that many remaining vacant and under-developed parcels will develop according to their highest and best use to achieve the greatest value for the property.

Most town and county governments in the area have prepared plans for managing anticipated growth for the next 20 to 30 years. Each plan expresses a vision for future land use based on assumptions about future growth patterns informed by a wide range of data including projections for population, employment, and infrastructure availability. These local land use plans document anticipated land use changes. Brief land use descriptions along the corridor are provided as follows for each county.

7.4.1 CHATHAM COUNTY

The *Chatham County Land Conservation and Development Plan* recommends designating towns and economic centers as areas to provide future water and/or sewer service, while restricting or prohibiting extension to areas designated for low-density growth. According to planners from Chatham County, the areas of development along the US 64 corridor shall be directed towards the Town of Pittsboro with limited development along the US 64 corridor. According to the proposed Chatham County corridor overlay districts, a special-use designation is recommended for parcels adjacent to the NC 751 and US 64 proposed interchange. This designation includes primarily non-retail uses, e.g. a research campus or industrial use. Areas around Jordan Lake are owned by the USACE. There are also special water restrictions to land use due to the Jordan Lake Watershed, as shown in the *Chatham County Watershed Ordinance* (Chatham County, January 1994), that prohibit high-density development directly adjacent to the watershed. Most areas from east of the Haw River to the Jordan Lake watershed have been designated by the *Chatham County Zoning Ordinance* (Chatham County, December 2008), *Chatham County Watershed Ordinance*, and the *Chatham County Land Conservation and Development Plan* as low-density development, with higher-density development located within the Town of Pittsboro.

7.4.2 WAKE COUNTY

The Towns of Apex and Cary both have well-developed future land use plans that consider transportation as well. According to the Town of Apex's *2025 Land Use Plan* and interviews with local planners, land along the US 64 corridor will have varied uses. Multi-use development is proposed for areas along the corridor at the proposed Western Wake Freeway from US 64 to Jenks Road, just east of the NC 751 proposed interchange, and the Davis Drive interchange. Residential areas along the corridor are proposed as medium to high density. The Town of Cary's *Future Land Use Plan* (February 2008) and interviews with local planners indicate that the area at the intersection of US 1 (eastern end of study area) will remain an area with high-density residential development, office/industrial, commercial areas, and parks.

Based on information provided by local planners, several undeveloped sites near proposed interchanges are likely to see the infill of vacant parcels and the redevelopment of existing underutilized parcels with new commercial and office facilities.

7.5 LAND USE ASSESSMENT

Not all counties and municipalities within the US 64 corridor study area have future land use plans available. In the absence of a formal plan, recommended future land use was determined using an examination of existing land use, watershed protection ordinances, and growth management plans. Meetings with local county and town planners were conducted to identify planning visions and goals for the study area and identify past, present, and planned development activities within the study area that should to be considered in addressing growth and land use with respect to the US 64 corridor.

7.5.1 DEVELOPMENT AREAS

Analyses of existing land use, zoning, development trends, and population growth were conducted to identify where transportation is most likely to influence growth and development as well as where land use is likely to influence traffic and travel patterns. Likely areas of development and redevelopment were identified along the US 64 corridor as development nodes at the interchanges of US 64 and US 64 Business in Pittsboro, Mt. Gilead Church/Pea Ridge Road in Chatham County, NC 751, Jenks Road, NC 55, and Davis Drive.

The land use assessment for the short-term solution is shown in Figure 7.2 and in Figure 7.3 for the long-term solution.

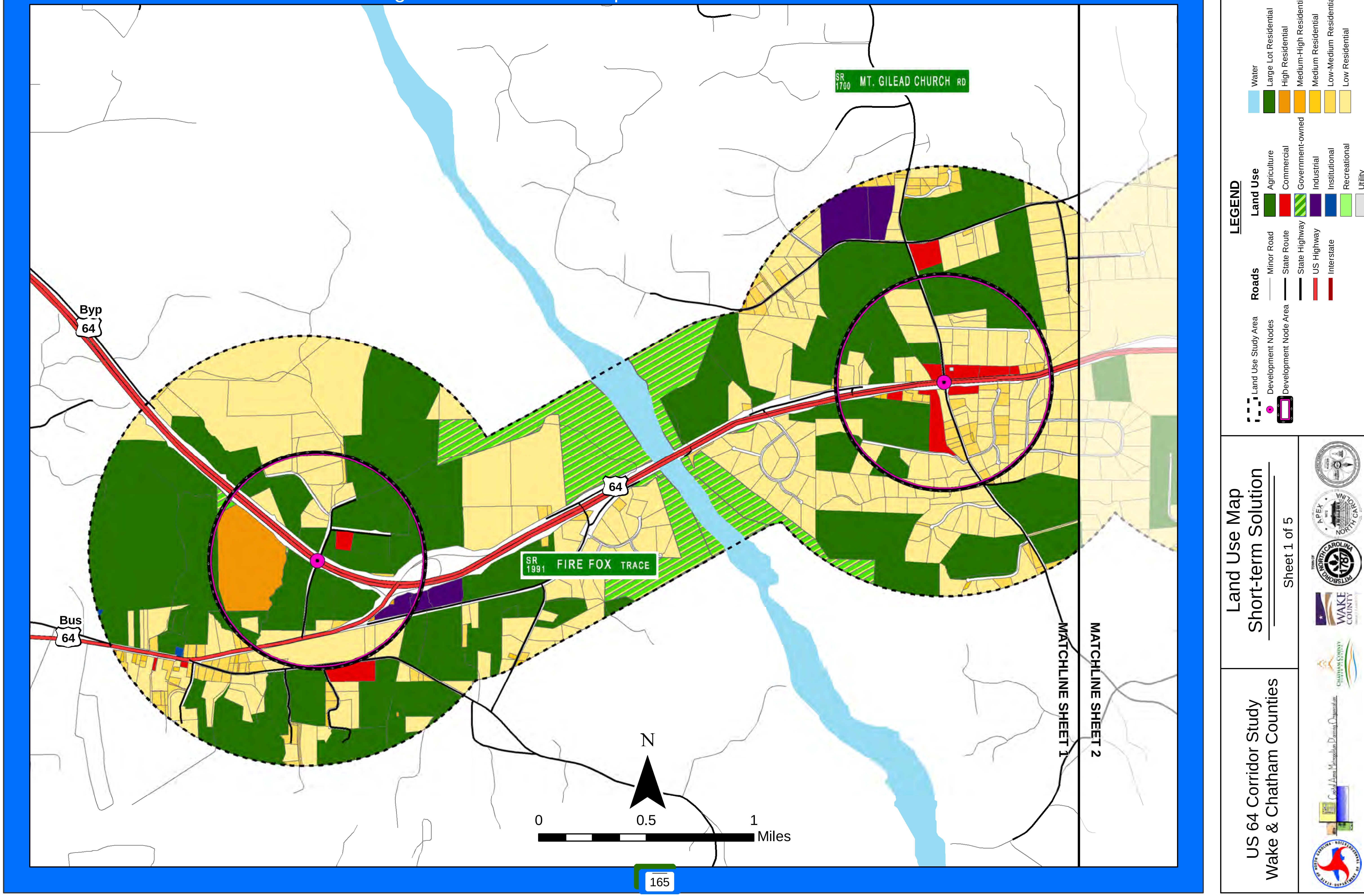
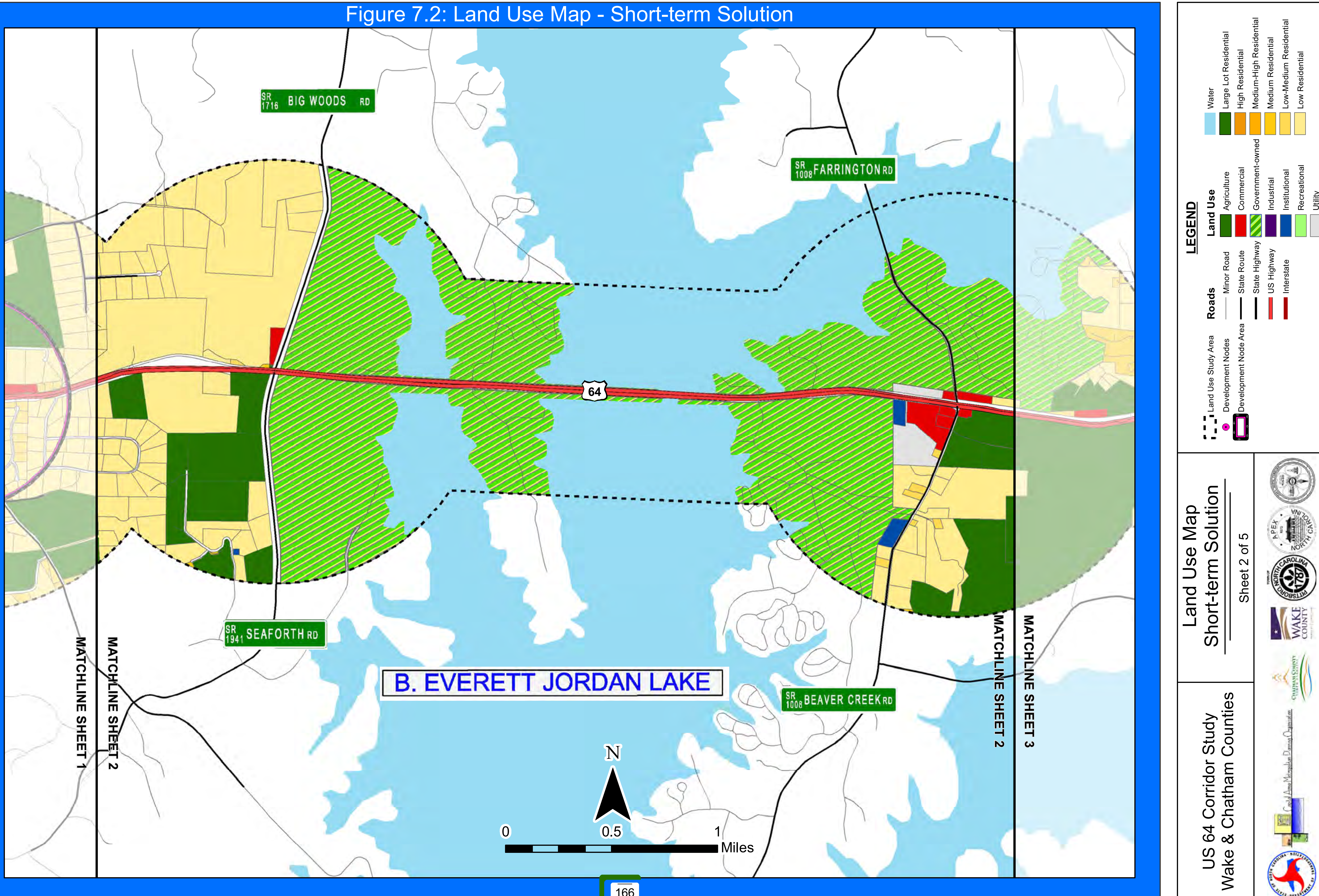


Figure 7.2: Land Use Map - Short-term Solution

Figure 7.2: Land Use Map - Short-term Solution



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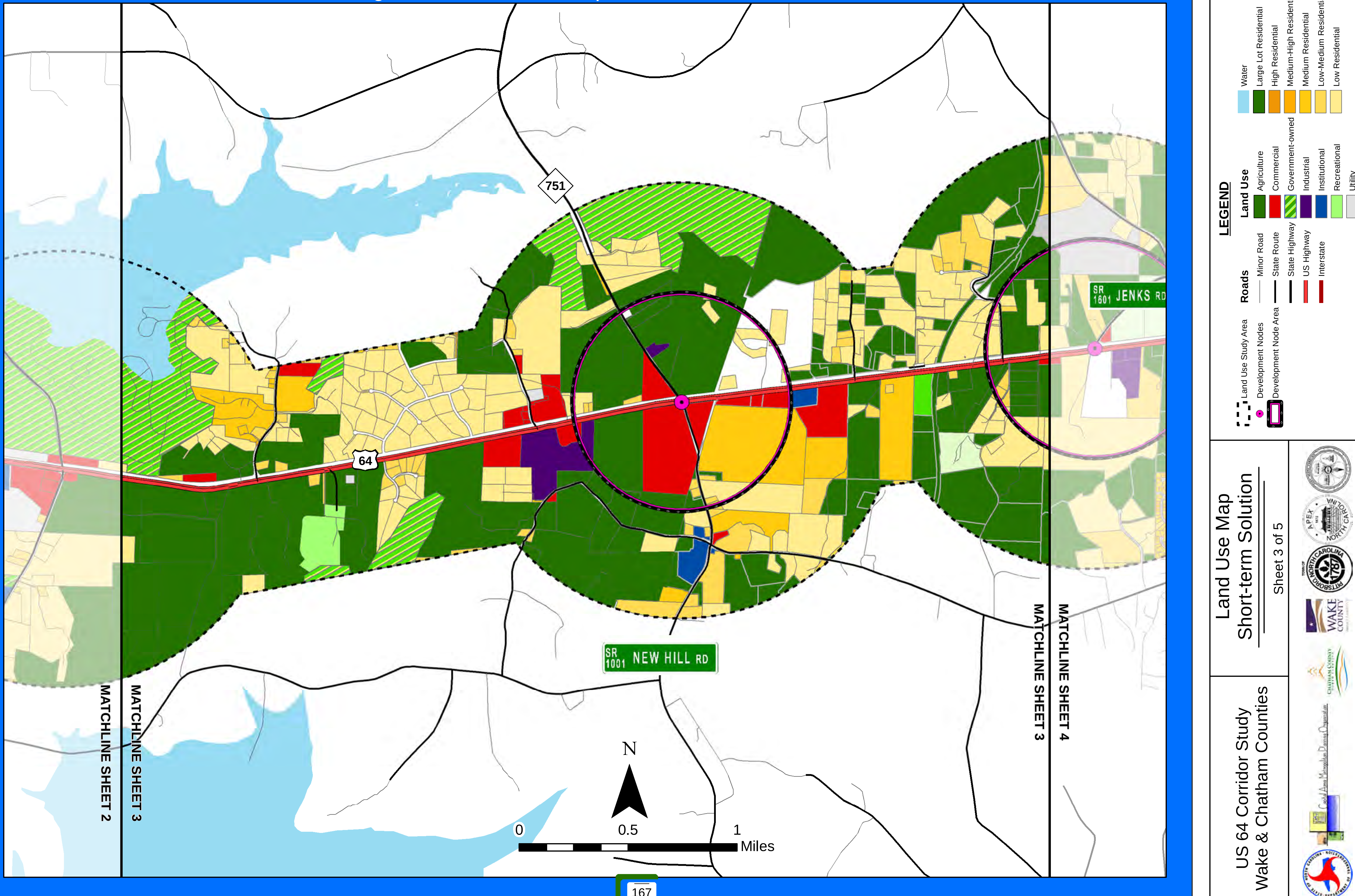

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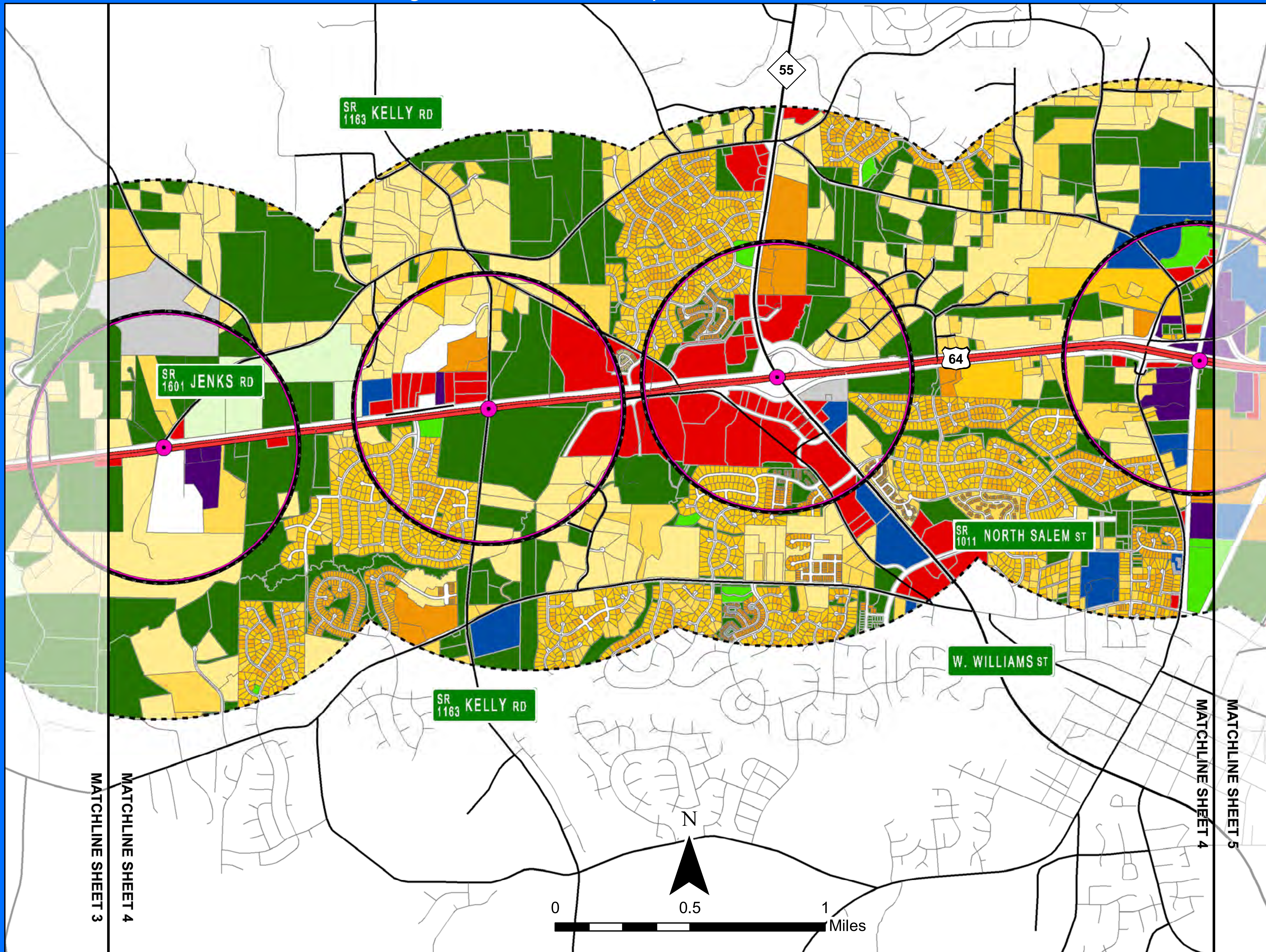


LEGEND

- Land Use Study Area
- Development Nodes
- Development Node Area

Roads

- Minor Road
- State Route
- State Highway
- US Highway
- Interstate

Land Use

- Agriculture
- Commercial
- Government-owned
- Industrial
- Institutional
- Recreational
- Utility
- Water
- Large Lot Residential
- High Residential
- Medium-High Residential
- Medium Residential
- Low-Medium Residential
- Low Residential

