



**FEASIBILITY STUDY**  
**US 264 – Greenville Boulevard Improvements**  
**From NC 11/Memorial Drive to US 264 East**  
**Greenville, Pitt County – Division 2**  
**FS-1002B**

**Prepared for:**  
**N.C. Department of Transportation**  
**Program Development Branch**  
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Appendix A: Traffic Forecast

Appendix B: Conceptual Designs (see also attached roll plots and CD)

Appendix C: Detailed Cost Estimates

# 1.0 INTRODUCTION

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The proposed project is planned to improve the existing US 264A (Greenville Boulevard) corridor between NC 11/Memorial Drive and US 264 East, in southeast Greenville, NC. This report evaluates various improvement alternatives which include widening the existing US 264A (Greenville Boulevard) corridor with conventional intersection improvements, as well as evaluating unconventional at-grade intersection treatments, and finally analyzing interchange alternatives at select locations. The project study area is located primarily in Pitt County, and is incorporated mostly into the Greenville Urban Area Metropolitan Planning Organization (GUAMPO) planning boundary. The purpose of the project is to identify feasible alternatives to improve traffic operations along the corridor, as there is existing congestion that is projected to worsen significantly in future. This report examines of the feasibility of these proposed improvement alternatives and provides conceptual designs for those determined feasible.

This is the initial step in the planning and design process for this project and is not the product of exhaustive environmental or design investigations. The purpose of this study is to describe the proposed project, including cost, and to identify potential concerns that may require consideration in the planning and design phases.

## 1.1 BACKGROUND