Land Use Map
Short-term Solution

Sheet 4 of 5

US 64 Corridor Study
Wake & Chatham Counties

Figure 7.2: Land Use Map - Short-term Solution

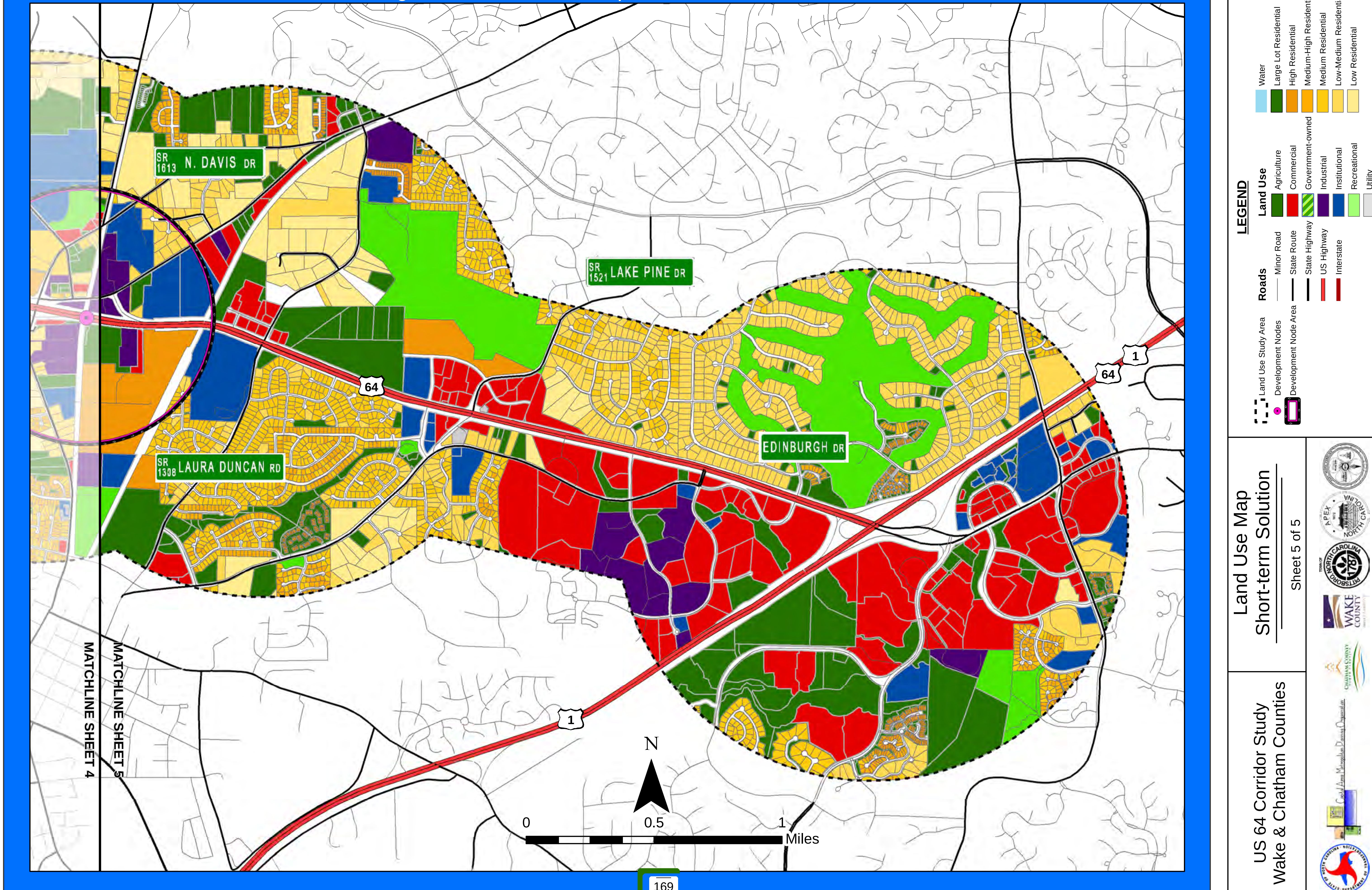


Figure 7.3: Land Use Map - Long-term Solution

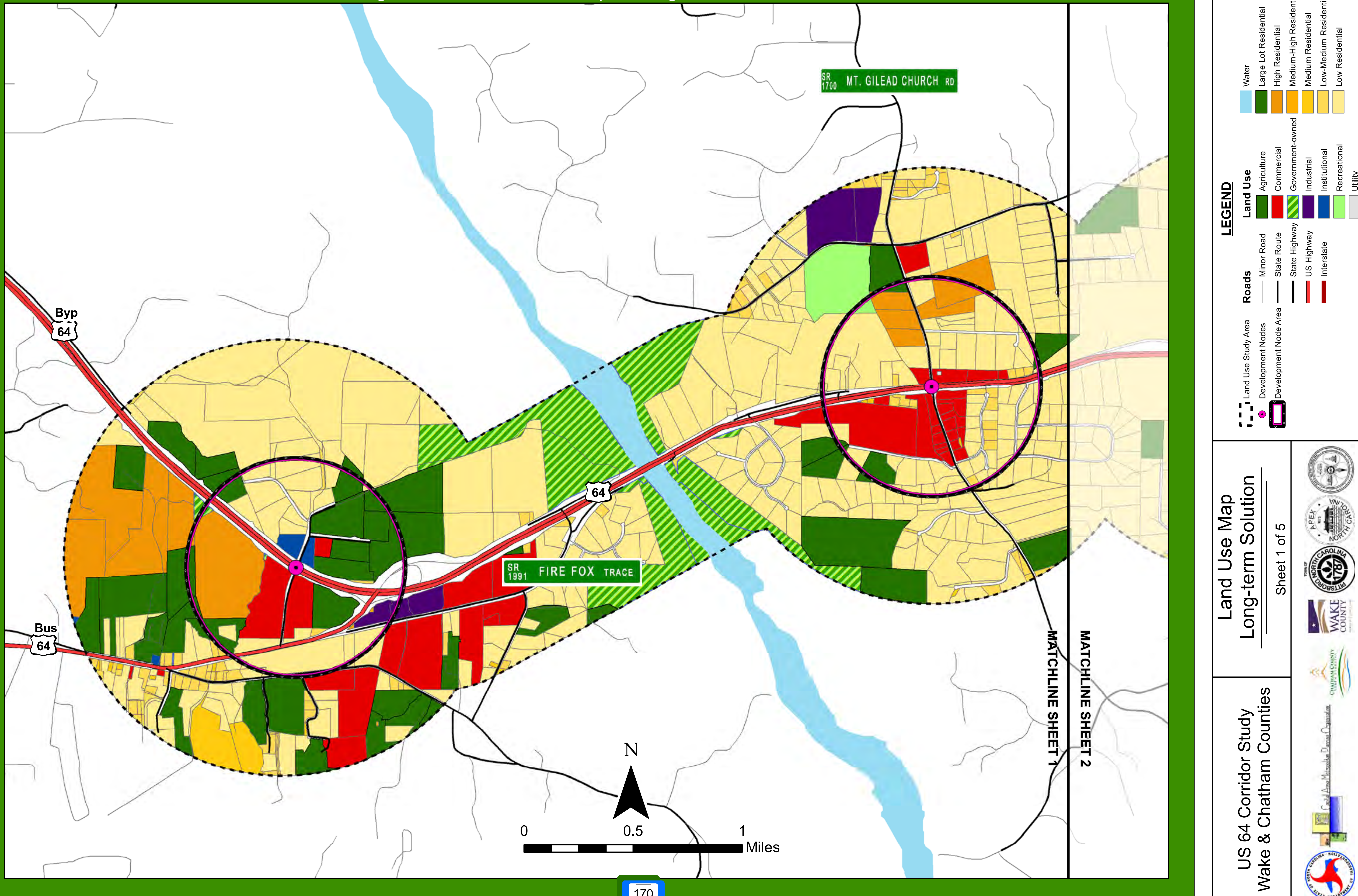


Figure 7.3: Land Use Map - Long-term Solution

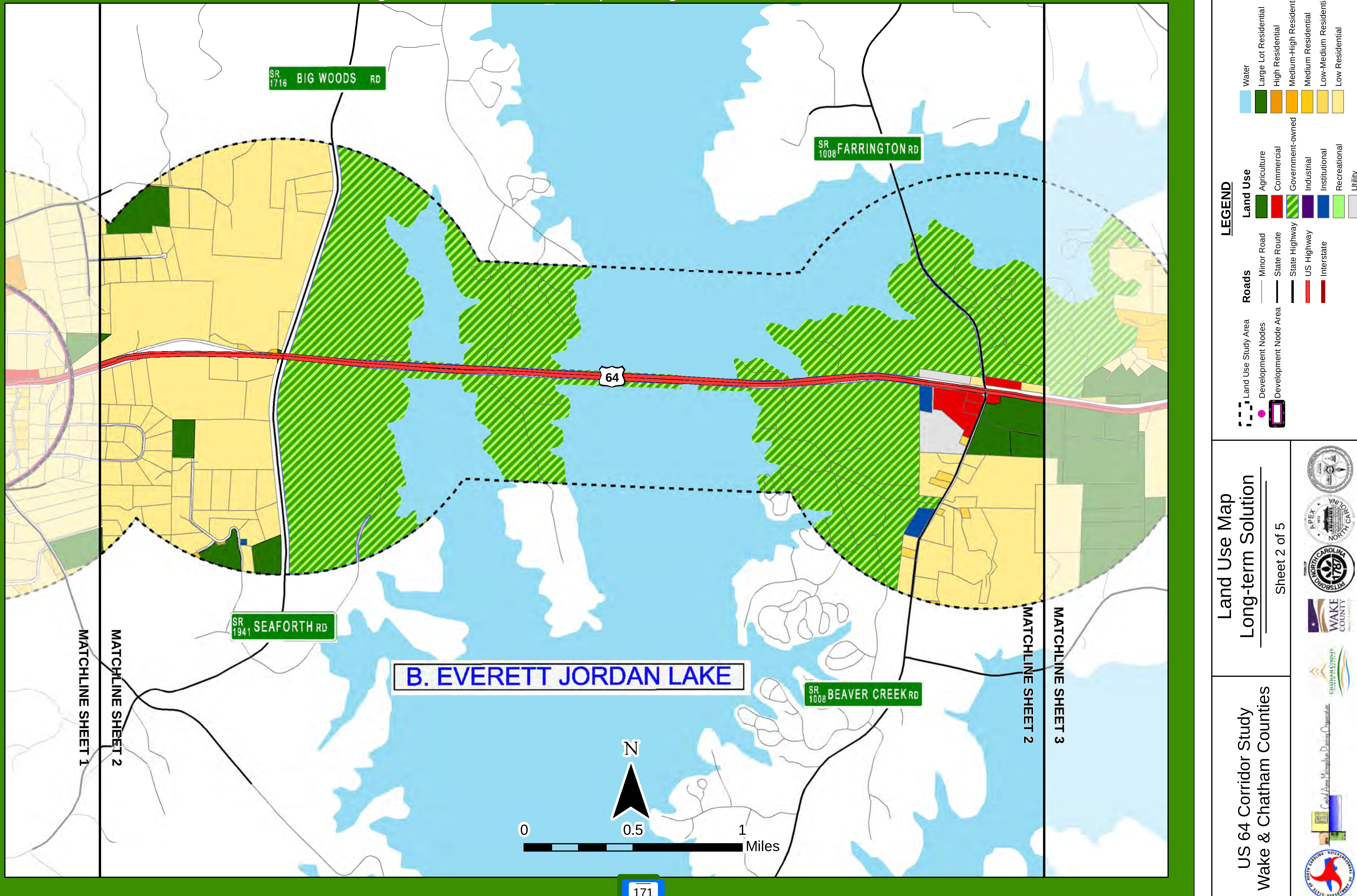


Figure 7.3: Land Use Map - Long-term Solution

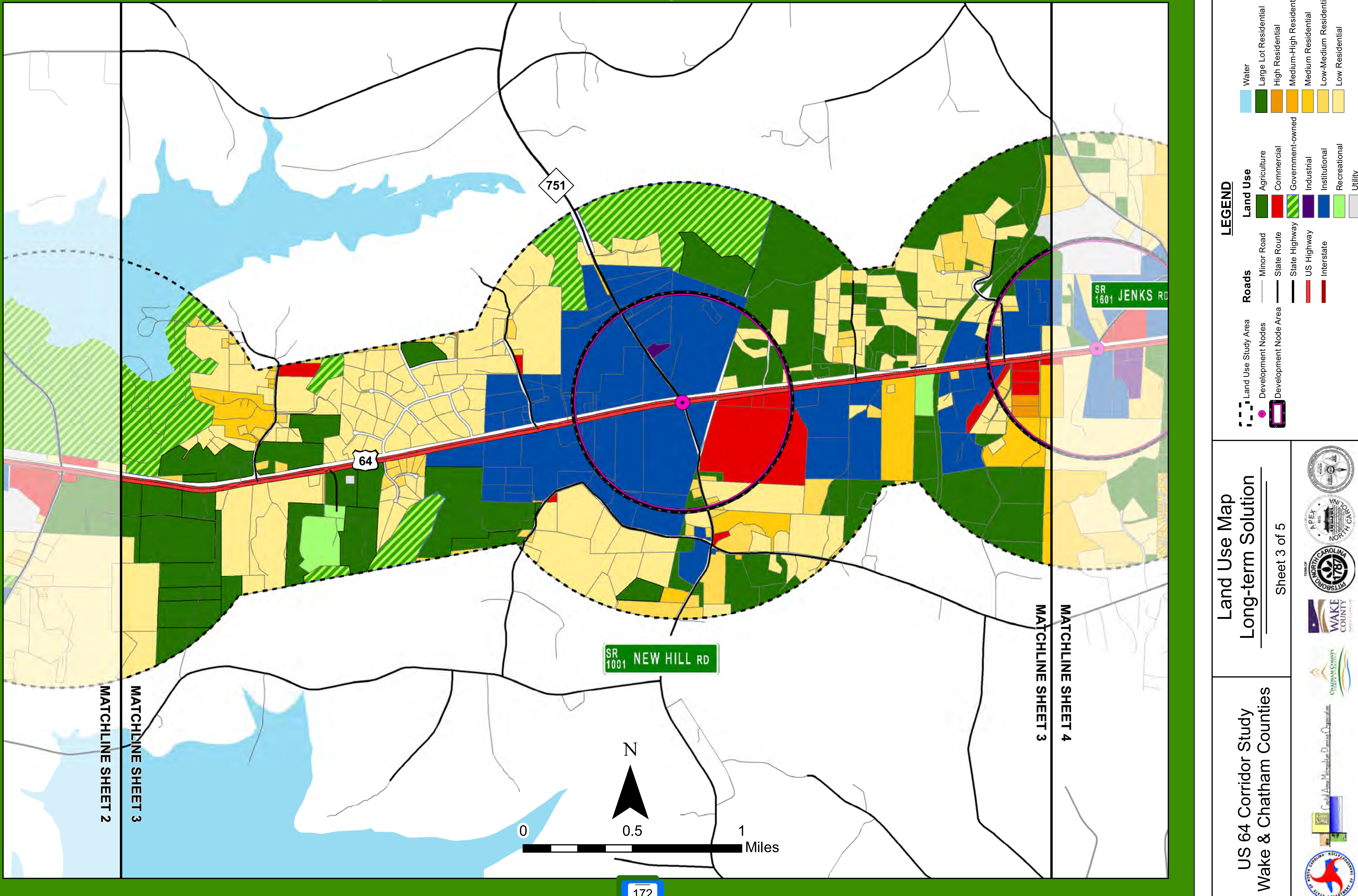


Figure 7.3: Land Use Map - Long-term Solution

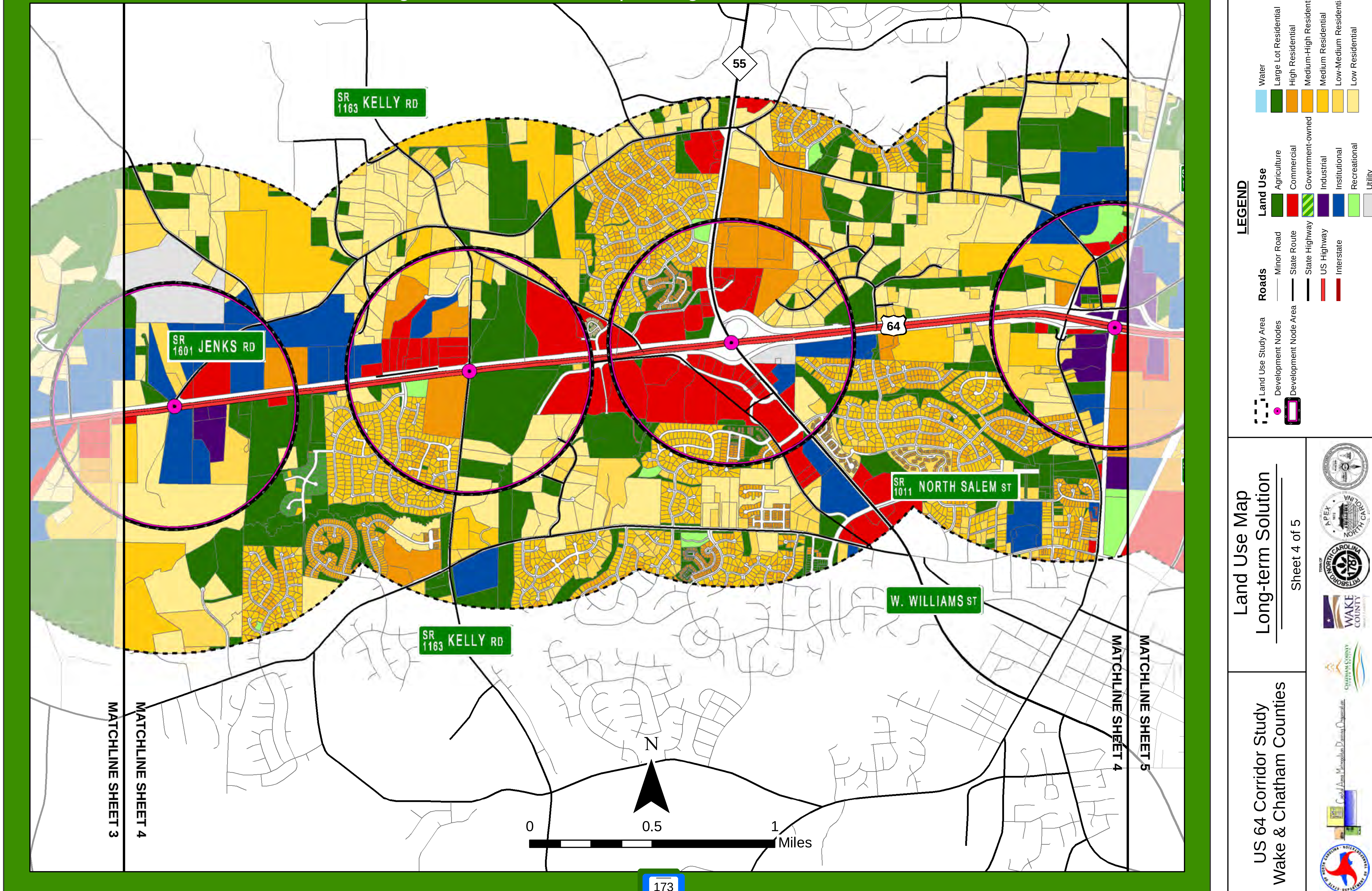
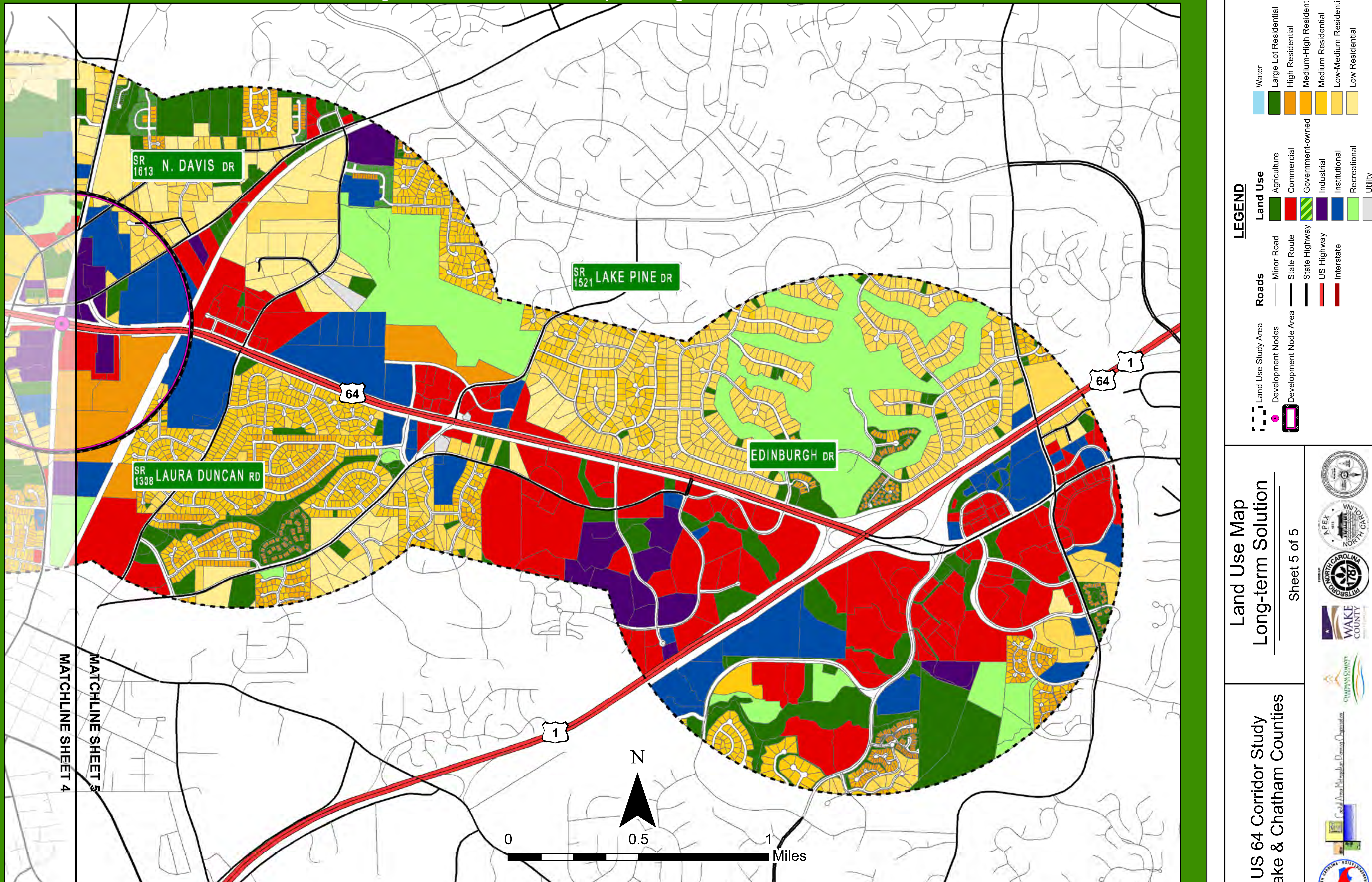


Figure 7.3: Land Use Map - Long-term Solution



7.6 LAND USE RECOMMENDATIONS

Recommended land use for the short-term and long-term US 64 corridor improvements are shown on Figures 7.2 and 7.3, respectively. Overall, the recommended land use maps reflect development patterns typical of highway corridors in growing regions, are consistent with local plans, and include visions and goals for the study area as guided by local planners.

The *Land Use Guidelines for Mobility Protection* document, prepared by NCDOT in September 2005, outlines solutions to protect mobility of improved roadway facilities along corridors where there is a continuing cycle of increased development and increased congestion, as is expected along the US 64 corridor in the future. Among these is the adoption of effective land use policies that are aimed at protecting mobility on these roads. It is important for municipalities to have specific growth management techniques to control the direction, pace, and timing of development. It is also important to have effective land use plans that describe the nature of development – its density and intensity, mixture of uses, site layout, building orientation, street patterns, and access/connectivity.

No particular land use can be described as suitable or unsuitable for areas adjacent to highways; instead, it is the mixture of uses, the relationship between them, and the way each use is accessed that determines whether development will have a positive or negative impact on the highway (NCDOT, September 2005). It is evident from existing and future traffic studies along the corridor, as well as interviews with local officials, that development has had an impact on mobility on the US 64 corridor and will continue to do so if effective land use plans are not in place.

Land Use Guidelines for Mobility Protection outlines several precedents that exhibit characteristics believed to help achieve mobility along corridors that face development pressure due to increased development and increased congestion. These precedents include a description of the beneficial characteristics of the precedents, and recommended policy guidelines that should be adopted throughout the corridor in order to address the land use/mobility issue.

7.6.1 CHATHAM COUNTY

The development node at the proposed Mt. Gilead Church/Pea Ridge Road interchange would present an exception to the rest of the future land use map, in that it includes recommendations not consistent with local planning visions and goals for this portion of the study area. According to Chatham County planners, future development is to be directed to the Town of Pittsboro, with only low-density residential development permitted in this interchange area. Due to the fact that this will be a major interchange with US 64 within close proximity to high growth areas of the region, Figure 7.3 does not represent the low-density vision of Chatham County. Instead, the figure presents a cluster of commercial and residential development at the proposed interchange. Absent of detailed growth management regulations, this area will experience significant development pressure likely to result in a future land use scenario similar to the one shown in Figure 7.3 where essential services such as grocery and other retail is concentrated together with medium and high density housing.

7.6.2 WAKE COUNTY

Wake County has more detailed growth management and future land use plans available. Both the Towns of Apex and Cary have future land use plans with a detailed transportation element. These plans also consider the US 64 improvements, and are consistent with the vision for the corridor. It is recommended that these areas within the Wake County portion of the study area develop mixed-use areas that exhibit characteristics consistent with NCDOT's *Land Use Guidelines for Mobility Protection*.

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Chapter 8: Public Involvement

Public Workshop #2
at Horton Middle School
(April 2009)

CHAPTER 8. PUBLIC, CORRIDOR STUDY TEAM AND AGENCY INVOLVEMENT

The US 64 Corridor Study was conducted with extensive input from the public, agencies and local leaders. The Corridor Study Team (CST) guided the study and had substantial influence over its direction. The public was engaged through two large workshops, one large community meeting, smaller group meetings and through other outreach activities and materials. Early coordination with environmental regulatory agencies was initiated through two agency meetings. A summary of the collaboration and involvement that took place throughout the study is provided in this section. Detailed information is available in the appendices referenced.

8.1 PUBLIC INVOLVEMENT

The US 64 Corridor Study garnered substantial attention from the communities surrounding the US 64 corridor. The methods and involvement opportunities used to reach out to the public are summarized in this section.

8.1.1 Public Outreach Methods

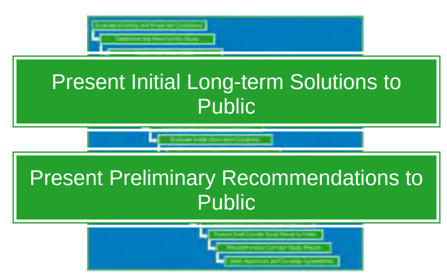
A variety of methods, summarized here, were used to reach out to the public and bring them into the corridor study:

8.1.1.1 Mailing List

A mailing list of nearly 1,800 addresses was generated using tax record data for all homes within 1,600 feet of existing US 64 within the study limits. Individuals could be added to the mailing list by calling the hotline, contacting study leaders, or signing up at workshops or on the project website.

8.1.1.2 Newsletters

Three newsletters were distributed to individuals on the mailing list during the course of the study. Each newsletter included: contact information for study leaders, the website address for the study website, a description of how stakeholders could get involved, an updated schedule and a description of next steps. Some of the specific topics covered in each newsletter are listed below. Copies of the newsletters are included in Appendix A.

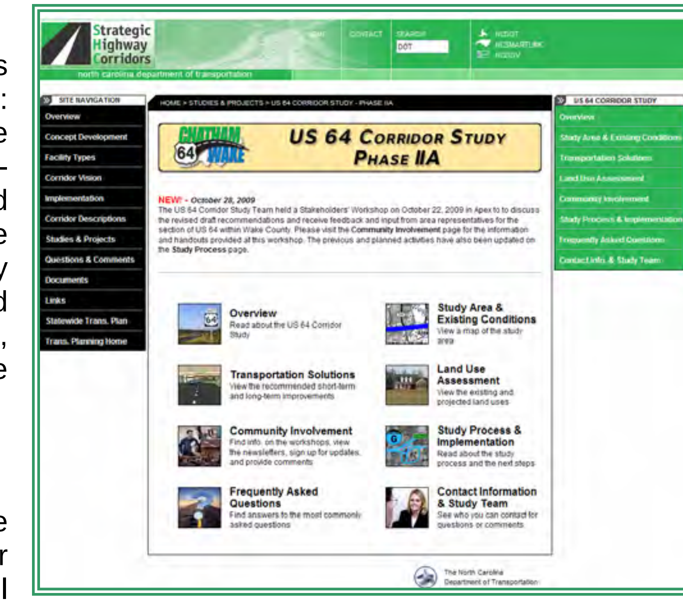


- The first newsletter was mailed on March 7, 2008 and introduced stakeholders to the study and its purpose and origin, introduced basic concepts pertinent to the study, such as, access management, freeways and expressways.
- The second newsletter was mailed on May 6, 2008 and announced the first workshop and introduced the concept of long term alternatives.
- The third newsletter was mailed on April 15, 2009 and announced the second workshop and the recommendation of a long-term solution, described the concept of phased transition of the US 64 corridor, explained the concept of a Superstreet, and described progress on a short-term solution and recommendations for land use and zoning changes.

8.1.1.3 Telephone Hotline

A toll-free project telephone hot-line was made available from 8am-5pm on weekdays.

8.1.1.4 Project Website



A website specific to the US 64 Corridor Study was hosted by NCDOT at: http://www.ncdot.org/~US64Study. The website provided an overview of the project along with up-to-date detailed information about: the study area and existing conditions, transportation solutions, the land use assessment, community involvement, and the study process and implementation. Frequently asked questions, contact information for the study team, maps, copies of newsletters, and much more were made available on the website.

8.1.1.5 Visualizations

Two types of visualizations were used to demonstrate the long term solutions: (1) a rendering of US 64 near Jordan Lake with proposed bicycle and pedestrian trail and (2) a video simulation (with sound) of the initial long-term plan recommendations along US 64 from west of Laura Duncan Road to US 1. The visualizations were displayed at the Workshop #2 and were accessible on

8.1.1.6 Public Notices

The NCODT Communications Office produced public notices for the three public involvement opportunities that were published in News and Observer, Apex Herald, Cary News, Chatham Journal and Que Pasa. Copies of the public notices are included in Appendix A.

Additionally, the Town of Cary sent letters to all Cary residents within 1,000 feet of the corridor on March 20, 2009 notifying them about Workshop #2. The Town of Apex included announcements for both workshops in their utility bills and Chatham County included a public notice on their website. The Town of Cary letter and Chatham County Public Notice are included in Appendix A.

8.1.2 Summary of Public Involvement Opportunities and Major Comments

Two workshops, one community meeting and two stakeholder meetings were held during the course of the study. The workshops were announced through public notices, newsletters and on the US 64 Corridor Study website. The handouts distributed during the sessions and the presentations made at each of the major public involvement activities are included in Appendix A. Brief descriptions of the workshops are provided in this section along with a short description of the major themes expressed in the public comments.

8.1.2.1 Workshop #1

Two public workshops were held on May 19 and 20, 2008 at the following locations:

Date: May 19, 2008
Time: 5:00 – 8:00 PM
Location: Apex High School
1501 Laura Duncan Road, Apex

Date: May 20, 2008
Time: 5:00 – 8:00 PM
Location: Northwood High School
310 Northwood High School Road, Pittsboro

The public was provided the opportunity to listen to a presentation describing the project and review maps showing the long-term solution alternatives. Participants were encouraged to talk to NCDOT staff and project team members and provide comments. The materials for this workshop were also available at the Eva Perry Library in Apex and the Pittsboro Memorial Library in Pittsboro. All attendees received a project handout with a comment form.

A total of 222 participants signed in at the two workshops (May 19 - 171; May 20 - 51). NCDOT also received 49 comment sheets, emails, or letters regarding the project during the comment period for the workshop. A summary of all of the comments received is included in Appendix B and a summary of the major themes from the comments follows:

- Many of the comments focused on a concern for access, impacts to property and effects of property values in the study area.
- Access concerns focused on opposition to individual neighborhoods being blocked for emergency vehicles, school buses and public buses. Some participants did not like the service road system.
- There was concern about providing better pedestrian and bike facilities and access to/from public facilities.
- Out of 47 comments, only 13 people clearly stated a preference to the proposed alternatives. Alternative 2 received eight supporters, Alternative 3 had three supporters and two favored Alternative 1.

8.1.2.2 Workshop #2

Two public workshops were held on April 27 and 28, 2009 at the following locations:

Date: April 27, 2009
Time: 5:00 – 8:00 PM
Location: Apex High School

Date: April 28, 2009
Time: 5:00 – 8:00 PM
Location: Horton Middle School

The public was provided the opportunity to listen to a presentation describing the project and review maps showing the long-term solution alternatives, short-term solution alternatives, land use assessment and implementation plan. Participants were encouraged to talk to NCDOT staff and project team members and provide comments. The materials for this workshop were also available at the Eva Perry Library in Apex and the Pittsboro Memorial Library in Pittsboro. All attendees received a project handout with a comment form.

A total of 171 participants signed in at the two workshops (April 27 - 143; April 28 - 28). The Corridor Study Team received comment sheets, e-mails, or letters regarding the project during the comment period for the workshop from a total of 195 individuals, groups of individuals or businesses. Additionally, a petition signed by approximately 2,500 individuals was submitted. A summary of all of the comments received is included in Appendix B and a summary of the major themes from the comments follows:

General Comments

- A petition signed by approximately 2,500 individuals was submitted requesting that all further action be stopped until citizen objections are resolved.
- Several people requested longer public comment periods, additional community meetings and additional measures to expand public awareness of the study and study process.
- Many of the comments focused on funding for the short- and long-term improvements, including, where funding would come from and why improvements to US 64 would be funded when other aspects of the State budget are in jeopardy.
- Some comments noted concern as to whether plans are being coordinated with land use and other transportation plans in both Chatham and Wake counties and the municipalities.
- Specific comments related to the number of lanes, pedestrians near the high school, access and safety issues.
- Individuals questioned the need for improvements to US 64 and the need relative to other roadways they considered to be more congested.
- Comments conveyed concerns about negative impacts to property owners and property values along the corridor.
- Several comments focused on the need for bicycle and pedestrian elements to be included in the study, specifically citing a need for the ability to cross US 64 by bike or on foot.

- Individuals noted concern about the environmental effects of the improvements to US 64, specifically mentioning: air pollution, noise, water run-off and removal of trees.

- Other comments questioned whether transit options were under consideration.

- Several comments were in support of the proposed improvements and encouraged moving forward.

Comments on Short-term Improvements

- Individuals made comments against the short-term improvements, generally indicating that they would not really solve any problems, would not improve traffic flow, and would disrupt the surrounding communities.

- Comments were made about safety concerns of a super-street for bicyclists, pedestrians and motorists.

- Individuals thought the superstreet would have negative impacts on businesses and would divide the community.

- Individuals requested noise walls in certain locations, pedestrian and bicycle considerations, traffic signal coordination and other specific items.

Comments on Long-term Improvements

- Individuals were concerned about impacts to their property, neighborhoods and access onto US 64.

- Individuals were concerned about noise.

- Several comments described general opposition to turning US 64 into an expressway and freeway.

Comments on Expressway portion of long-term improvements for Cary/Apex

Many individuals focused their comments on this particular section of the corridor. There was also a petition signed by 2500 individuals voicing opposition to an extended elevated expressway. In general, comments focused on the following:

- Concern about impacts to the quality of life and property value for residents along this portion of the corridor, specifically in the MacGregor Downs and MacGregor West subdivisions.

- Concern about impacts to community cohesion and the character of the area.

- Concern about safety of motorists, pedestrians and cyclists, particularly near Apex High School.

- Questions about whether the improvements are really needed. Suggestions were made that traffic should be routed to 540 and that the community in this area should not be negatively impacted in order to support suburban sprawl in outlying areas.

- Concerns about access to neighborhoods and businesses.

- Individuals questioned the methods used to inform the public about the study and indicated more needs to be done to collaborate with surrounding communities about the planned improvements. A few comments indicated that the purpose of the workshops was not clear and, specifically, that people did not realize they could voice opposition to the plans.

- Other comments conveyed general support for the plans.

Comments on Using NC 540 as a Bypass of US 64

A number of comments were received that suggested NC 540 should be used as a bypass of US 64, alleviating the need (or future need) of converting US 64 to a freeway and expressway and reserving it for local traffic. Some comments suggested that NCDOT should at least wait until NC 540 is complete and then evaluate whether there is a need for improvements to US 64.

8.1.2.3 Community Meeting

A Community Meeting was held on July 16, 2009 from 6:30 – 9:00 PM at Green Hope High School in Cary. The public was provided the opportunity to listen to a presentation describing the section of US 64 in Wake County, and were encouraged to ask questions and provide comments. Corridor Study Team members were available to talk with participants during the entire meeting. All attendees received handouts, which included a "Top 10 Questions and Concerns" sheet, Study Fact Sheet, Frequently Asked Questions and Answers, and a Community Meeting Comment Form.

A total of approximately 250 participants attended the meeting. The US 64 Corridor Study Team received comment forms, e-mails, or letters regarding the project during the comment period (July 16-31) for the meeting from a total of 63 individual citizens or businesses. A summary of all of the comments received is included in Appendix B and a summary of the major themes from the comments follows:

General Comments

- The speed limit along US 64 is too high.

- US 64 is a local road and should be treated more like a street and less like a highway.

- There is no need for the improvements.

- The proposed NC 540 Triangle Expressway and US 1 would provide a bypass of the area in Cary and Apex and US 64 wouldn't require the magnitude of changes proposed.

- Some citizens requested extending the public comment collection period beyond July 31, 2009 and expand public awareness of the study and study process (include Chambers, neighborhood groups, etc.).

- Individuals asked to halt this project and wait until I-540 is completed to assess the US 64 needs.

- Many comments recognized the need for improvements but are not willing to accept road changes that cause undesirable quality of life in the community.

- Several comments suggested traffic signal synchronization to assist traffic flows.

- Individuals questioned the methods used to inform the public about the study and indicated more needs to be done to collaborate with surrounding communities about the planned improvements.

- Some citizens question how this project can get approved if the community is opposed to it.

- Some citizens question the data used and would like the studies to be redone based on the future and how the economy is now (reduction in businesses, etc.).

- A few citizens would like nothing done and suggested reducing the speed limit.

Comments on Superstreet/Short-term Solution

- The Superstreet would not be safe, especially with requiring u-turns and weaving across traffic.
- Aesthetics along the corridor would be negatively affected by the Superstreet.
- The speed limit along US 64 is too high.
- The Superstreet would not preserve the community along the corridor and would divide the communities on the north and south side of the highway.
- Connectivity across US 64 would be negatively affected, especially to Apex Community Park.
- The Superstreet would have negative effects on access to neighborhoods and businesses.
- The Superstreet would increase the response time for emergency access vehicles.
- The navigation of the Superstreet would be confusing and would not improve traffic flow for vehicles.
- The navigation of the Superstreet for bicyclists (especially advanced bicyclists) would be unsafe if they were required to make the u-turn movements with vehicular traffic.
- The Superstreet would have negative effects on traffic operations for the minor streets.
- The Superstreet would be unsafe for bicycle travel along US 64 due to the u-turn bulb-outs.
- The two-stage diagonal pedestrian crossing required at Superstreet intersections is unsafe.
- The Superstreet would have a negative affect on access to the library.
- The use of a Superstreet at Laura Duncan Road near Apex High School and the safety of students crossing US 64, having to wait in the median during the two-stage crossing are concerning.
- The Superstreet would have a negative effect on school bus safety.
- Numerous citizens are interested in reviewing the data that supports the traffic flows for the superstreet concept.
- Several comments were in support of the proposed improvements, specifically the superstreet concept, and encouraged moving forward.

Comments on Expressway/Long-term Solution

- Aesthetics along the corridor would be negatively affected by the Long-term Solution.
- The Long-term Solution would create negative effects due to noise, especially for the residential areas.
- The Long-term Solution would not preserve the community along the corridor and would divide the communities on the north and south side of the highway.
- The Long-term Solution would not fit the scale and context of the corridor and would create a "Berlin Wall" affect.
- Connectivity across US 64 would be negatively affected, especially to Apex Community Park.
- The Long-term Solution would have negative effects on access to neighborhoods and businesses.
- The Long-term Solution would not be safe due to the traffic patterns and higher speeds.
- The Long-term Solution would have a negative effect on access to the library.
- The Long-term Solution would not provide adequate connections to greenways and pedestrian facilities.
- Access to Jordan Lake would be negatively affected and an expressway across Jordan Lake would create a bottleneck.
- The Long-term Solution did not include enough consideration for mass transit.
- The cost of implementing the Long-term solution would be too high and would not be a good investment.
- The Long-term Solution does not allow for safe bicycle travel along US 64 or for bicyclists crossing US 64
- The Long-term Solution would not adequately address pedestrians crossing US 64.
- An interchange at Laura Duncan Road would compromise the safety of students crossing US 64 from Apex High School.
- The Long-term Solution would be confusing and would be difficult for young drivers to understand.
- The Long-term Solution would not be safe for school buses.
- The Long-term Solution would reduce property values in the area.

8.1.2.4 Small Group Meetings

Throughout the study numerous meeting were held with stakeholders who had an interest in the study. The following is a listing of the small group meetings that have been held to discuss the study:

- Chatham County Board of Commissioners Meeting – April 21, 2008
- Chatham County Board of Commissioners Meeting – April 20, 2009
- Regional Transportation Alliance Meeting at Apex Chamber of Commerce – June 10, 2009
- Triangle Rural Planning Organization – Rural Technical Advisory Committee (RTAC) – June 18, 2009
- Save64.org Meeting at NCDOT – June 30, 2009
- Regional Transportation Alliance Meeting at Cary Town Hall – July 1, 2009
- Chatham County Board of Commissioners Meeting – July 20, 2009
- Stakeholders Follow-up Meeting – December 16, 2009

8.1.2.5 Local Officials Meeting

Prior to the Workshop #1 meetings a special meeting for local elected officials (on May 19, 2008 at Apex Town Hall and May 20, 2008 at Central Carolina Community College) was held to allow elected officials the opportunity to preview the materials that would be presented, ask questions and provide input. No elected officials from Wake County, the Town of Cary nor the Town of Apex attended the meeting on May 19th. The meeting on May 20th was attended by three Chatham County Commissioners; George Lucier, Mike Cross and Tom Vanderbeck.

8.1.2.6 Stakeholders Meetings

A Stakeholder Meeting was held at the Apex Town Hall on October 22, 2009 from 8:00 AM to 4:00 PM. The purposes of the workshop were to:

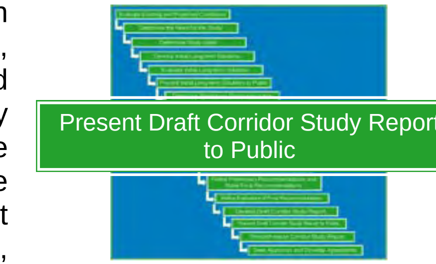
- discuss the comments received from the July 16th Community Meeting;
- discuss the results of the August 20th CST meeting to re-evaluate the plans;
- allow the stakeholders to provide feedback on revised recommendations;
- have a work session to discuss any concerns, ask questions and try to develop consensus on the solutions; and
- discuss the results of the work session and determine where consensus was established.

It was explained that, subsequent to the meeting, the CST would use the input received to make the draft final short- and long- term recommendations. The Draft Corridor Study Report would then be prepared and the public would have an opportunity to comment. Stakeholders requested a follow-up meeting be held to review the decision made by the CST which was held on December 16, 2009.

The Stakeholder Group included individuals representing the following interests:

- Apex High School
- CAMPO Bicycle and Pedestrian Task Force
- Save64.org
- Abbington Subdivision
- Castlewood Subdivision
- Knollwood Subdivision
- MacGregor West Subdivision
- Shepherd's Vineyard Subdivision
- Normandie Subdivision
- MacGregor Downs Subdivision
- Lord Corporation
- Bradley's Carpet
- Hendrick Auto Group
- Apex Chamber of Commerce
- Cary Chamber of Commerce

8.1.2.7 Draft Corridor Study Report Comment Period



The Draft US 64 Corridor Study Report was made available to the public on May 5, 2010 with comments on the plan being accepted until June 30, 2010. Chatham County requested an extension to provide comments and was provided additional time to review the draft study. Chatham County provided comments on August 30, 2010. A total of 83 comments were provided by individuals, groups, local governments or elected officials. The most substantial comments related to a desire to provide a facility that met what some local stakeholders envisioned for the corridor. Further, stakeholders stated their desire to maintain the existing aspects of the corridor that they perceived to be the positive. In general, a majority of the comments received on the study felt that the recommended solutions were too large and disruptive to the communities along US 64 as well as did not fit the unique context of the US 64 Corridor. A summary of the comments is included in Appendix B.

8.2 CORRIDOR STUDY TEAM INVOLVEMENT

A Corridor Study Team (CST) was created to provide guidance to and oversight of the study. The CST had substantial influence over every aspect and direction of the study. Their involvement was crucial for ensuring that the plans for US 64 are compatible with the needs, goals and planned land use for the surrounding communities. A brief summary of the topics discussed in each CST meeting is provided in this section. Detailed meeting minutes are included in the Appendix C. Team members include representatives from:

- North Carolina Department of Transportation (NCDOT)
- Capital Area Metropolitan Planning Organization (CAMPO)
- Triangle Area Rural Planning Organization (TARPO)
- Town of Cary
- Town of Apex
- Town of Pittsboro
- Wake County
- Chatham County
- North Carolina Turnpike Authority (NCTA)
- US Army Corps of Engineers
- North Carolina State Park Service
- Federal Highway Administration (FHWA)

8.2.1 CORRIDOR STUDY TEAM MEETING #1

The first CST meeting was held on December 12, 2007 in Apex. The purpose of the project kick-off meeting was to introduce the CST to each other, to the consultant and to the history and purpose of the study. The

CST reviewed the project management plan and administrative details and discussed data collection and next steps.

8.2.2 Corridor Study Team Meeting #2

The second CST meeting was held on January 23, 2008 in Apex. The CST focused on public involvement, long term solution alternatives and understanding concepts necessary to evaluate alternatives. The CST reviewed and commented on the following items during the meeting:

- existing conditions maps
- possible study logos
- existing 2007 traffic conditions
- future 2035 no-build traffic conditions
- Newsletter #1
- website materials
- long-term solution alternatives

The team was also given an overview of design concepts for long-term solutions and an overview of design criteria (design speed and level of service) to be used for the corridor.

8.2.3 Corridor Study Team Meeting #3

The third CST meeting was held on March 19, 2008 in Apex. The CST reviewed maps of the long-term solution alternatives and identified both "liked" and "disliked" components. This was followed by a presentation and discussion of project components (i.e., existing/2035 no-build capacity analysis, crash analysis, 2035 build traffic forecasts, control of access at interchanges, single-point interchanges vs. tight urban diamond interchanges) and the long-term solution alternatives. The first public workshop was discussed in detail including location, date, time, format and how it should be advertised. The meeting concluded with the CST selecting three alternatives for the long-term solution, that would be developed and presented at the workshop.

8.2.4 Corridor Study Team Meeting #4

The fourth CST meeting was held on July 17, 2008 in Apex. The meeting began with a review of the public comments received from the first workshop.

Much of the meeting was devoted to the development of a preferred alternative for the long-term solution. The team looked at each of the alternatives, one segment at a time, discussed the components of each and concluded on a preferred alternative.

The CST also discussed short term solution alternatives. It was determined that one alternative would be a full superstreet alternative and the second alternative would include slight variations to the superstreet including potential reverse superstreet configurations or other measures at the more complex intersections to maximize life span and efficiency of the short-term option.

Towns and counties were asked to review land use maps and provide comment outside of the meeting. It was also noted that the study report must clearly indicate that a NEPA analysis will have to be done on projects along this corridor and that location and design changes could occur.

8.2.5 Corridor Study Team Meeting #5

The fifth CST meeting was held on February 12, 2009 in Cary. A presentation was given on the superstreet concept and its advantages as the short-term solution for the US 64 corridor. The CST's comments and questions were discussed. The CST provided comments specific to each intersection. It was determined that the consultants would evaluate the items discussed and determine if any configurations beside the superstreet would be appropriate for the corridor. A follow-up meeting would be held with the key individuals with an interest in the Cary/Apex area in order to present findings and determine the alternative or alternatives that would be presented at the public workshop

The CST was given an update on the status of the implementation plan. It was explained that the implementation plan would include sections on determining potential funding, determining corridor segments, developing the life-span of improvements, developing options for staged construction, and determining the priority of long-term improvements.

A brief overview of the land use analysis was provided including existing, interim and future land use maps. It was explained that all analyses were conducted with input from the municipalities and were consistent with local land use plans. The CST was told that the next steps for the land use analysis would be to overlay the conceptual short-term and long-term design on the interim and future land use maps, and to make recommendations of land use policy change for preserving mobility on the corridor.

Updates were also provided regarding:

- potential design changes at NC 540
- visualizations depicting the improvements to the corridor
- the use of a facilitator to moderate meetings and keep them on track
- The design of the preferred alternative for long-term improvements

8.2.6 Corridor Study Team Meeting #6

The CST met on August 21, 2009 in Raleigh. The CST first reviewed a list of common concerns for the study based on the public input from the second workshop and the community meeting. The CST reviewed the short- and long-term alternatives discussing broader issues such as bicycle and pedestrian safety and then taking an intersection-by-intersection look at proposed solutions, discussing concerns and determining which treatment would be recommended for the short-term and long-term improvement at each location. The CST also discussed the outline for this report.

8.2.7 Corridor Study Team Meeting #7

The CST met on March 25, 2010 in Cary. The CST reviewed the comments and the draft report and discussed how each comment would be included in the Draft Corridor Study Report. The CST also discussed the next steps in the process and determined when the Draft CSR would be released to the public for comment.

8.2.8 Corridor Study Team Meeting #8

The CST met on September 21, 2010 in Apex. The CST reviewed the public comments on the draft report and discussed how each comment would be addressed in the Final Corridor Study Report. The CST also discussed the next steps in the process and determined that forming of Council of Planning would be discussed in greater detail in the future.

8.3 AGENCY INVOLVEMENT

The National Environmental Policy Act (NEPA)/Section 404 merger process is in place in North Carolina to move major projects jointly through the required NEPA analysis and Clean Water Act (Section 404) permitting processes. Through this process, a Merger Team made up of the different agencies with an interest in a project meet and come to an agreement on key decisions. The Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requires coordination with agencies in planning stages. The CST and agency representatives from the Merger Team met jointly two times throughout the corridor study in order to facilitate early agency coordination and comply with SAFETEA-LU. Attendees of the two meetings included representatives from:

- Federal Highway Administration (FHWA)
- US Army Corps of Engineers (USACE)
- Environmental Protection Agency (EPA)
- US Fish and Wildlife Service (USFWS)
- NC Wildlife Resources Commission
- NC Department of Cultural Resources/State Historic Preservation Office
- NC Division of Water Quality
- NC Department of Environmental and Natural Resources
- NCDOT
- CAMPO
- Triangle J Council of Governments (TJCOG)
- NCTA

Brief summaries of the meetings are included in this section. Complete meeting minutes can be found in the Appendix C.

8.3.1 AGENCY TEAM MEETING #1

A meeting was held between the CST and the Merger Team on February 21, 2008 in Raleigh. The purpose of this meeting was to initiate early coordination with Federal, state, and local agencies. An overview of the US 64 Corridor Study was presented that included the following topics:

- Project overview
- Project (Phase IIA) description – project involves:
  - Functional design, long-term and short-term
  - Traffic forecasts
  - Identification of environmental features/issues
  - System linkage
  - Land use
  - Community/stakeholder involvement
  - Development of a phasing plan
  - Preparation of a Corridor Study Report
- Merger Team participation:
  - Early agency coordination in planning phase is required for SAFETEA-LU compliance
  - Project is not looking for concurrence or permits
  - Seeking input on Purpose and Need and environmental resources
- Traffic volumes, operations, intersection/interchanges
- Purpose and Need
- Overview of identification of environmental issues
- Preliminary Study Alternatives

The Merger Team provided input throughout the presentation and commented specifically on historic properties, impacts to farmland, coordinating with developers of planned projects, water quality and USACE-owned property. Participants agreed that the next agency meeting would be held after alternatives are developed and public input is received on those alternatives.

8.3.2 AGENCY TEAM MEETING #2

A meeting was held between the CST and the Merger Team on April 20, 2010 in Raleigh. The purpose of this meeting was to continue coordination with Federal, state, and local agencies and present the information form the Draft Corridor Study Report. An overview of the US 64 Corridor Study was presented that included the following topics:

- Project overview
- Short-term Solution
- Long-term Solution
- Environmental Analysis

The Merger Team provided input throughout the presentation and commented specifically on historic properties, archeological sites, impacts to farmland, coordinating with developers of planned projects, water quality and USACE-owned property.

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Short Term Solution

US 64 at
Kelly Road
(October 2009)

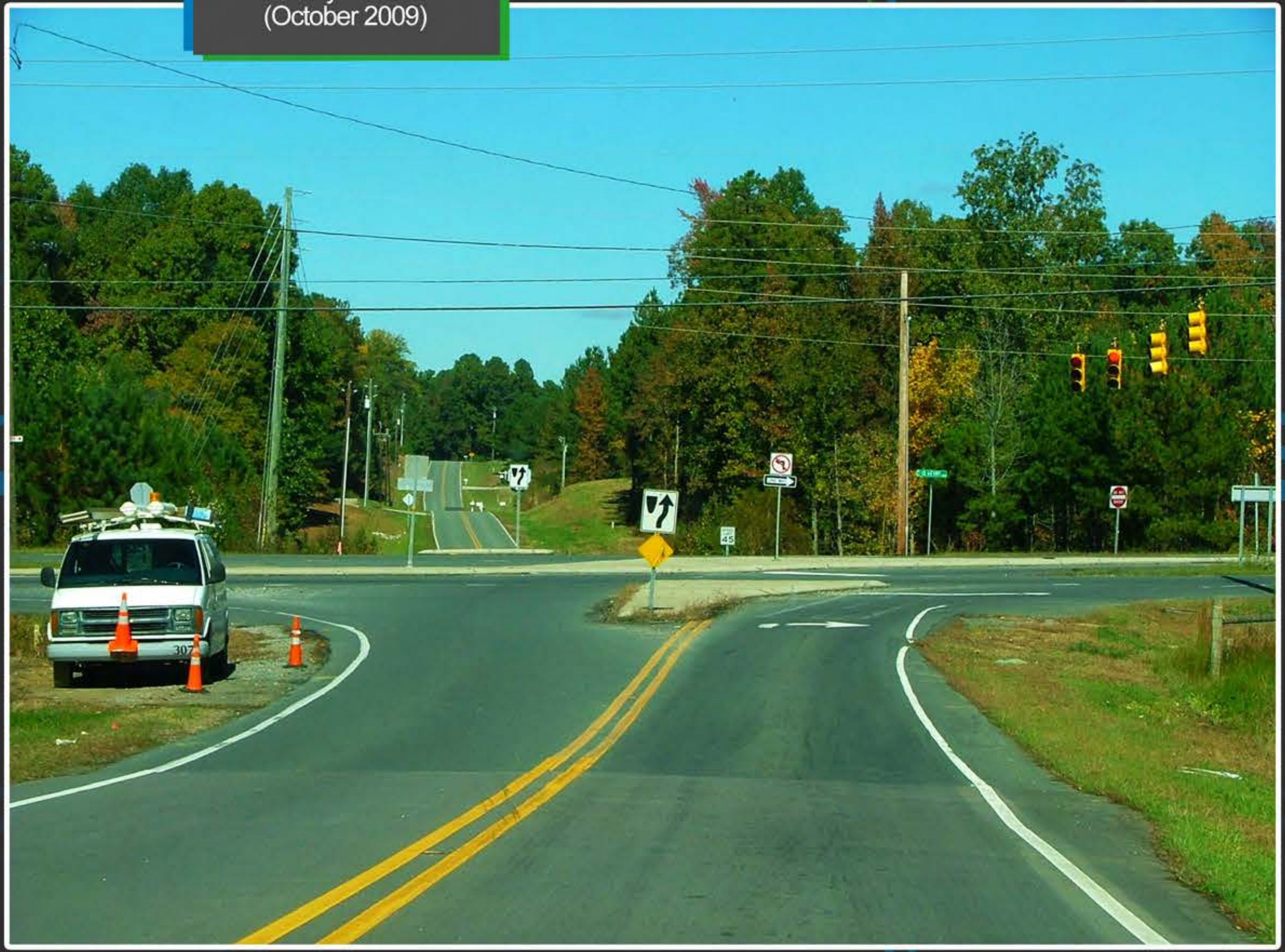
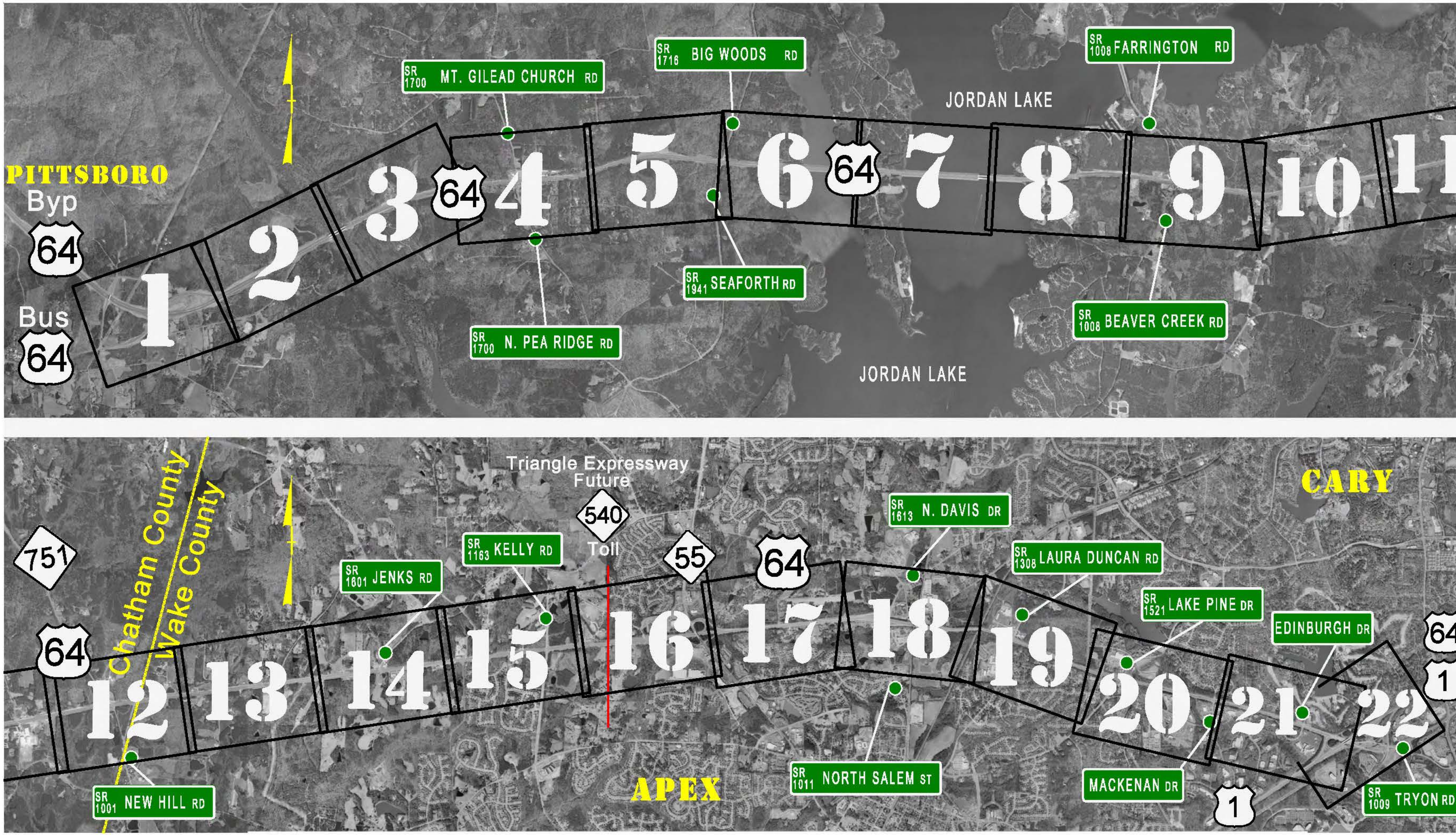
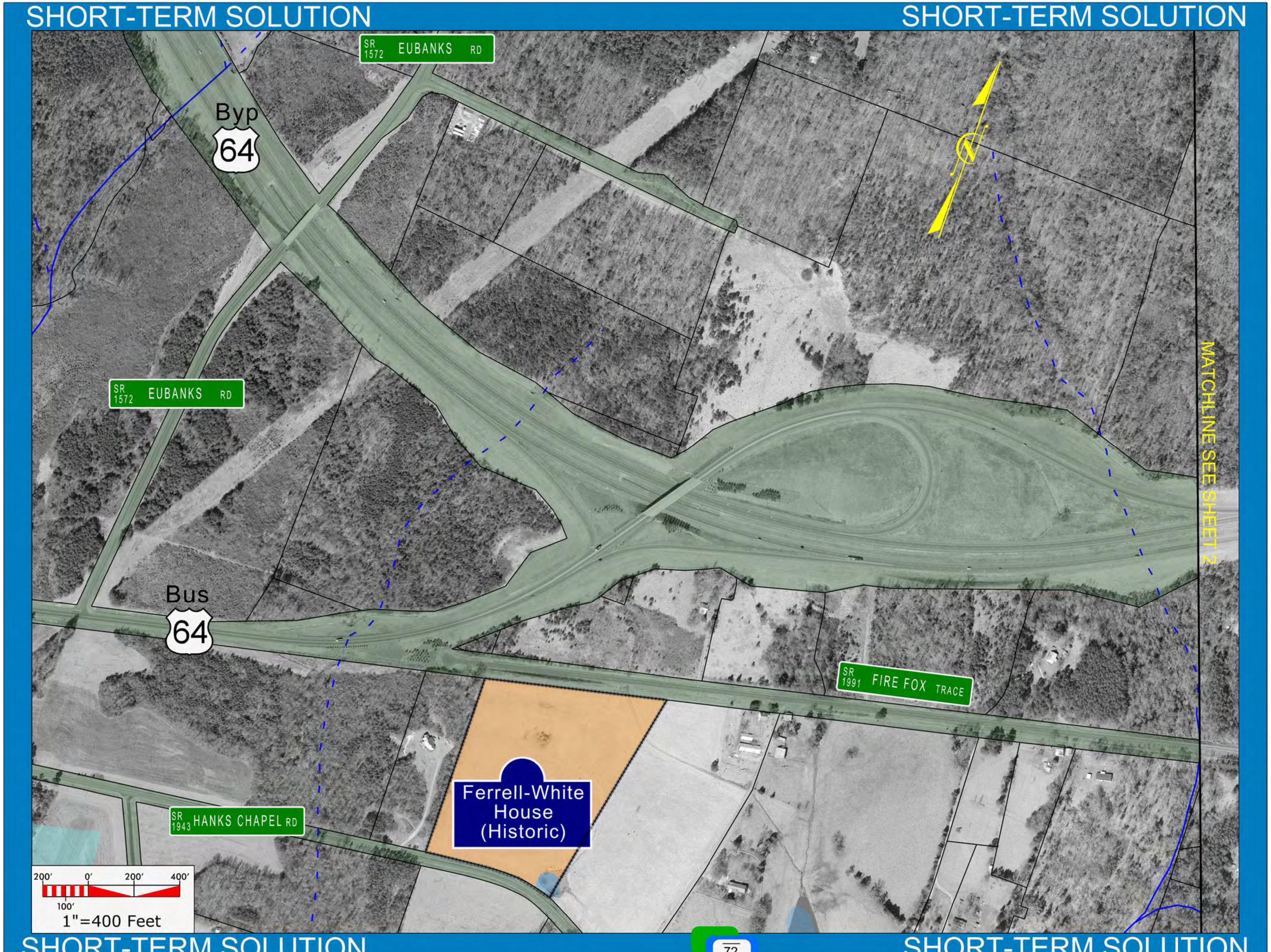


Figure 3.14: Short-term Design Plans Map Key





LEGEND

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- Town of Cary Municipal Boundary
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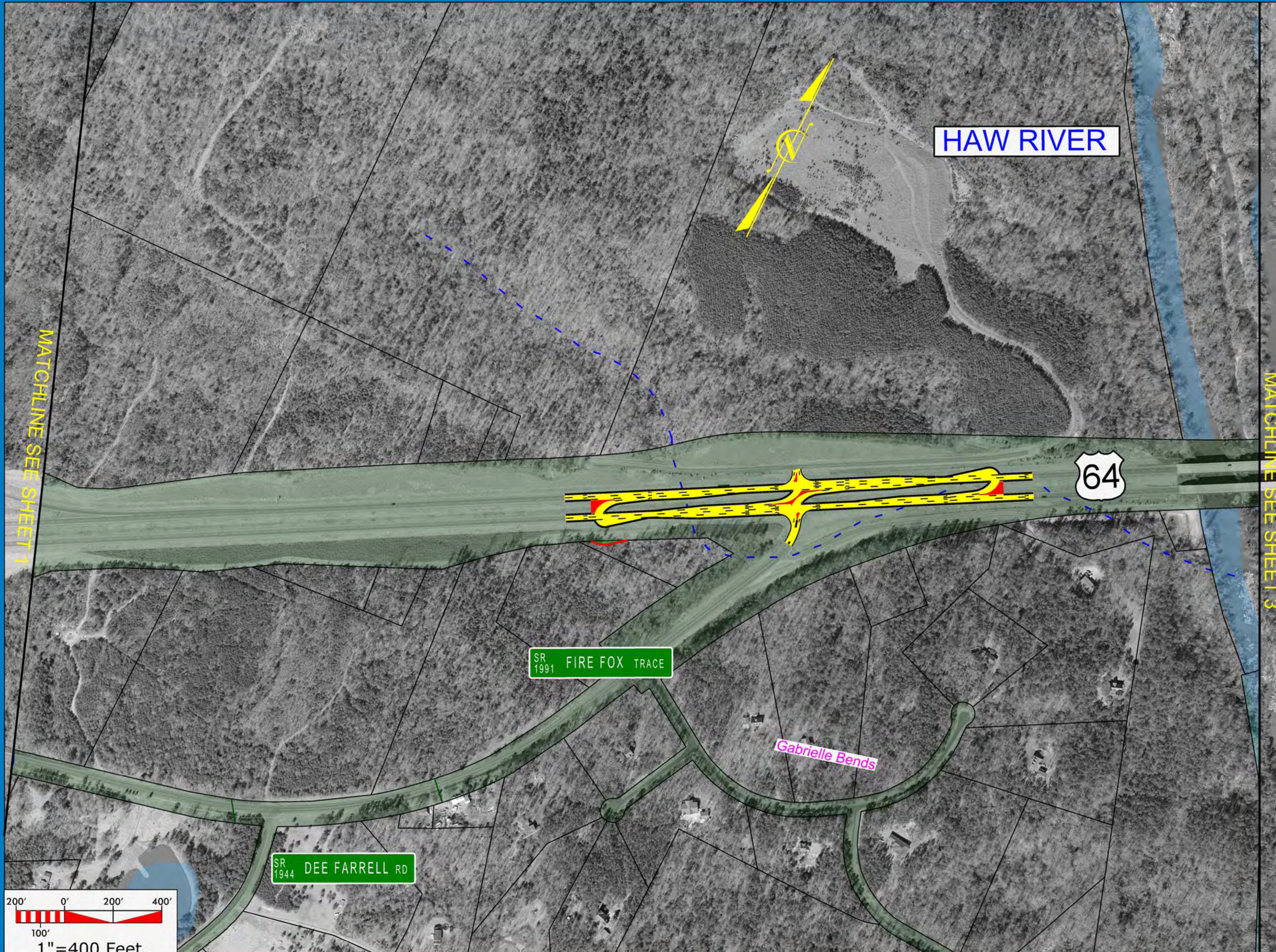
Recommended Short-term Solution

Sheet 1 of 22

US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION SHORT-TERM SOLUTION



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Recommended Short-term Solution

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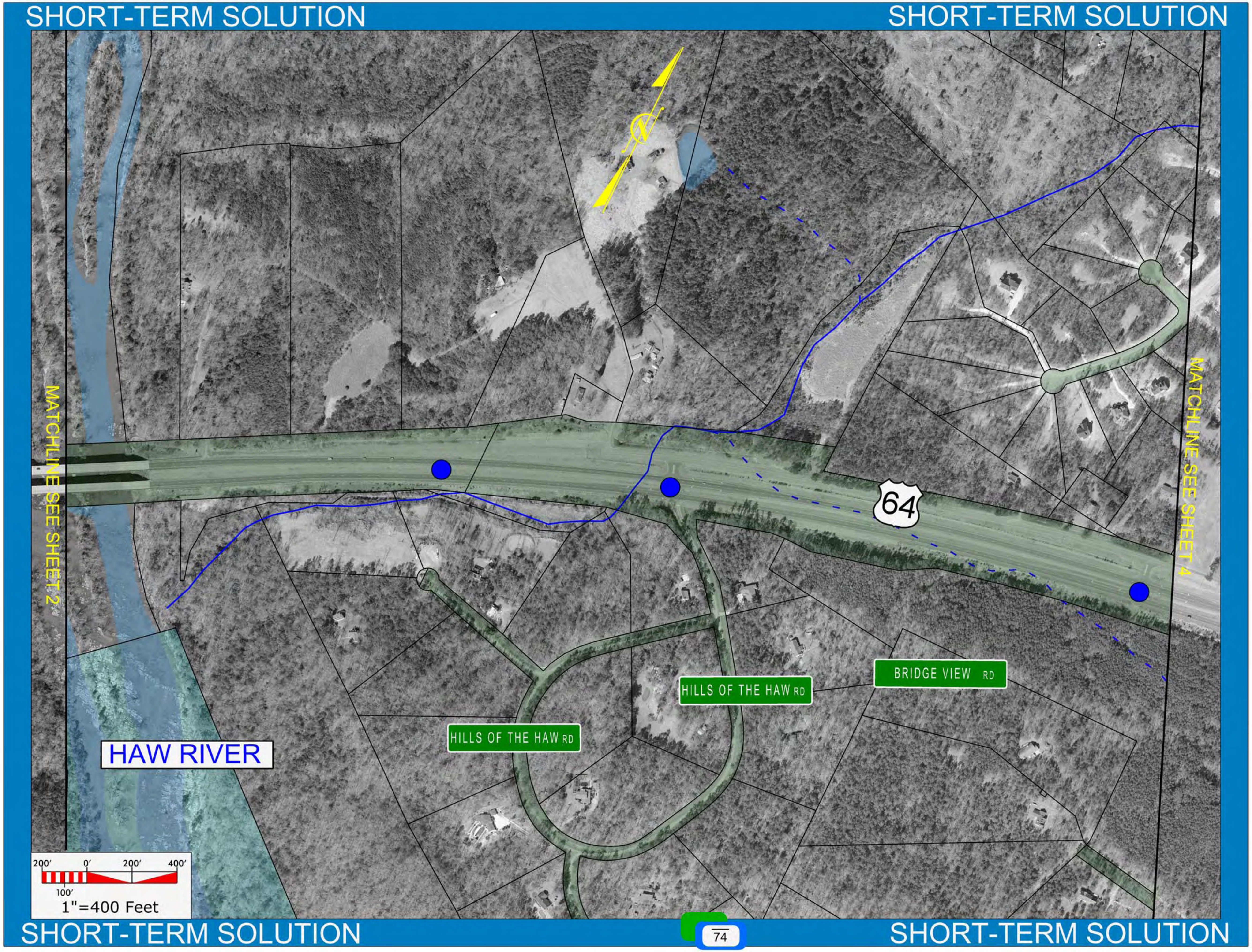
US 64 Corridor Study
Wake & Chatham Counties



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Recommended Short-term Solution

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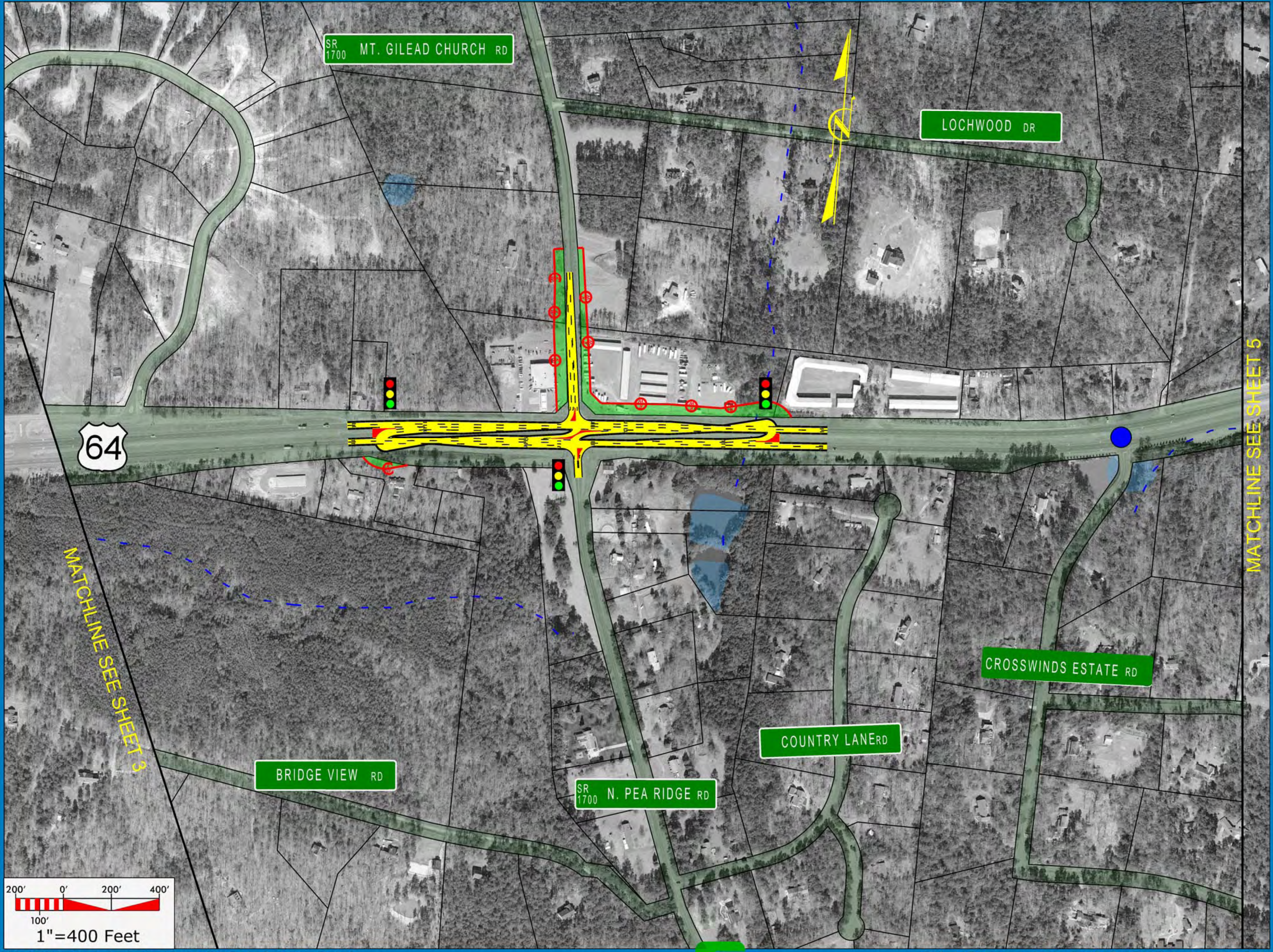
US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION



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Recommended Short-term Solution

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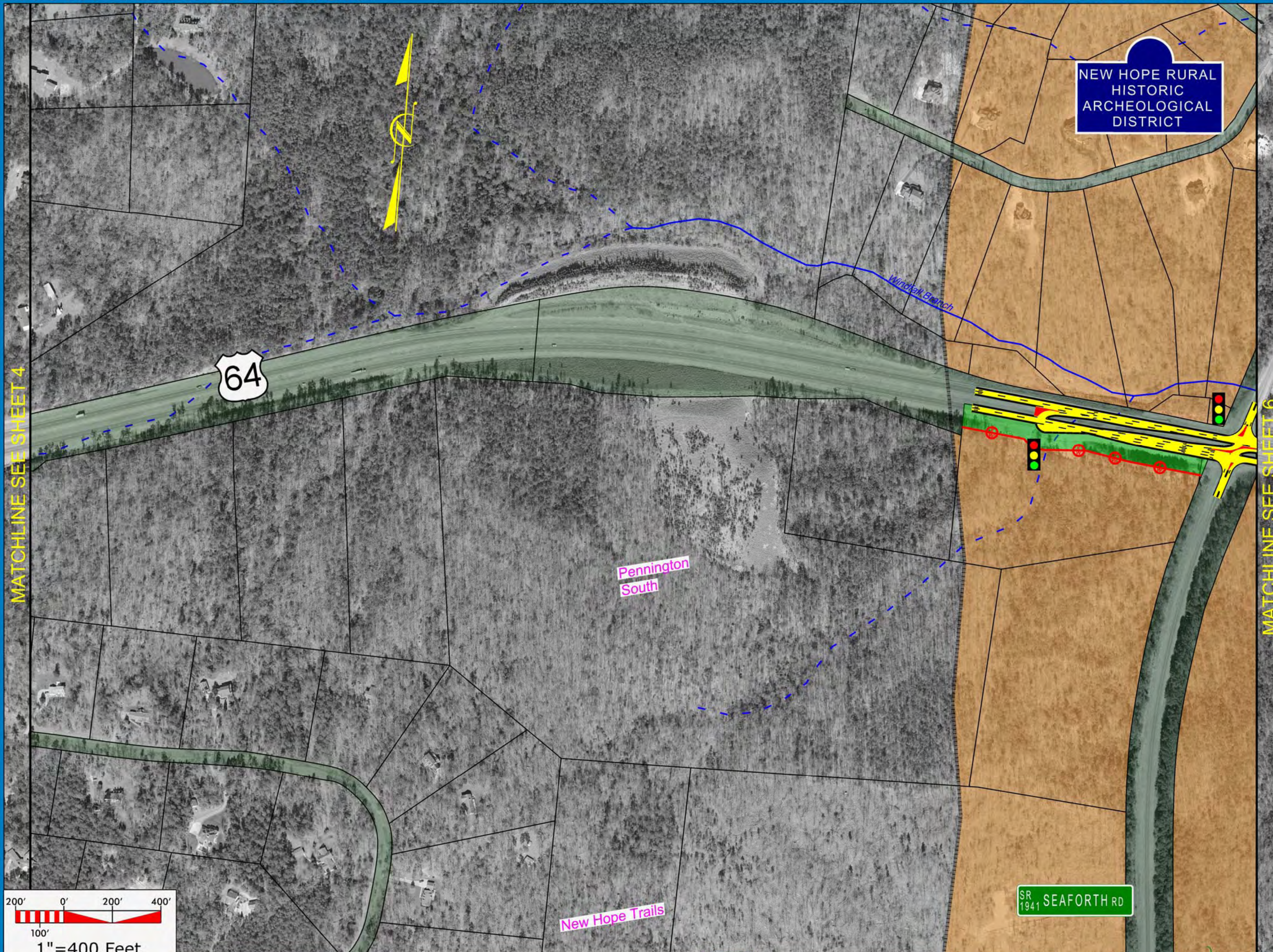
US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION SHORT-TERM SOLUTION



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US 64 Corridor Study
Wake & Chatham Counties

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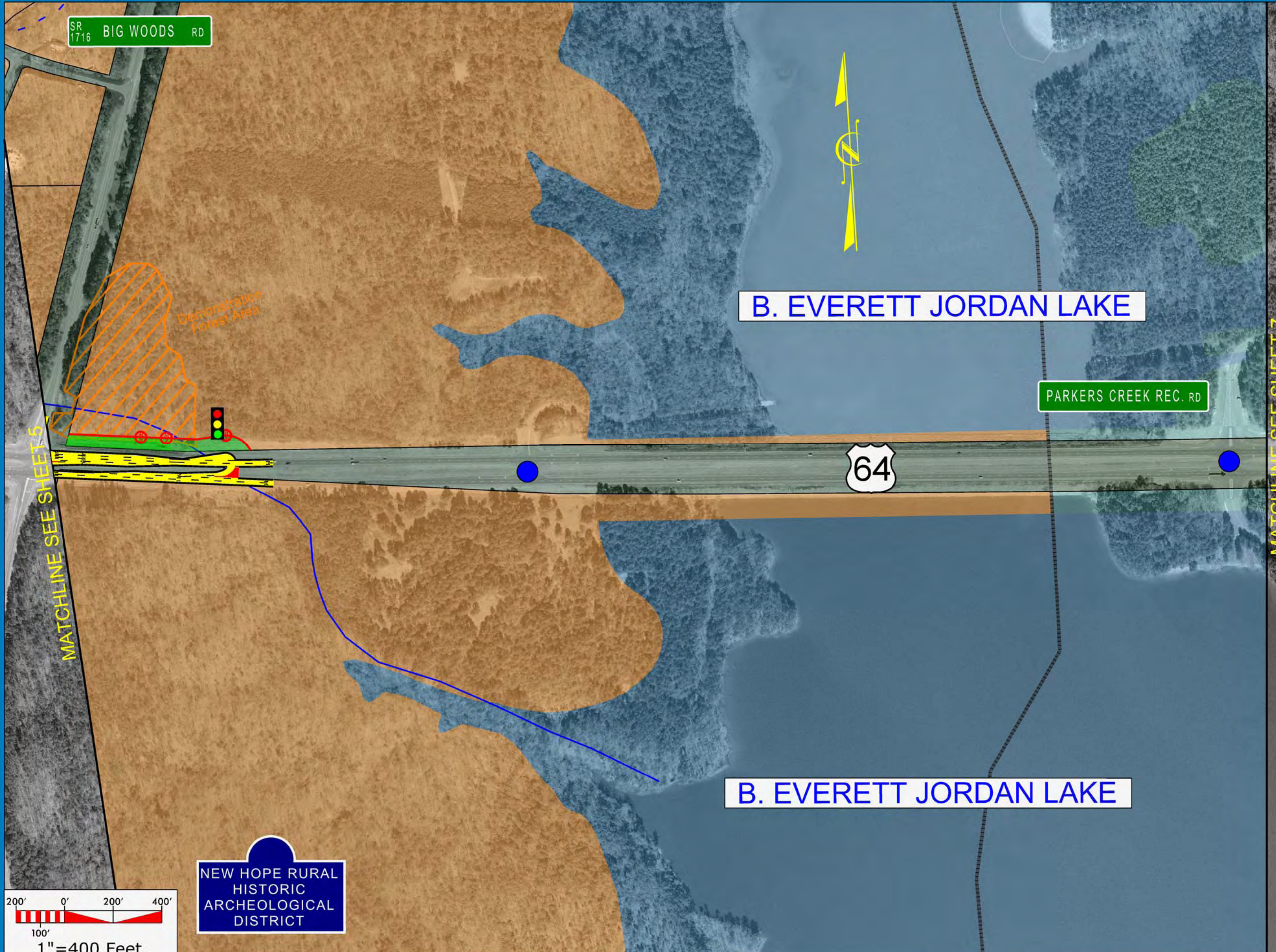

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Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

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US 64 Corridor Study
Wake & Chatham Counties

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Recommended
Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION SHORT-TERM SOLUTION

SHORT-TERM SOLUTION SHORT-TERM SOLUTION

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Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

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TEXT

Recommended Short-term Solution

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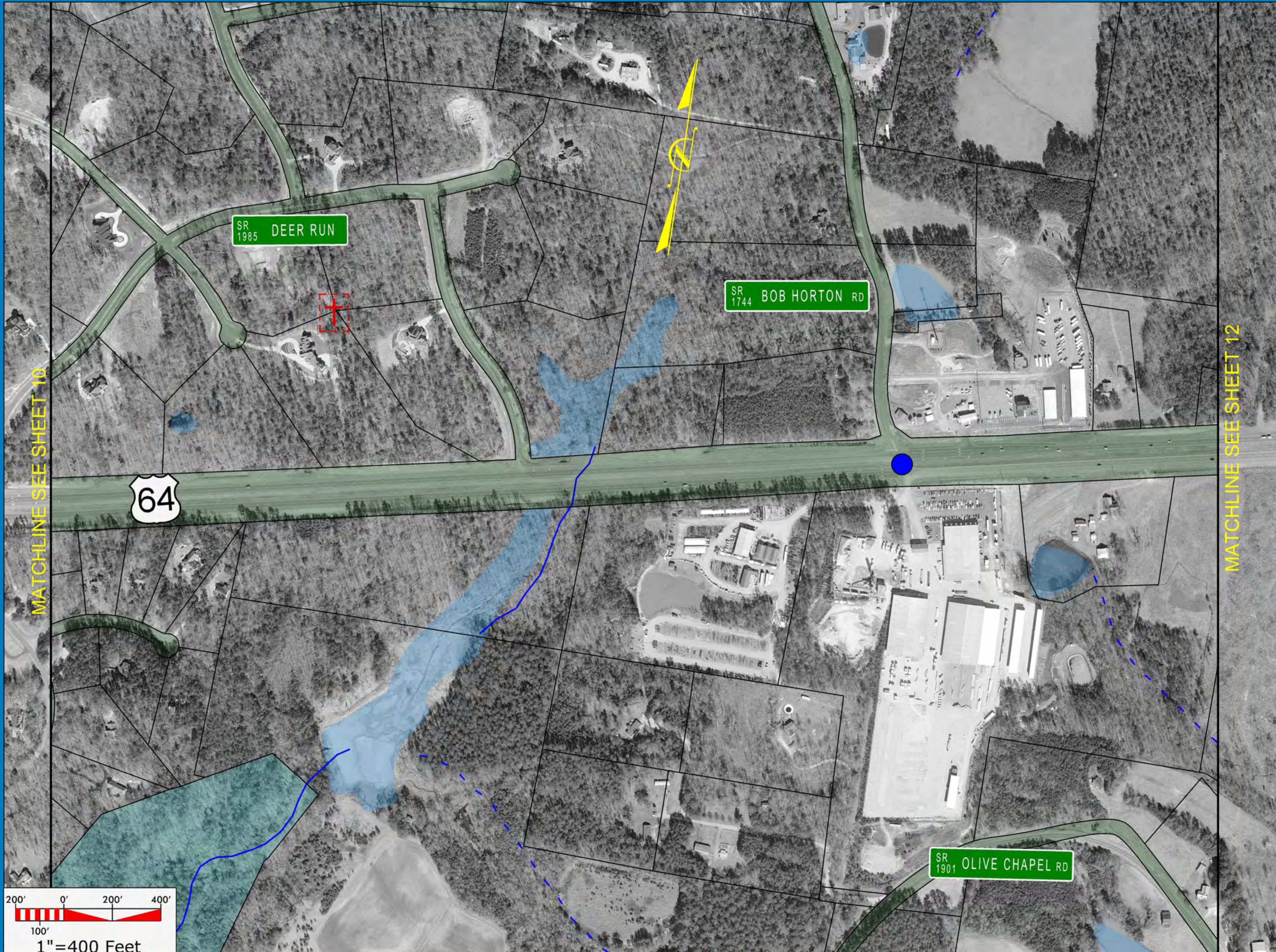
US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION



SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

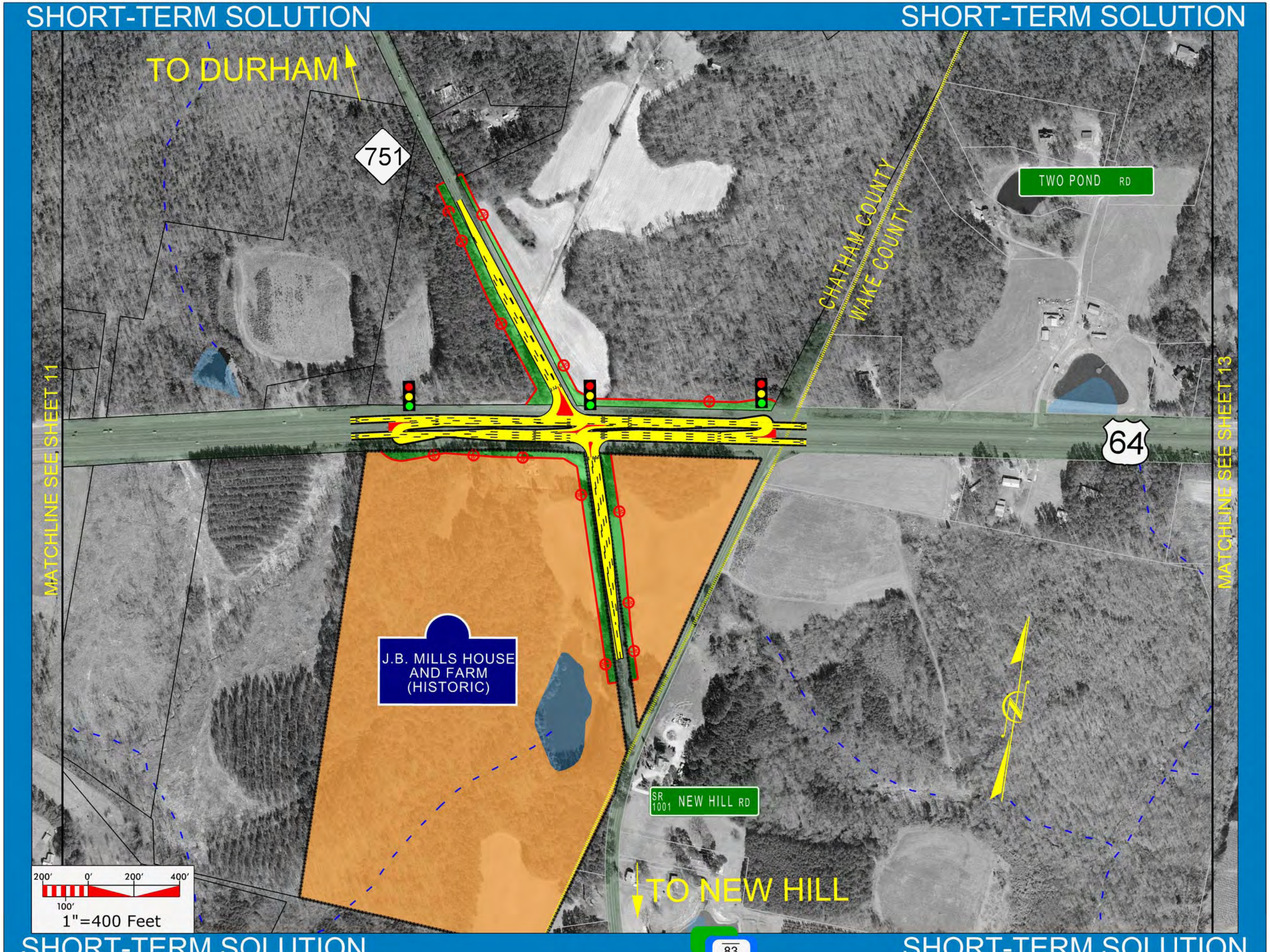
LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Right of Way Area (Worst Case)
- Proposed Right of Way Limits
- Pavement Constructed Under NC 540 Project
- Existing Bridges to Remain
- Existing Bridges to be Removed
- Existing Pavement to be Removed
- Traffic Signal
- Existing Median Opening (Note: all median openings will be considered for closure in the future)
- Property Lines
- Railroad
- Streams
- School
- Cemetery
- Church
- Hospital
- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Short-term Solution

Sheet 11 of 22

US 64 Corridor Study
Wake & Chatham Counties



LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
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- Proposed Right of Way Limits
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- Park/Golf Course
- Historic Property
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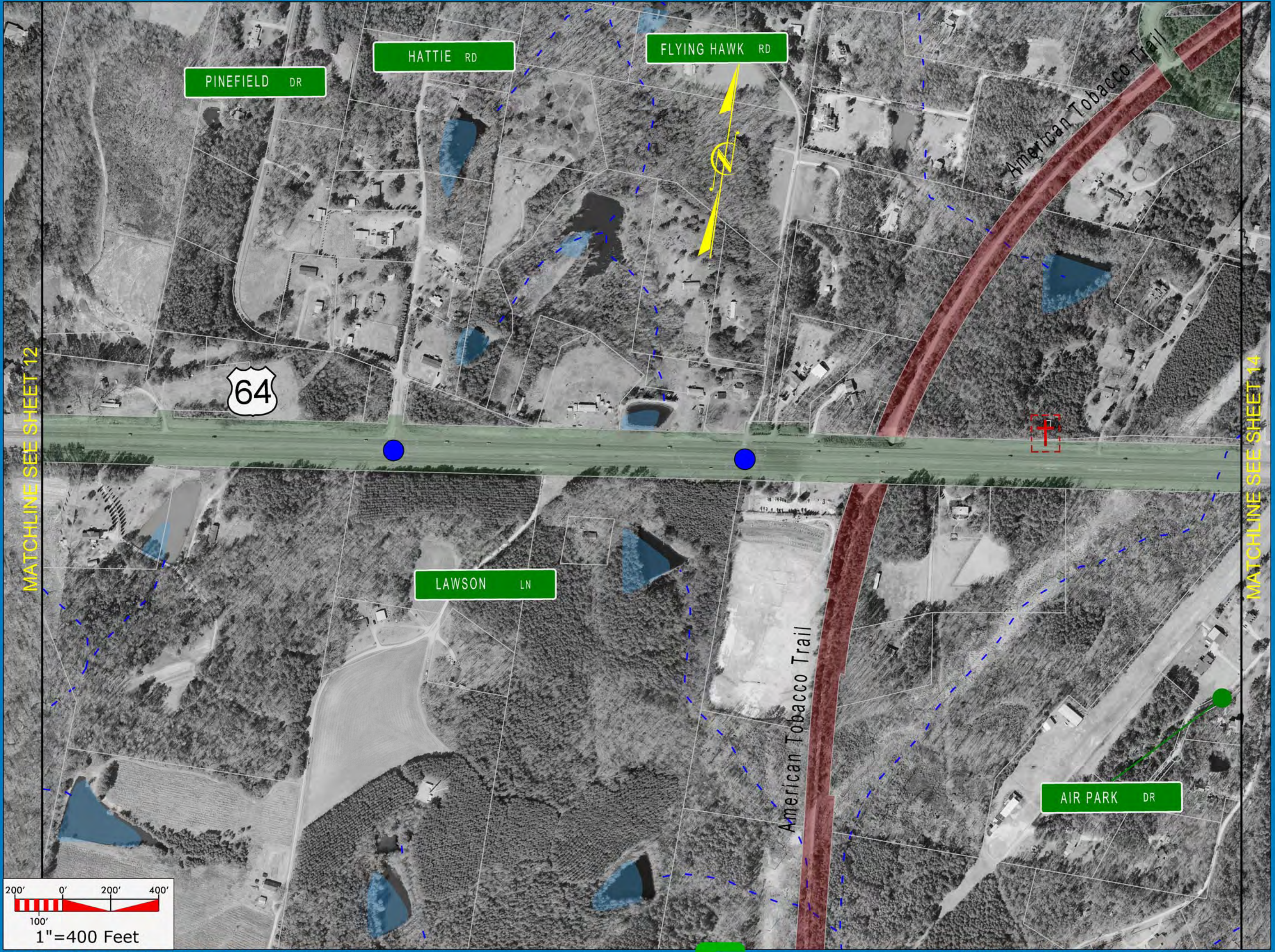
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT

Recommended Short-term Solution

Sheet 12 of 22

US 64 Corridor Study
Wake & Chatham Counties



LEGEND

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- Proposed Bridges and Islands
- Proposed Right of Way Area (Worst Case)
- Proposed Right of Way Limits
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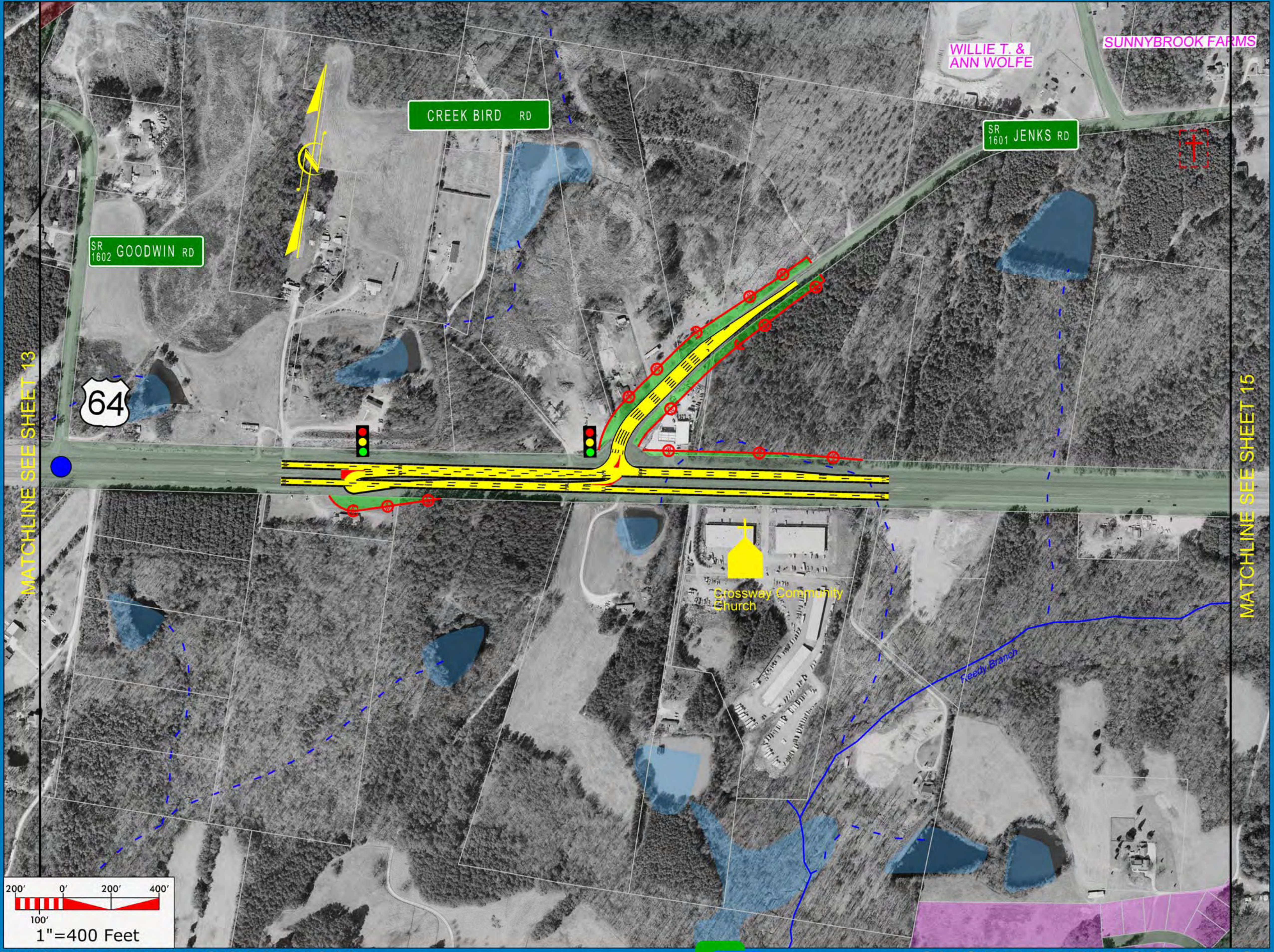
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Short-term Solution

Sheet 13 of 22

US 64 Corridor Study
Wake & Chatham Counties

 SHORT-TERM SOLUTION



SHORT-TERM SOLUTION SHORT-TERM SOLUTION

LEGEND

- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT
- Property Lines
- Railroad
- Streams
- School
- Cemetery
- Church
- Hospital
- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Right of Way Area (Worst Case)
- Proposed Right of Way Limits
- Pavement Constructed Under NC 540 Project
- Existing Bridges to Remain
- Existing Bridges to be Removed
- Existing Pavement to be Removed
- Traffic Signal
- Existing Median Opening (Note: all median openings will be considered for closure in the future)

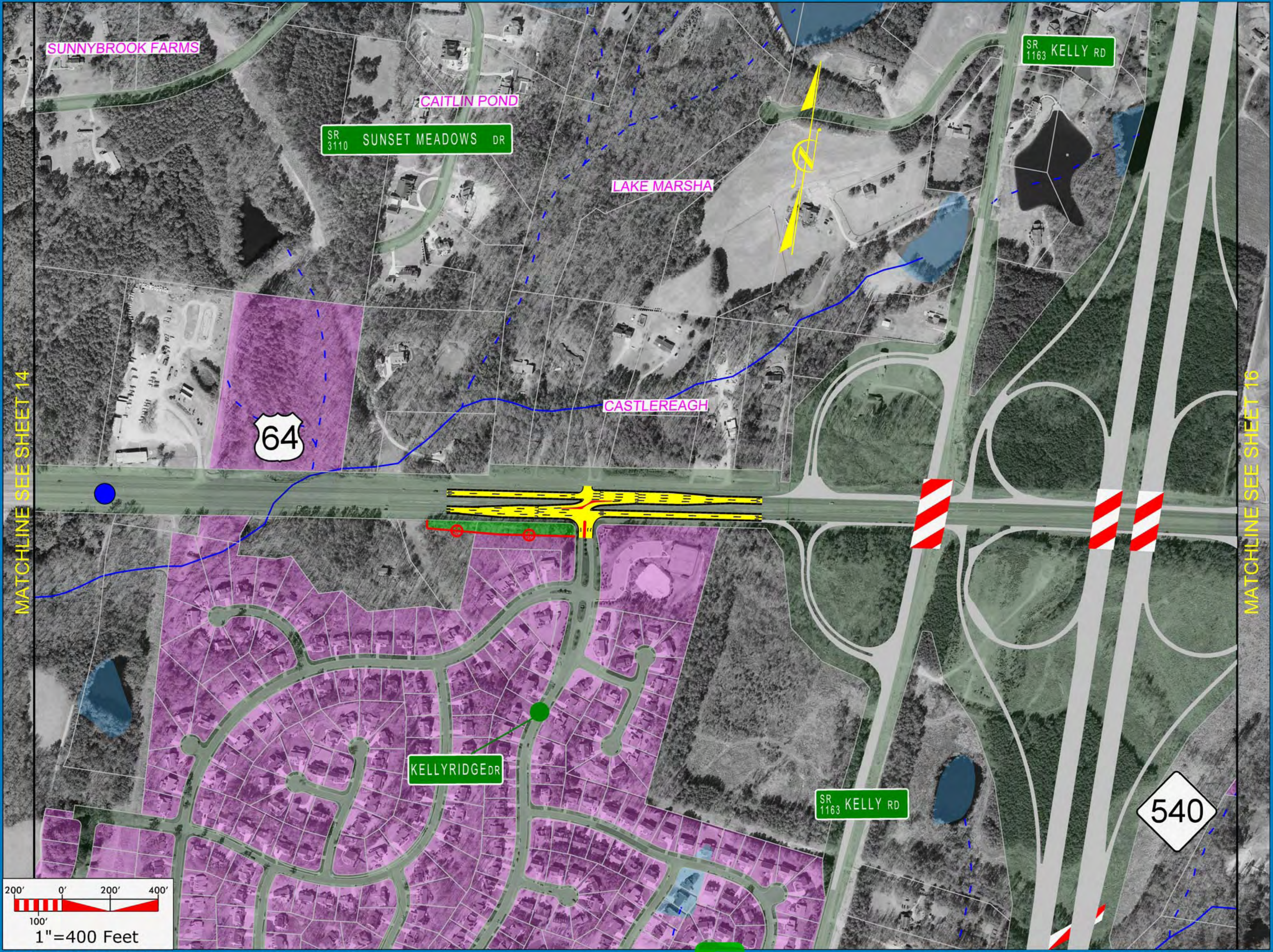
Recommended Short-term Solution

Sheet 14 of 22

US 64 Corridor Study Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION



SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Right of Way Area (Worst Case)
- Proposed Right of Way Limits
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- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Short-term Solution

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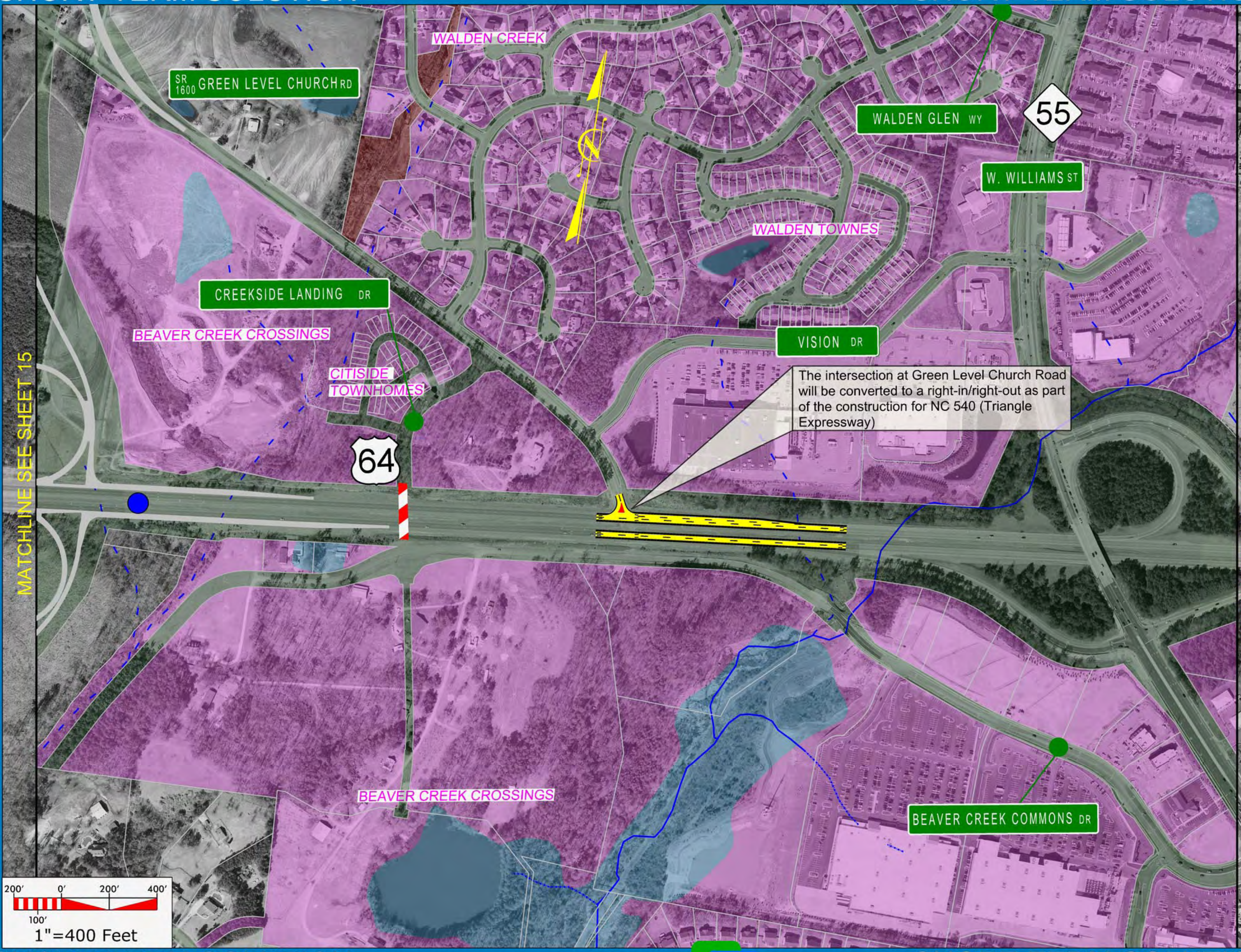
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT

Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital

Proposed Pavement
Proposed Bridges and Islands
Proposed Right of Way Area (Worst Case)
Proposed Right of Way Limits
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Traffic Signal
Existing Median Opening (Note: all median openings will be considered for closure in the future)

Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT

Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital

Proposed Pavement
Proposed Bridges and Islands
Proposed Right of Way Area (Worst Case)
Proposed Right of Way Limits
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Traffic Signal
Existing Median Opening (Note: all median openings will be considered for closure in the future)

Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
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- Proposed Right of Way Limits
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- School
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- Hospital
- Wetlands
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- Federal Land
- Park/Golf Course
- Historic Property
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- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood TEXT

Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

LEGEND

Proposed Pavement	Property Lines
Proposed Bridges and Islands	Railroad
Proposed Right of Way Area (Worst Case)	Streams
Proposed Right of Way Limits	School
Pavement Constructed Under NC 540 Project	Cemetery
Existing Bridges to Remain	Church
Existing Bridges to be Removed	Hospital
Existing Pavement to be Removed	
Traffic Signal	
Existing Median Opening (Note: all median openings will be considered for closure in the future)	

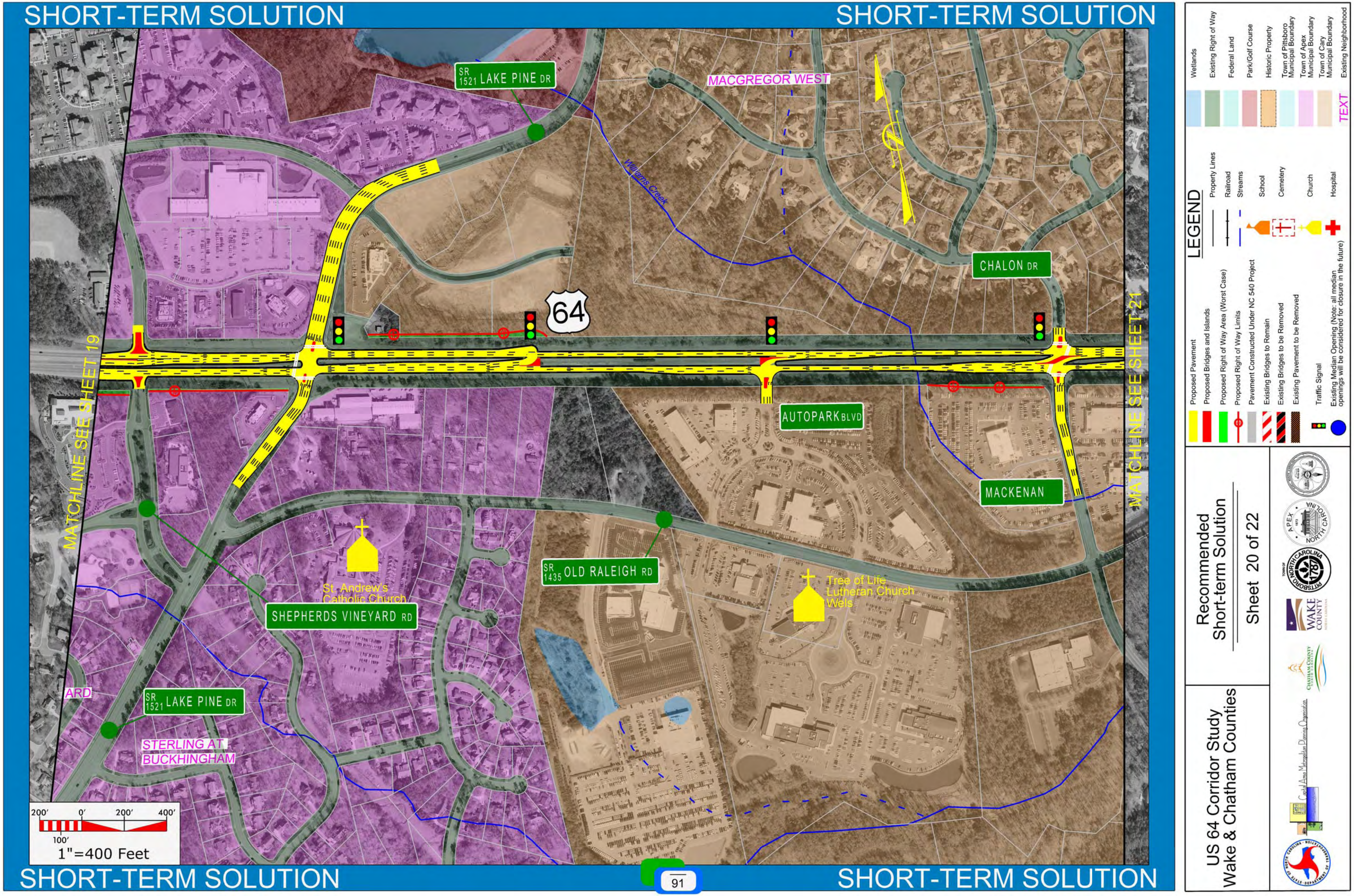
Wetlands	
Existing Right of Way	
Federal Land	
Park/Golf Course	
Historic Property	
Town of Pittsboro Municipal Boundary	
Town of Apex Municipal Boundary	
Town of Cary Municipal Boundary	
TEXT	Existing Neighborhood

Recommended Short-term Solution

Sheet 19 of 22

US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION


SHORT-TERM SOLUTION
SHORT-TERM SOLUTION
SR 1521 LAKE PINE DR
MACGREGOR WEST
Williams Creek
CHALON DR
64
MATCHLINE SEE SHEET 19
MATCHLINE SEE SHEET 21
AUTOPARK BLVD
MACKENAN
SR 1435 OLD RALEIGH RD
St. Andrew's Catholic Church
Tree of Life Lutheran Church Wels
SHEPHERDS VINEYARD RD
SR 1521 LAKE PINE DR
ARD
STERLING AT BUCKHINGHAM
200' 0' 200' 400'
100'
1"=400 Feet
SHORT-TERM SOLUTION
SHORT-TERM SOLUTION
LEGEND
Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
TEXT
Existing Neighborhood
Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital
Proposed Pavement
Proposed Bridges and Islands
Proposed Right of Way Area (Worst Case)
Proposed Right of Way Limits
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Traffic Signal
Existing Median Opening (Note: all median openings will be considered for closure in the future)
Recommended Short-term Solution
Sheet 20 of 22
US 64 Corridor Study
Wake & Chatham Counties

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Right of Way Area (Worst Case)
- Proposed Right of Way Limits
- Pavement Constructed Under NC 540 Project
- Existing Bridges to Remain
- Existing Bridges to be Removed
- Existing Pavement to be Removed
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- Railroad
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- School
- Cemetery
- Church
- Hospital
- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Short-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

SHORT-TERM SOLUTION

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
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- Existing Bridges to be Removed
- Existing Pavement to be Removed
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- Property Lines
- Railroad
- Streams
- School
- Cemetery
- Church
- Hospital
- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT

Recommended Short-term Solution

Sheet 22 of 22

US 64 Corridor Study
Wake & Chatham Counties

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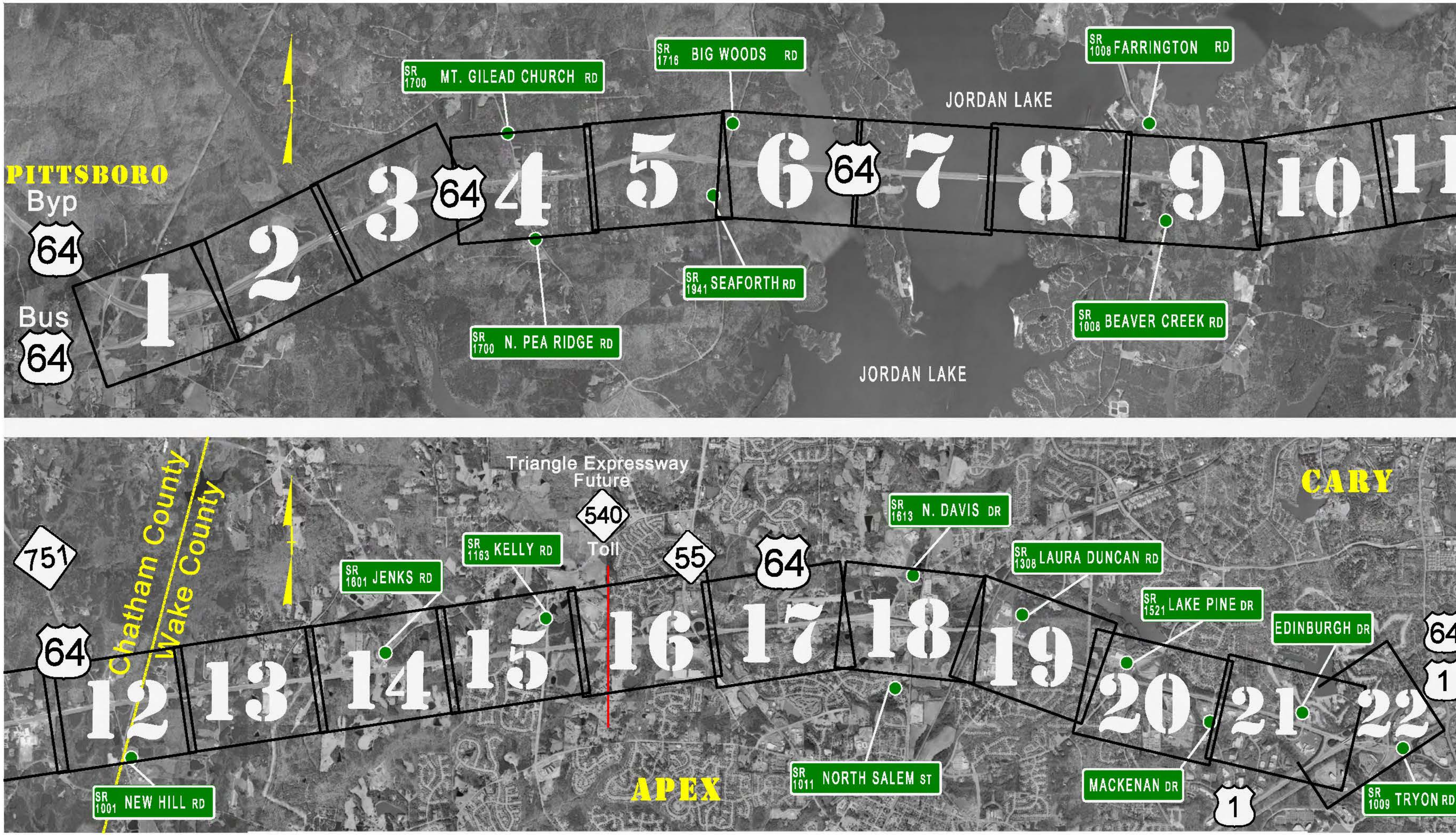
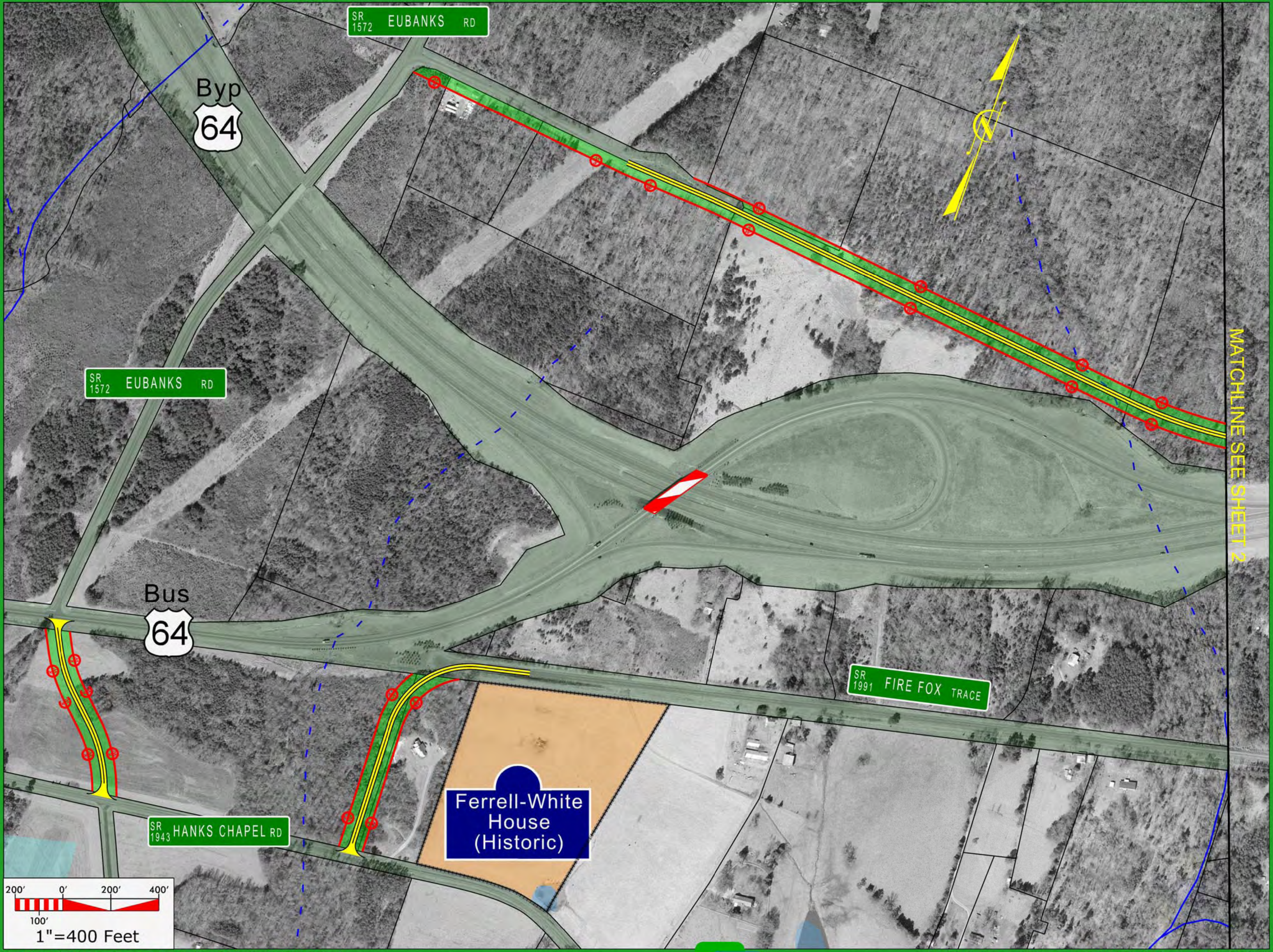
Long Term Solution

US 64 at
Pittsboro Bypass
(October 2009)

Figure 3.15: Long-term Design Plans Map Key



LONG-TERM SOLUTION



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
TEXT Existing Neighborhood

Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital

Proposed Pavement
Proposed Bridges and Islands
Proposed Concrete Barrier
Proposed Right of Way Area
Proposed Right of Way Limits
Proposed Sidewalk/Multi-use Path
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal

Recommended Long-term Solution

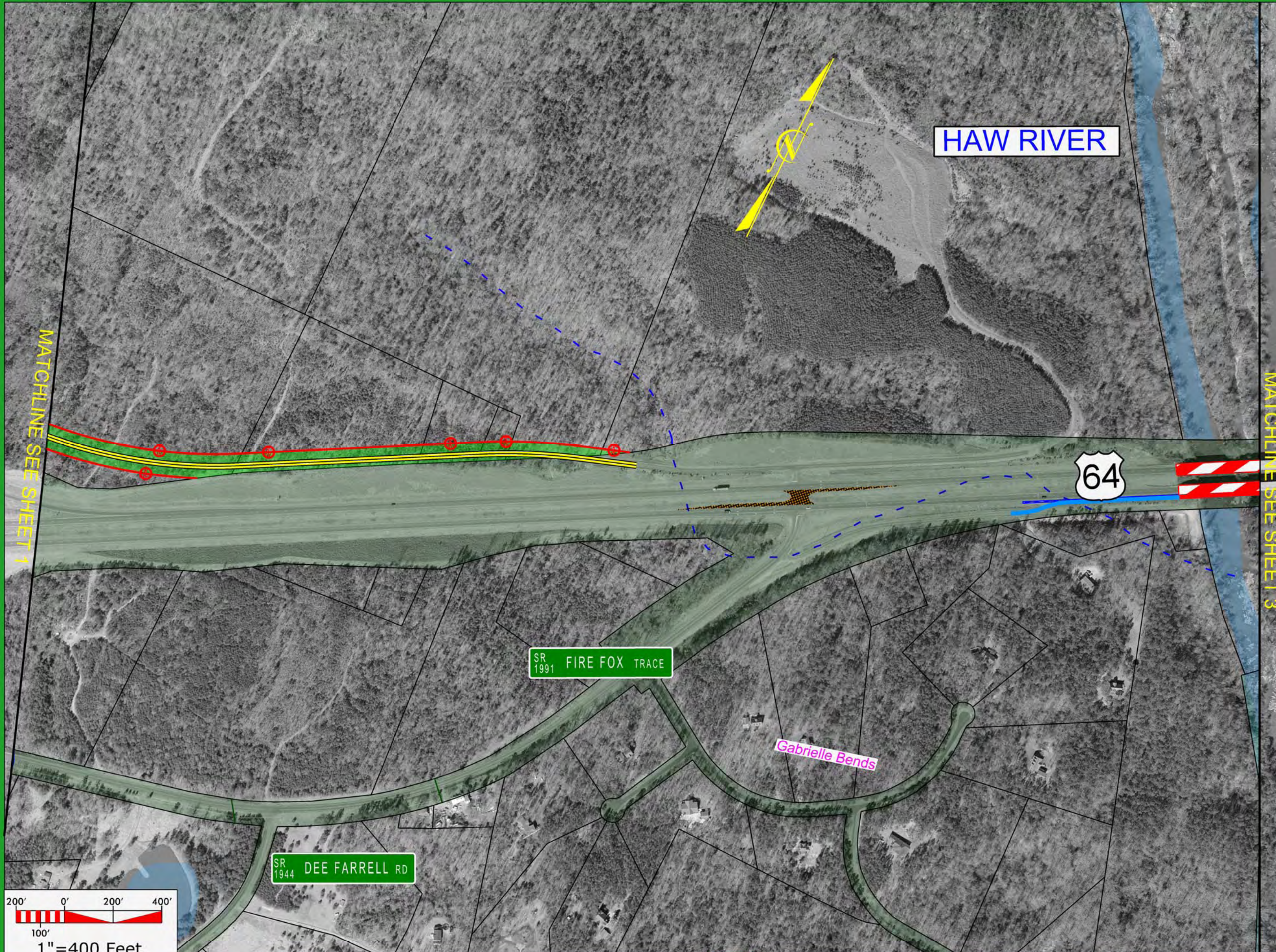
Sheet 1 of 22

US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION

LONG-TERM SOLUTION

LONG-TERM SOLUTION



LONG-TERM SOLUTION

LONG-TERM SOLUTION

US 64 Corridor Study
Wake & Chatham Counties

Recommended
Long-term Solution

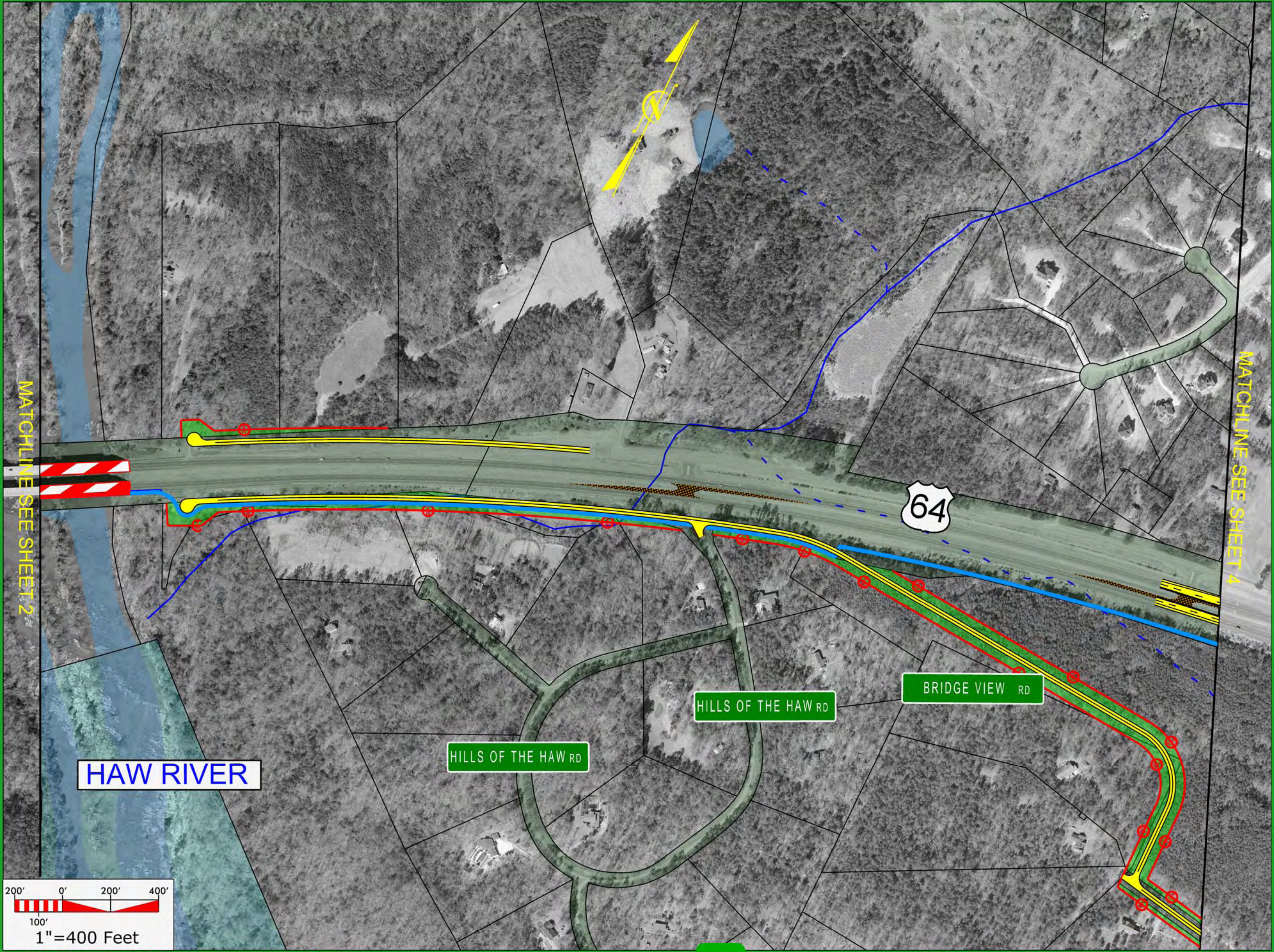
Sheet 2 of 22

LEGEND

Proposed Pavement
Proposed Bridges and Islands
Proposed Concrete Barrier
Proposed Right of Way Area
Proposed Right of Way Limits
Proposed Sidewalk/Multi-use Path
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal

Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT



LEGEND

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- Proposed Concrete Barrier
- Proposed Right of Way Area
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- Driveway Accessto be Removed
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- Railroad
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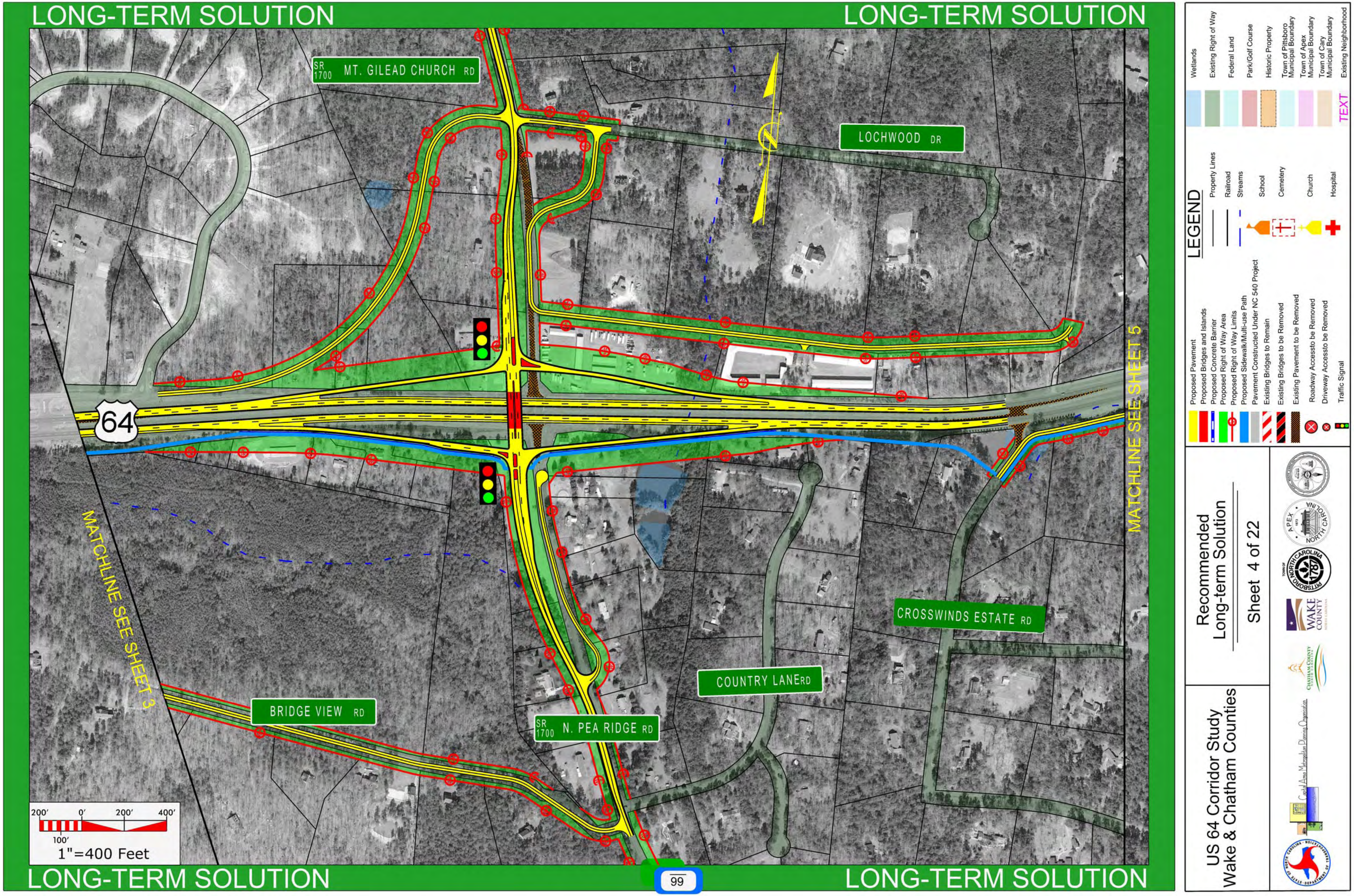
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT

Recommended Long-term Solution

Sheet 3 of 22

US 64 Corridor Study
Wake & Chatham Counties



LONG-TERM SOLUTION
LONG-TERM SOLUTION
SR 1700 MT. GILEAD CHURCH RD
LOCHWOOD DR
64
MATCHLINE SEE SHEET 5
MATCHLINE SEE SHEET 3
CROSSWINDS ESTATE RD
COUNTRY LANE RD
BRIDGE VIEW RD
SR 1700 N. PEA RIDGE RD
200' 0' 200' 400'
100'
1"=400 Feet
99
LONG-TERM SOLUTION
LONG-TERM SOLUTION
LEGEND
Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
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Proposed Pavement
Proposed Bridges and Islands
Proposed Concrete Barrier
Proposed Right of Way Area
Proposed Right of Way Limits
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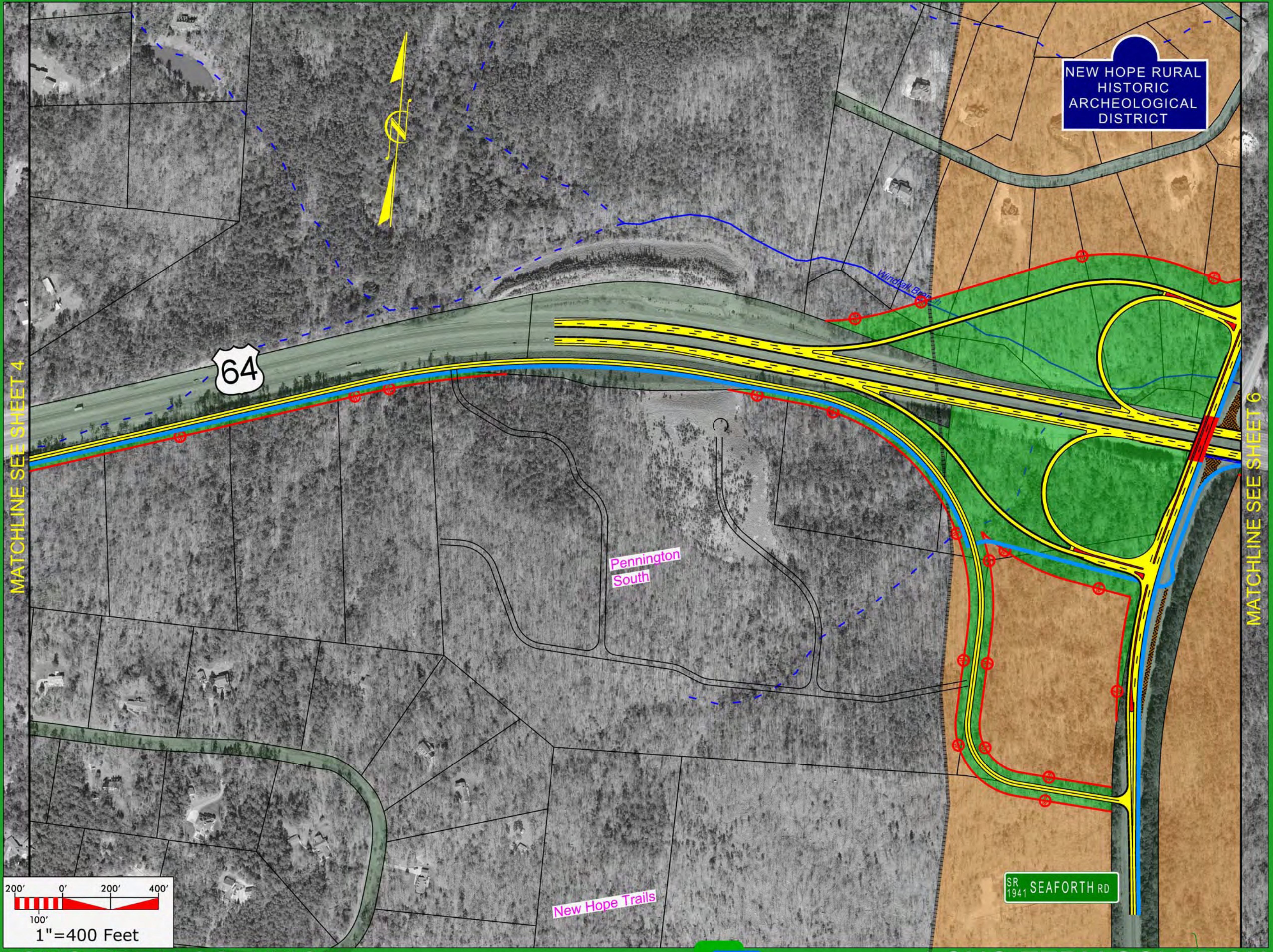
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal
Recommended Long-term Solution
Sheet 4 of 22
US 64 Corridor Study Wake & Chatham Counties

LONG-TERM SOLUTION LONG-TERM SOLUTION



LONG-TERM SOLUTION LONG-TERM SOLUTION

LEGEND

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- Proposed Bridges and Islands
- Proposed Concrete Barrier
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- Church
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- Federal Land
- Park/Golf Course
- Historic Property
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- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Long-term Solution

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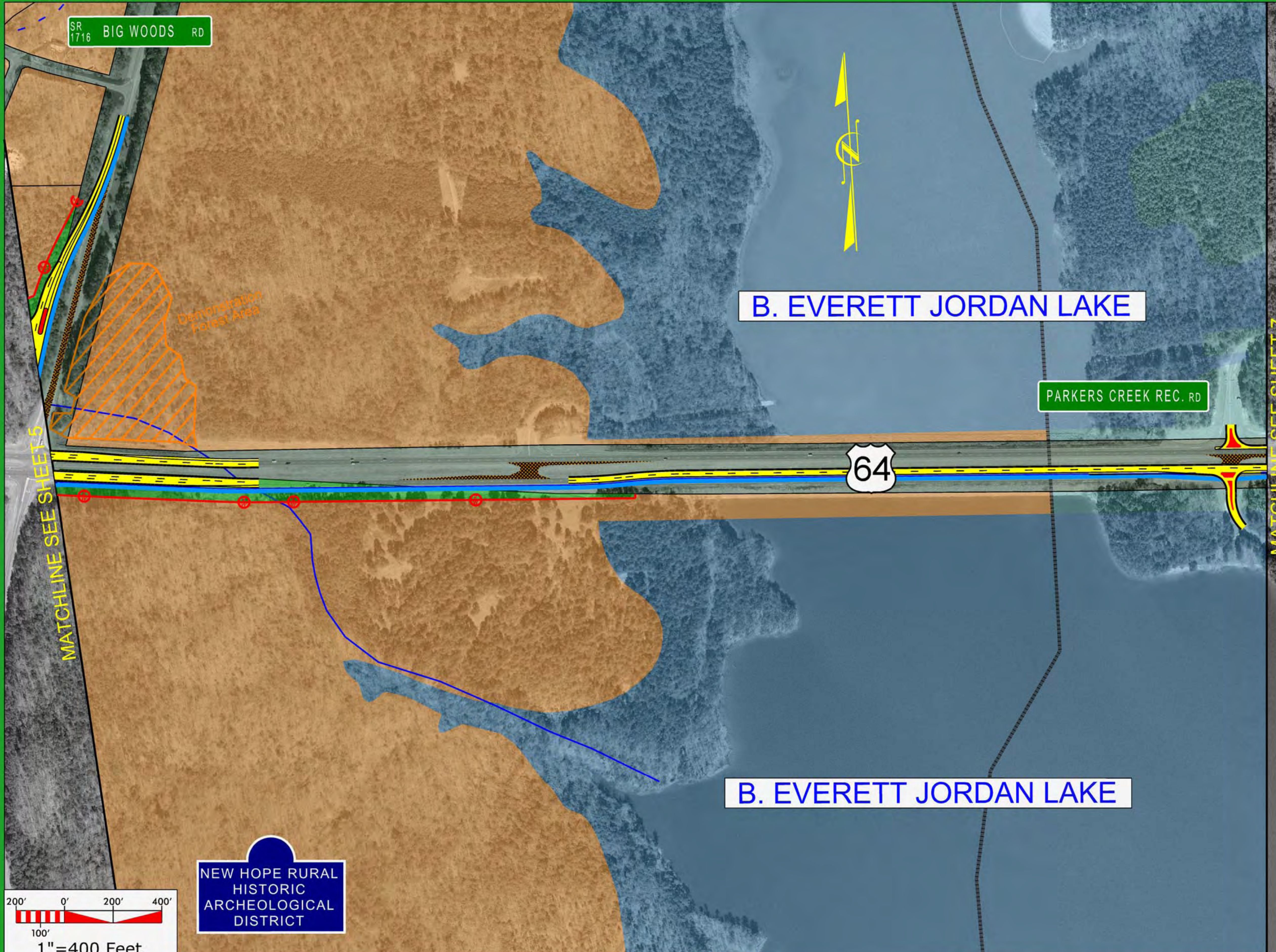
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
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Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT
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School
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Church
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Proposed Right of Way Limits
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Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal

Recommended Long-term Solution

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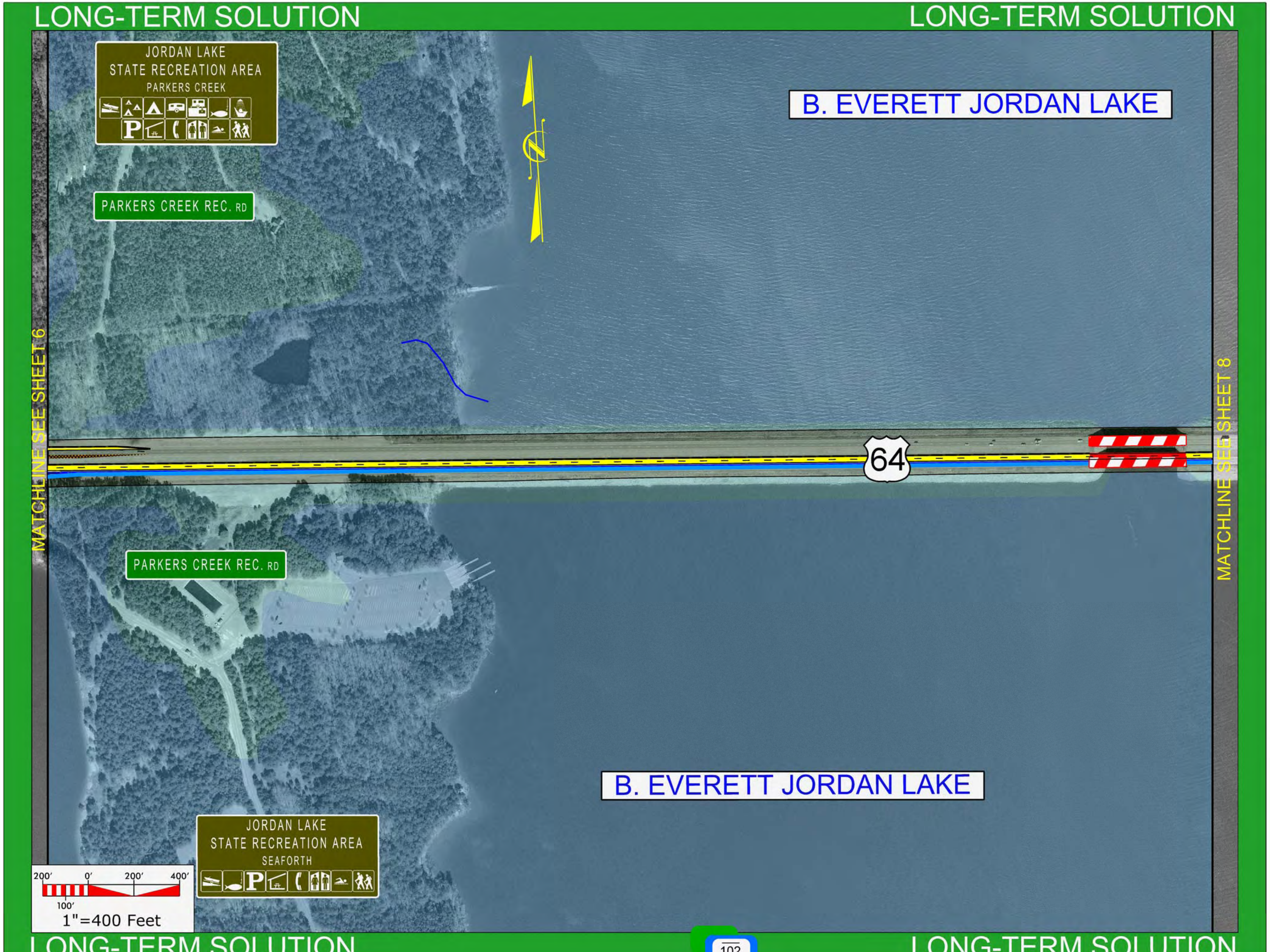
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

Proposed Pavement
Proposed Bridges and Islands
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Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
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Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT

Recommended Long-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Concrete Barrier
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- Hospital
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- Park/Golf Course
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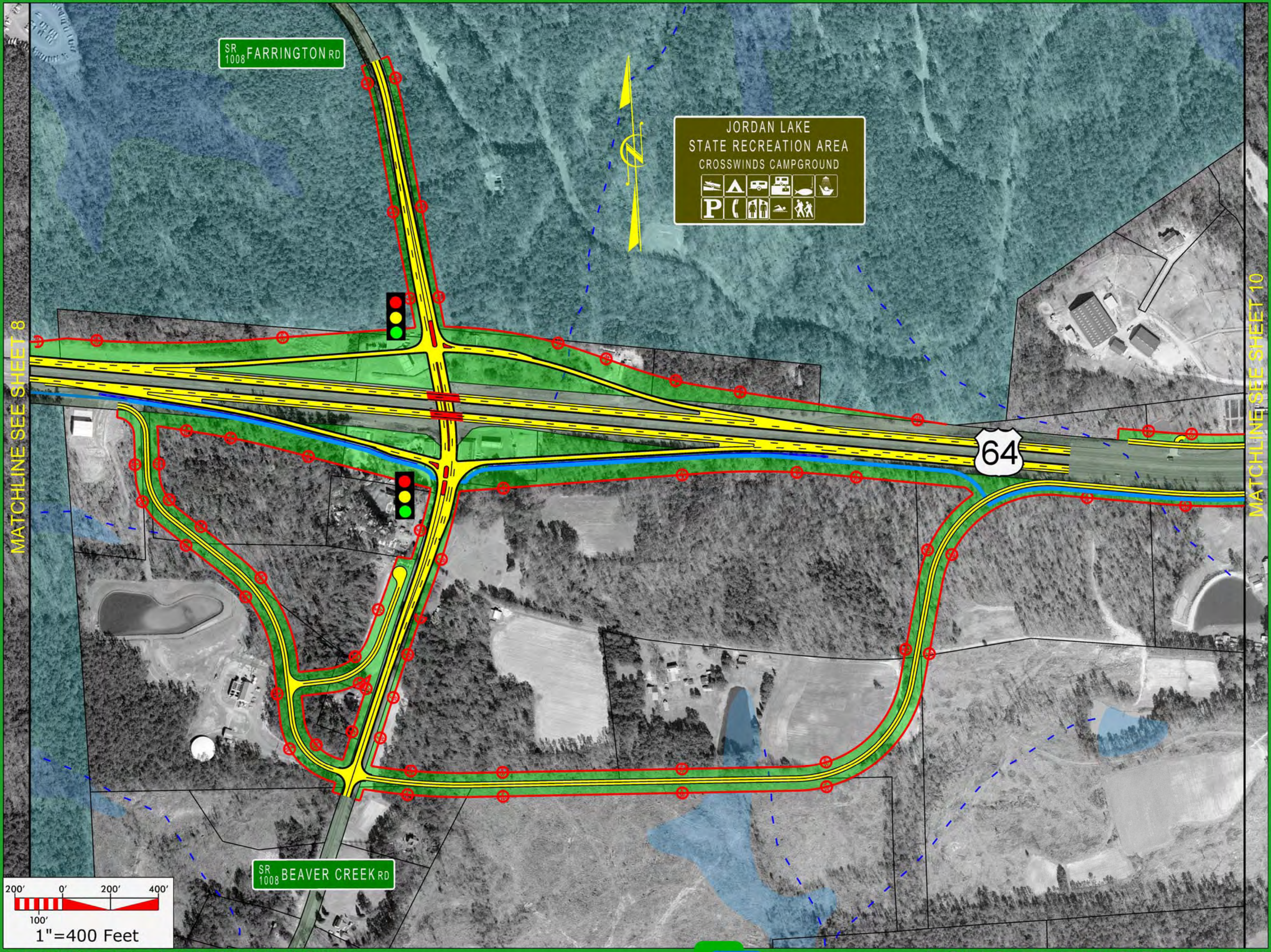
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT

Recommended Long-term Solution

Sheet 8 of 22

US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
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Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal

Recommended Long-term Solution

Sheet 9 of 22

US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION

LONG-TERM SOLUTION

LEGEND

- Proposed Pavement
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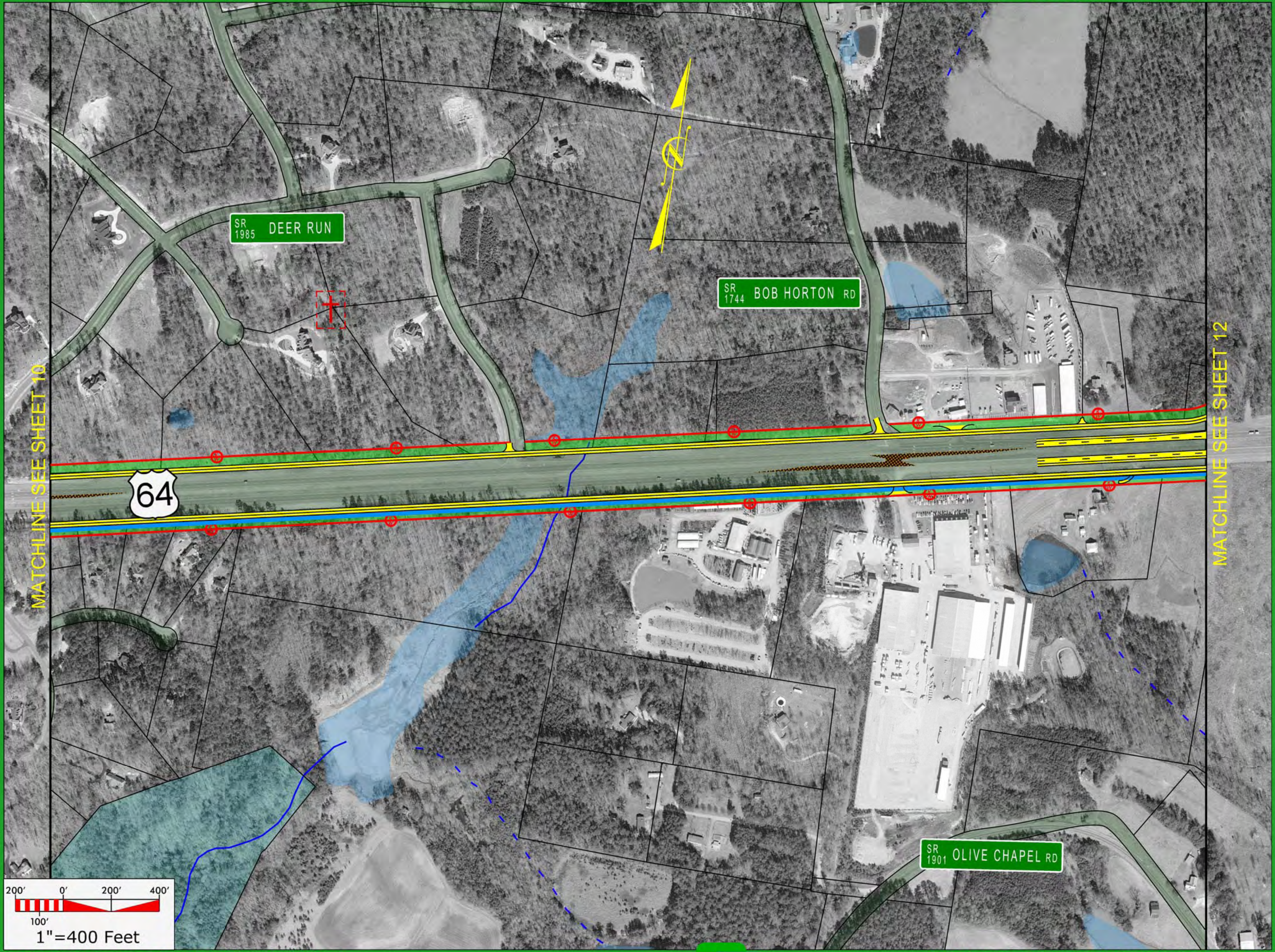
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Long-term Solution

Sheet 10 of 22

US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION



LEGEND

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Recommended Long-term Solution

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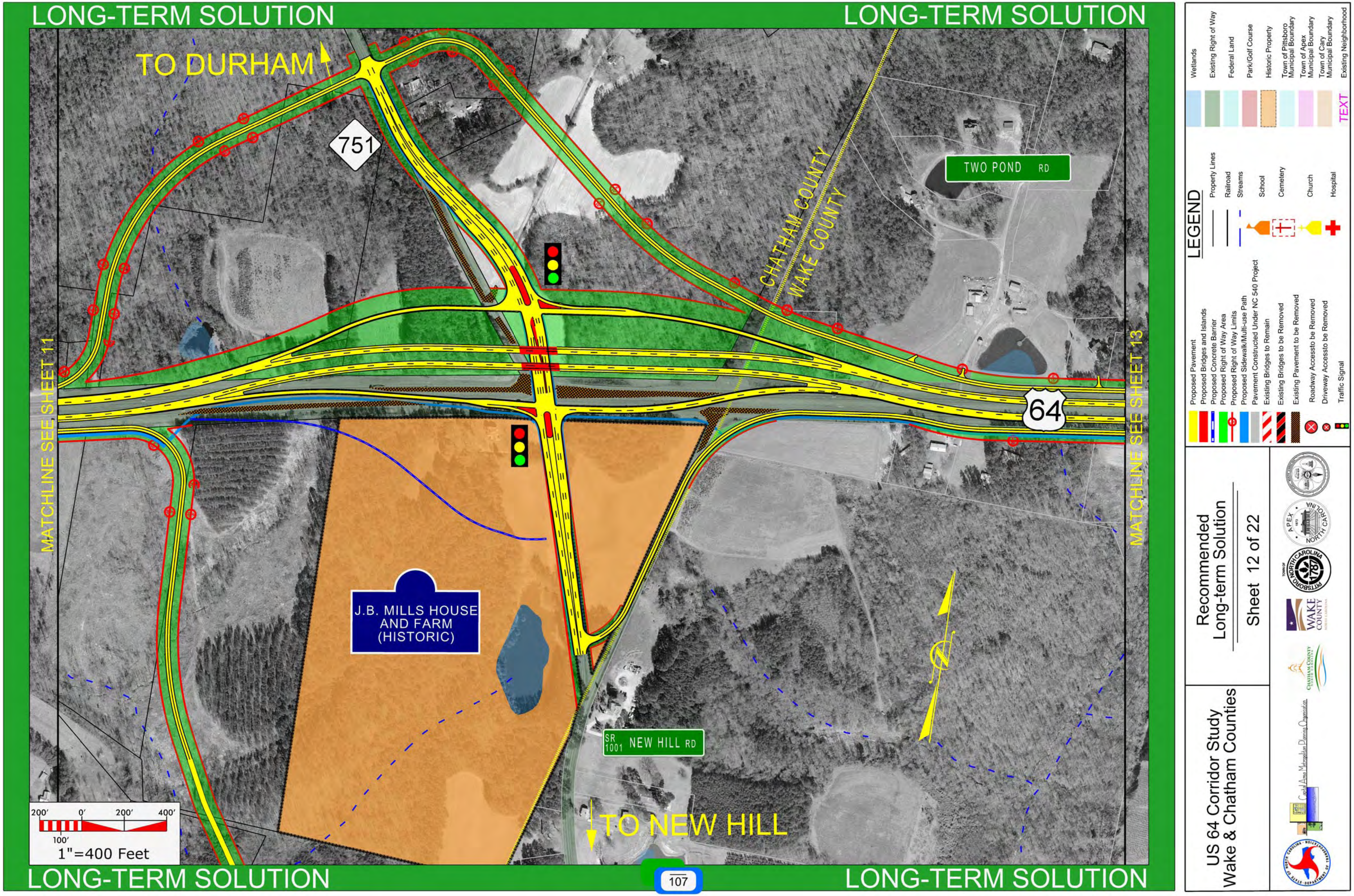
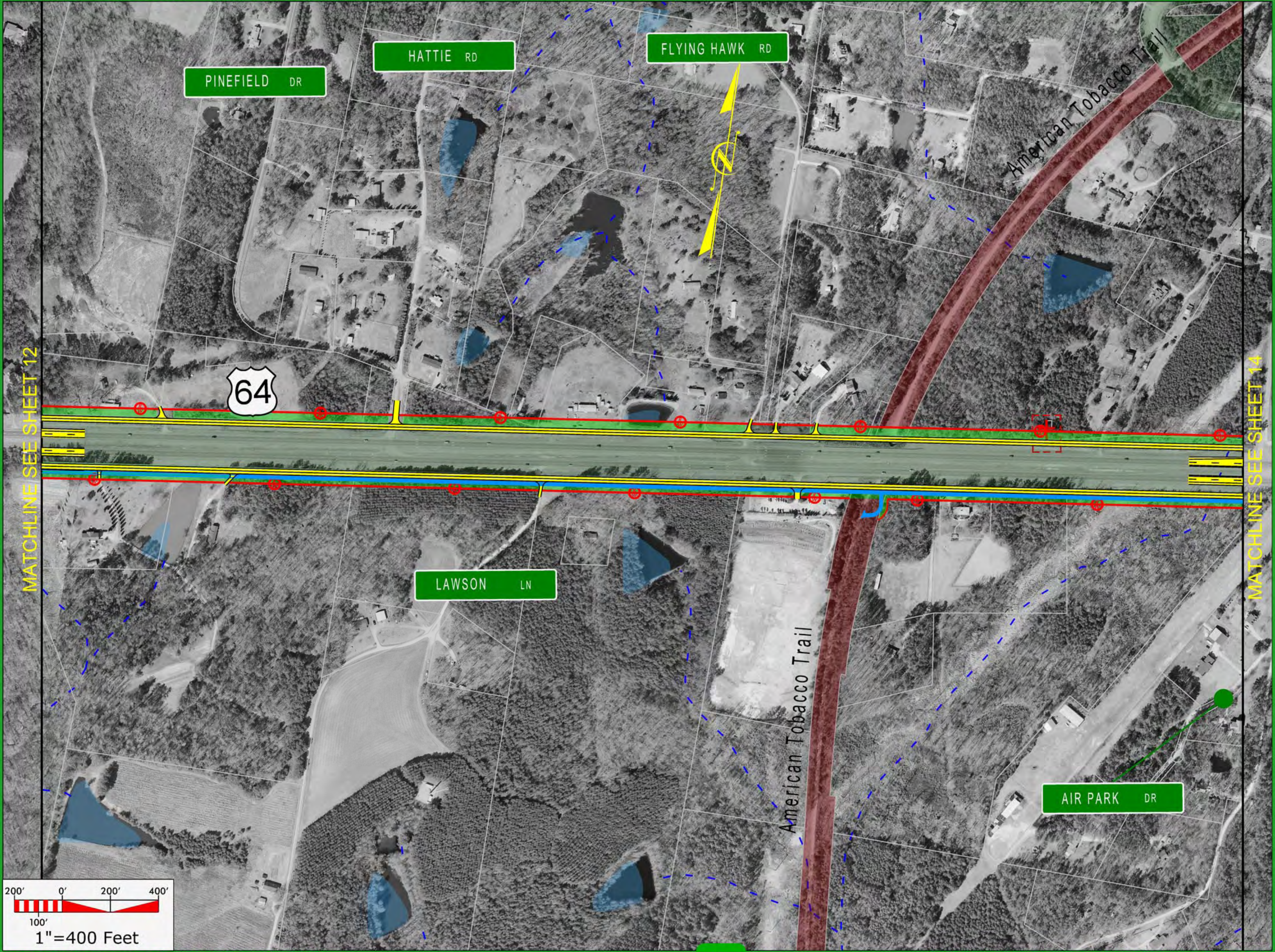
US 64 Corridor Study
Wake & Chatham Counties


LONG-TERM SOLUTION
LONG-TERM SOLUTION
TO DURHAM
751
TWO POND RD
CHATHAM COUNTY
WAKE COUNTY
64
MATCHLINE SEE SHEET 11
MATCHLINE SEE SHEET 13
J.B. MILLS HOUSE AND FARM (HISTORIC)
SR 1001 NEW HILL RD
TO NEW HILL
200' 0' 200' 400'
100'
1"=400 Feet
LONG-TERM SOLUTION
LONG-TERM SOLUTION
LEGEND
Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood
TEXT
Property Lines
Railroad
Streams
School
Cemetery
Church
Hospital
Proposed Pavement
Proposed Bridges and Islands
Proposed Concrete Barrier
Proposed Right of Way Area
Proposed Right of Way Limits
Proposed Sidewalk/Multi-use Path
Pavement Constructed Under NC 540 Project
Existing Bridges to Remain
Existing Bridges to be Removed
Existing Pavement to be Removed
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal
Recommended Long-term Solution
Sheet 12 of 22
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- Existing Neighborhood
- TEXT
- Property Lines
- Railroad
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- Cemetery
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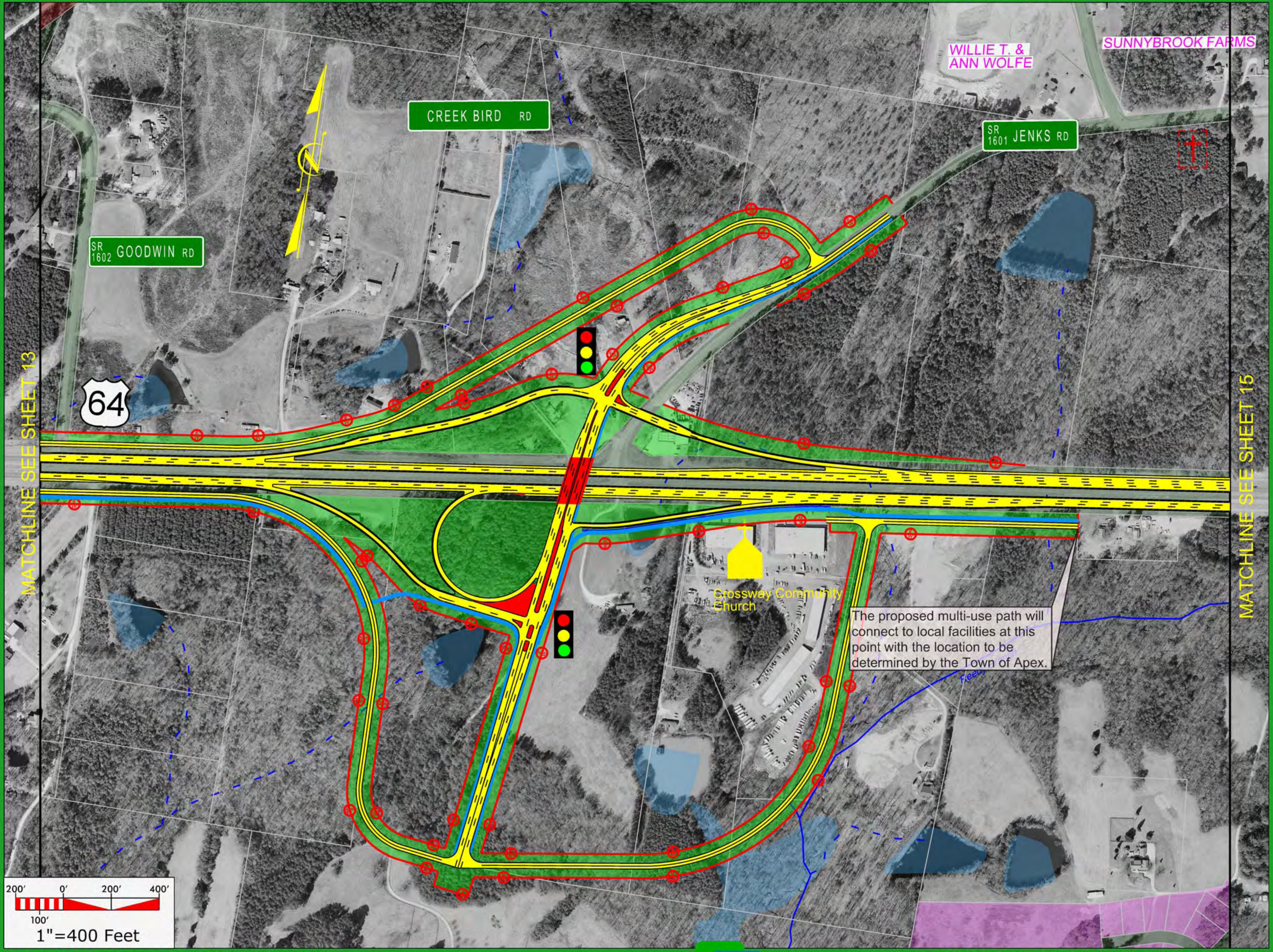
- Existing Bridges to be Removed
- Existing Pavement to be Removed
- Roadway Accessto be Removed
- Driveway Accessto be Removed
- Traffic Signal

Recommended Long-term Solution

Sheet 13 of 22

US 64 Corridor Study Wake & Chatham Counties



LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Concrete Barrier
- Proposed Right of Way Area
- Proposed Right of Way Limits
- Proposed Sidewalk/Multi-use Path
- Pavement Constructed Under NC 540 Project
- Existing Bridges to Remain
- Existing Bridges to be Removed
- Existing Pavement to be Removed
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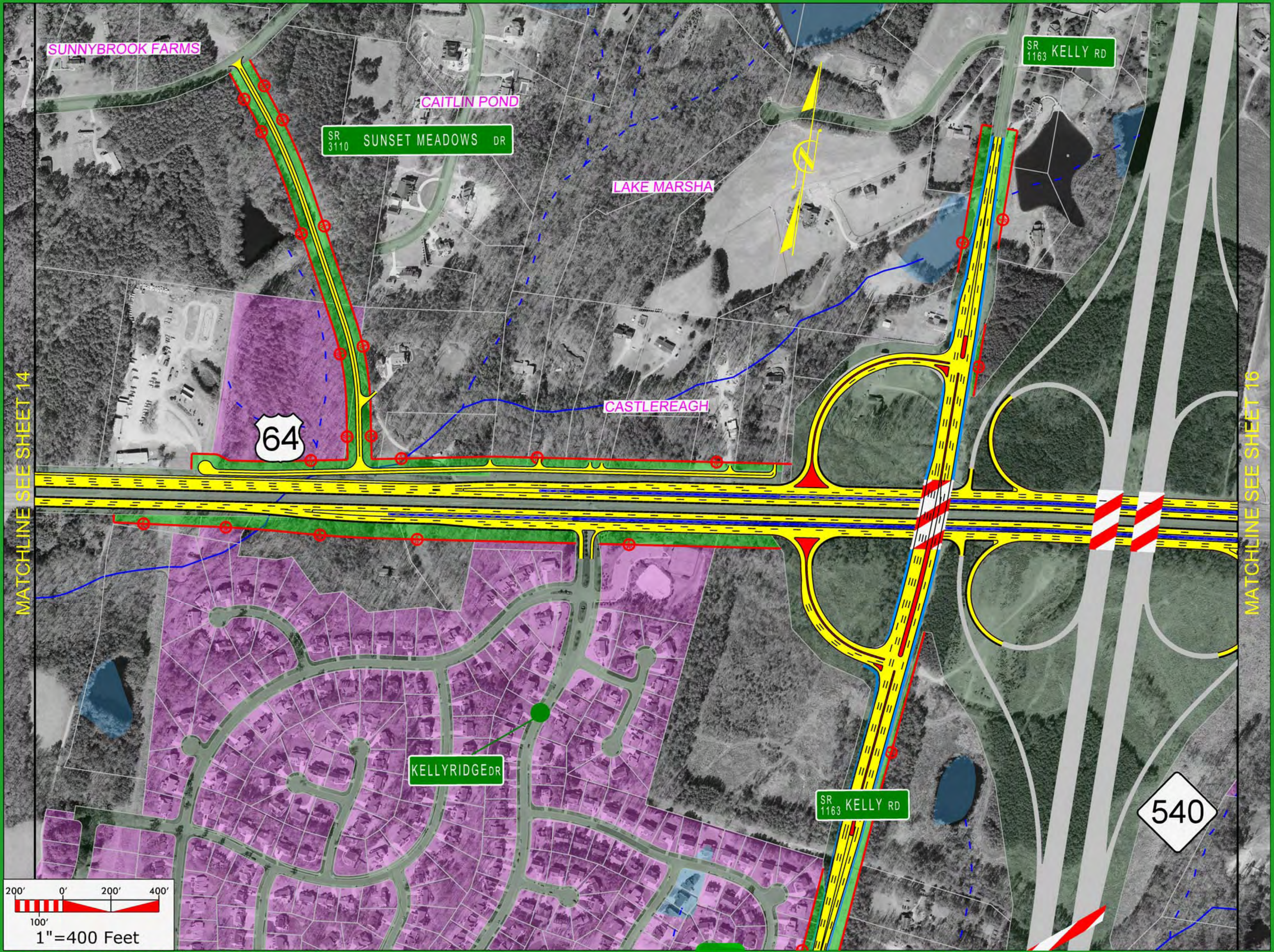
- Driveway Accessto be Removed
- Traffic Signal
- Property Lines
- Railroad
- Streams
- School
- Cemetery
- Church
- Hospital
- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended Long-term Solution

Sheet 14 of 22

US 64 Corridor Study
Wake & Chatham Counties



LEGEND

- Proposed Pavement
- Proposed Bridges and Islands
- Proposed Concrete Barrier
- Proposed Right of Way Area
- Proposed Right of Way Limits
- Proposed Sidewalk/Multi-use Path
- Pavement Constructed Under NC 540 Project
- Existing Bridges to Remain
- Existing Bridges to be Removed
- Existing Pavement to be Removed
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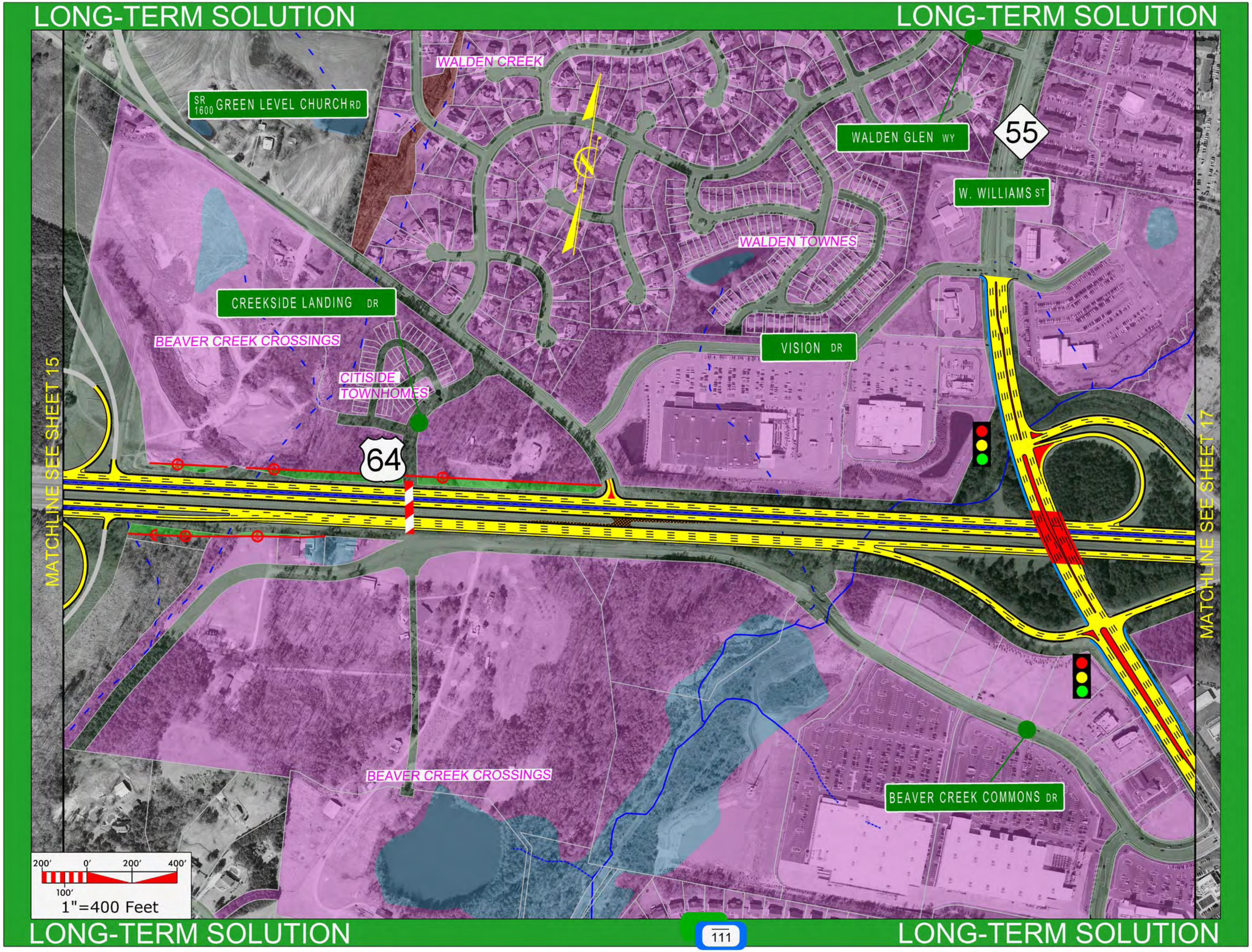
- Driveway Accessto be Removed
- Traffic Signal
- Property Lines
- Railroad
- Streams
- School
- Cemetery
- Church
- Hospital
- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
- Town of Pittsboro Municipal Boundary
- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
- TEXT Existing Neighborhood

Recommended
Long-term Solution

Sheet 15 of 22

US 64 Corridor Study
Wake & Chatham Counties



LEGEND

- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
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- Town of Apex Municipal Boundary
- Town of Cary Municipal Boundary
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- Existing Pavement to be Removed
- Roadway Accessto be Removed
- Driveway Accessto be Removed
- Traffic Signal

Recommended Long-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION
MATCHLINE SEE INSET
LONG-TERM SOLUTION
ASTLEWOOD
SR 3076 THORN HOLLOW DR
SR 3074 FERN VALLEY LN
INSET
64
MATCHLINE SEE SHEET 16
MATCHLINE SEE SHEET 18
BLACKBURN RD
ABBY KNOLL DR
55
HADDON HALL
HADDON HALL
200' 0' 200' 400'
100'
1"=400 Feet
TO APEX
LONG-TERM SOLUTION
LONG-TERM SOLUTION
LEGEND
Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
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Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
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Existing Bridges to be Removed
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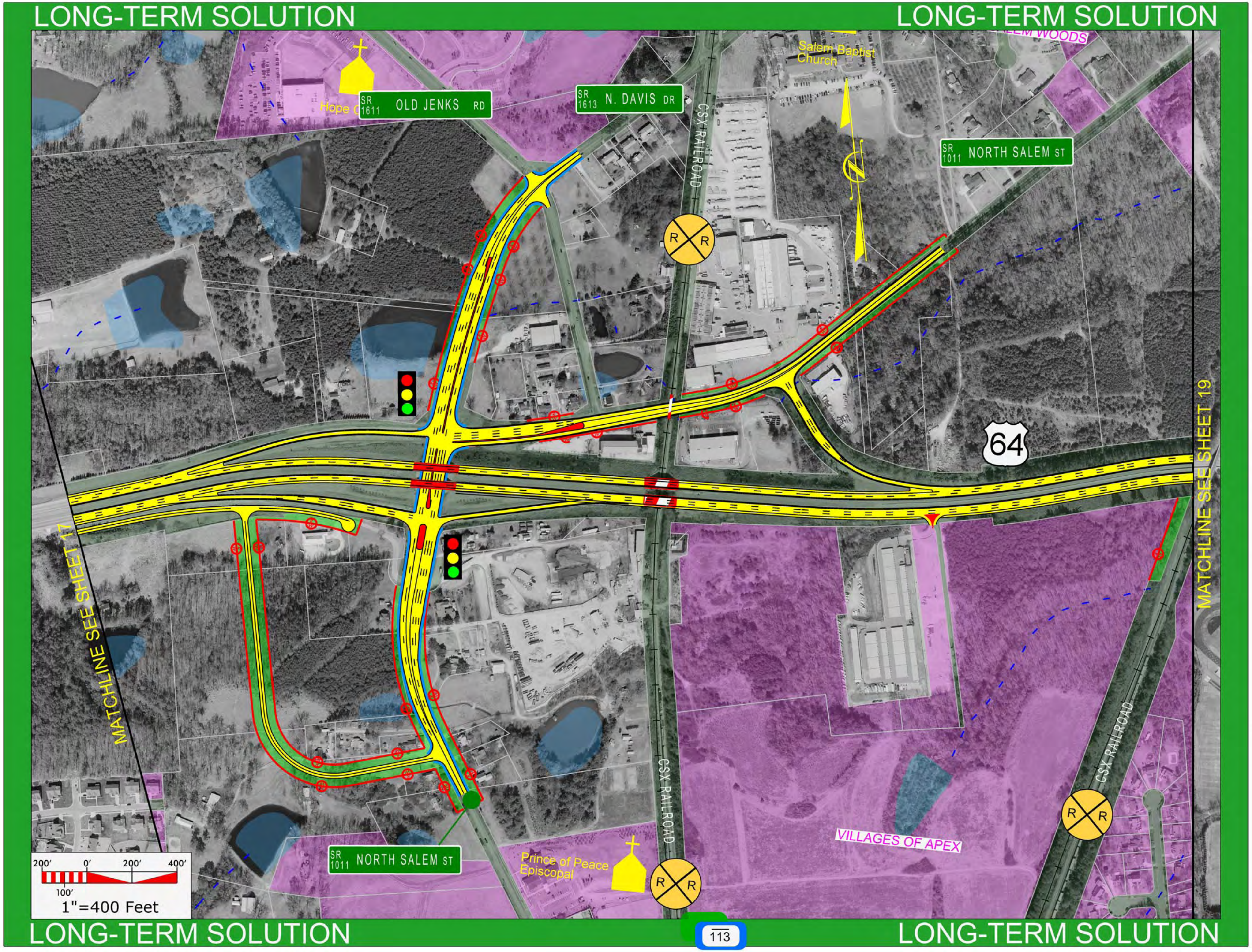
Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal
Recommended Long-term Solution
Sheet 17 of 22
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

- Wetlands
- Existing Right of Way
- Federal Land
- Park/Golf Course
- Historic Property
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- Town of Cary Municipal Boundary
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- Roadway Accessto be Removed
- Driveway Accessto be Removed
- Traffic Signal

Recommended Long-term Solution

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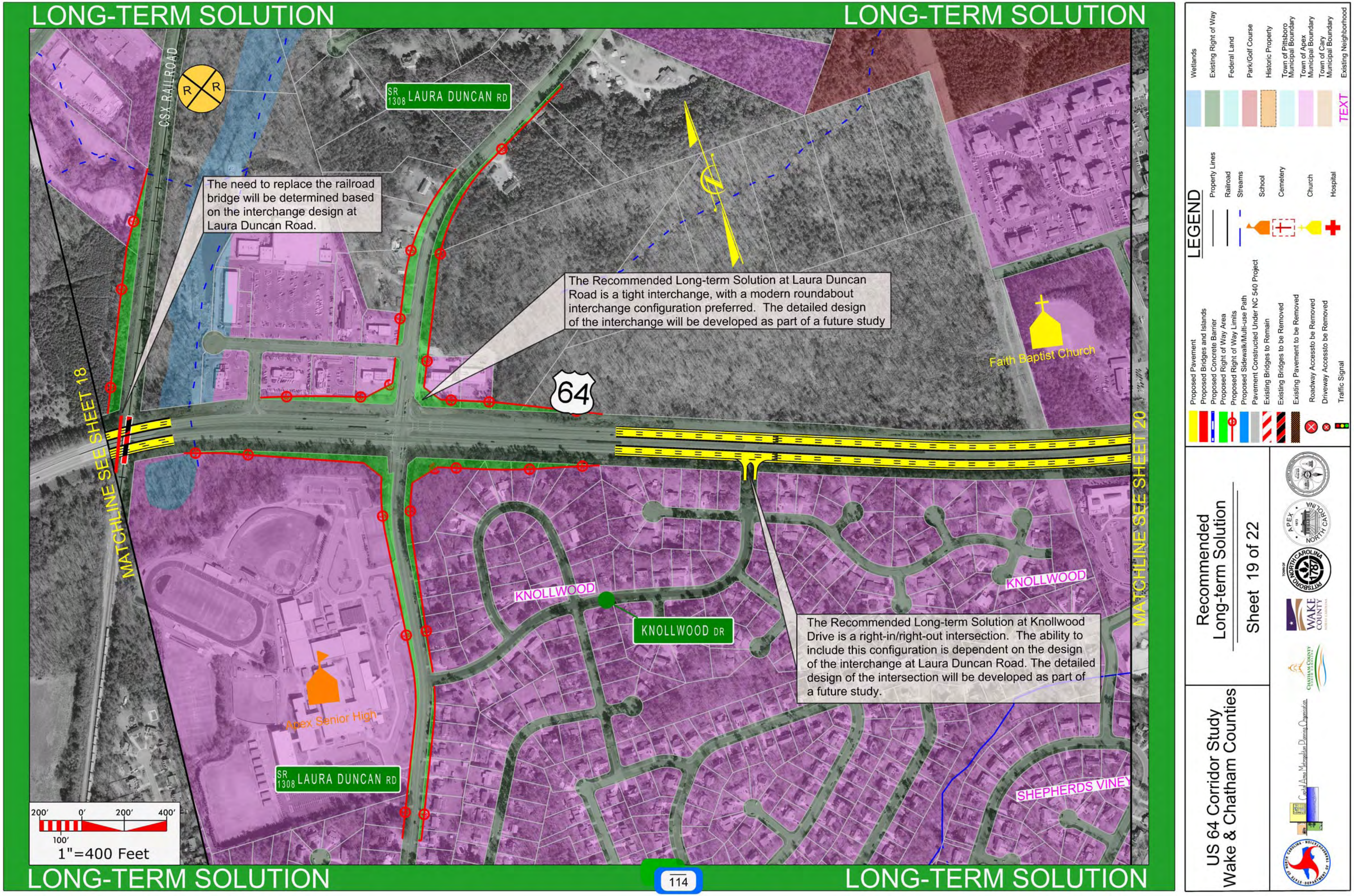
US 64 Corridor Study
Wake & Chatham Counties



Recommended Long-term Solution

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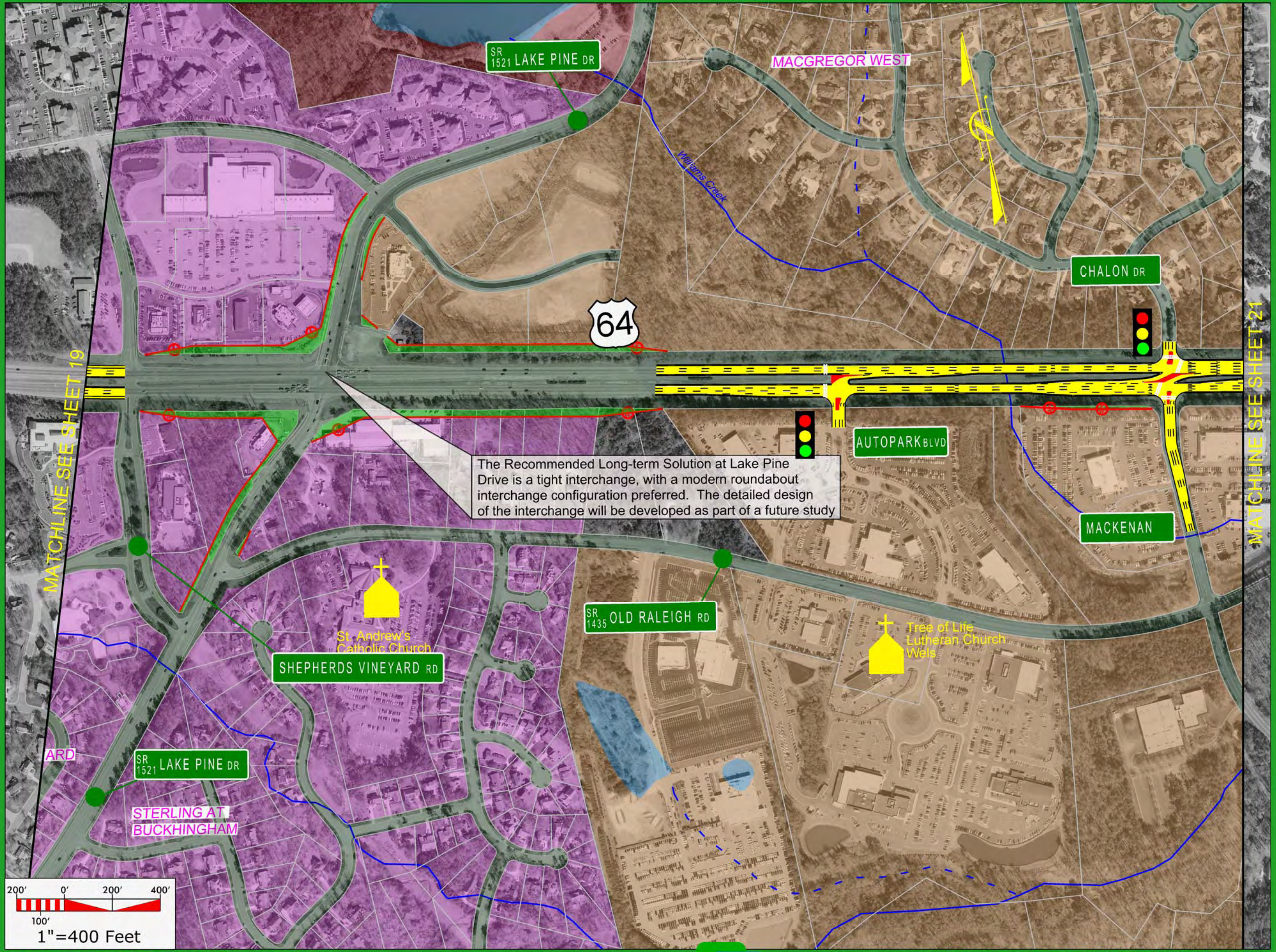
US 64 Corridor Study
Wake & Chatham Counties



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
Existing Neighborhood — TEXT

Property Lines
Railroad
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Roadway Accessto be Removed
Driveway Accessto be Removed
Traffic Signal

Recommended Long-term Solution

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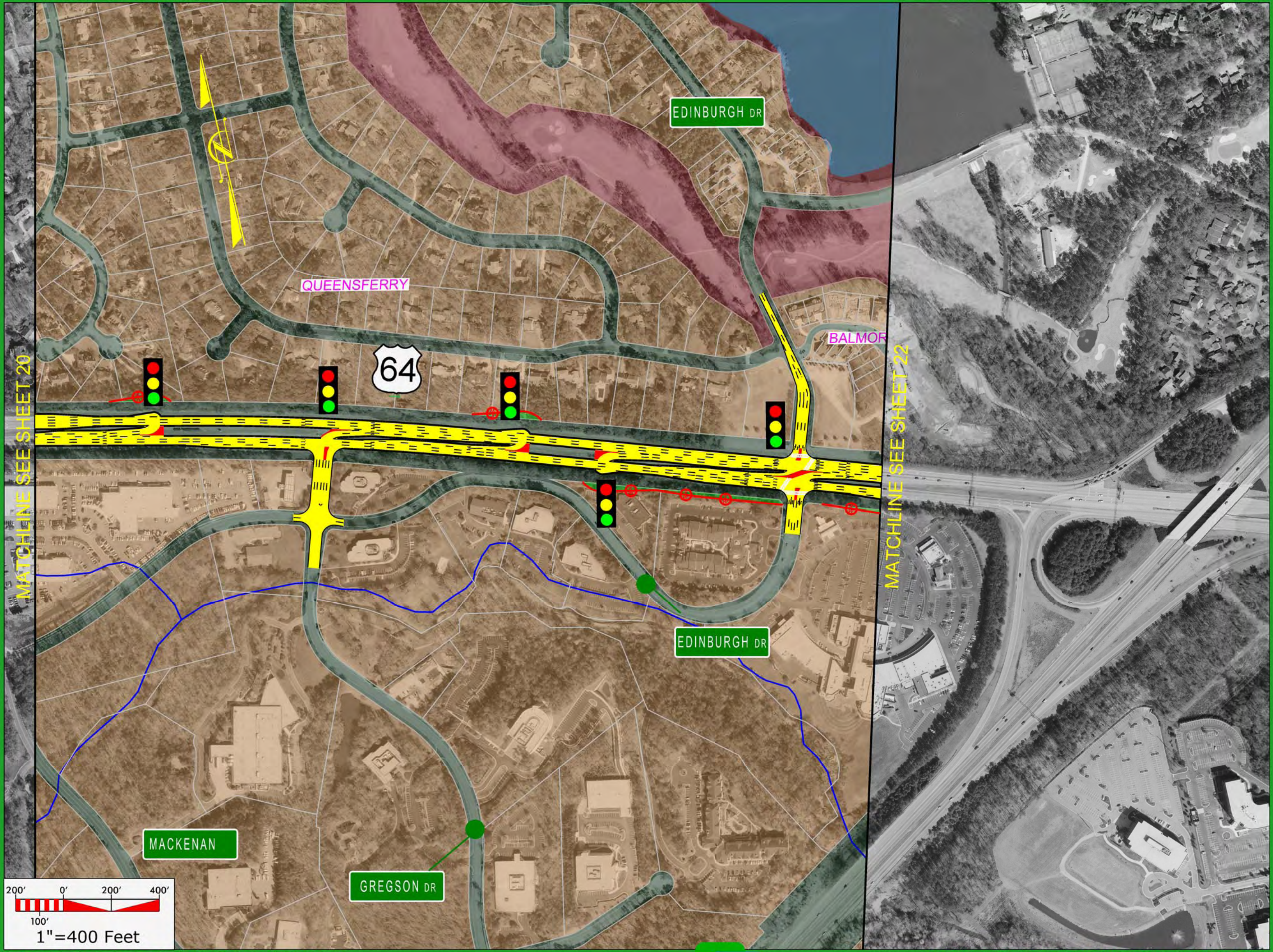
US 64 Corridor Study
Wake & Chatham Counties

LONG-TERM SOLUTION

LONG-TERM SOLUTION



LONG-TERM SOLUTION

LONG-TERM SOLUTION

LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
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Driveway Accessto be Removed
Traffic Signal

Recommended Long-term Solution

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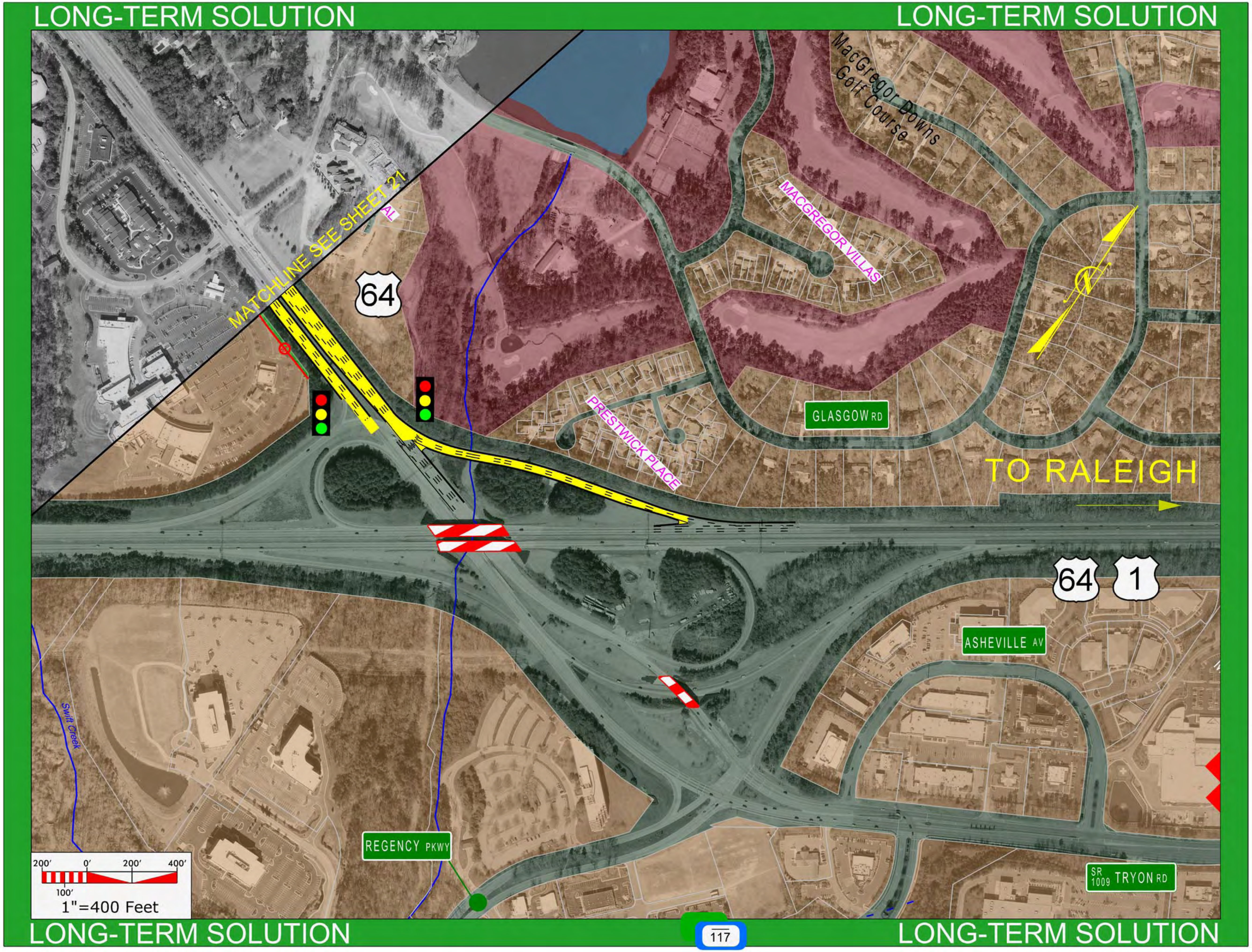
US 64 Corridor Study Wake & Chatham Counties



LEGEND

Wetlands
Existing Right of Way
Federal Land
Park/Golf Course
Historic Property
Town of Pittsboro Municipal Boundary
Town of Apex Municipal Boundary
Town of Cary Municipal Boundary
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Driveway Accessto be Removed
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Recommended Long-term Solution

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US 64 Corridor Study
Wake & Chatham Counties

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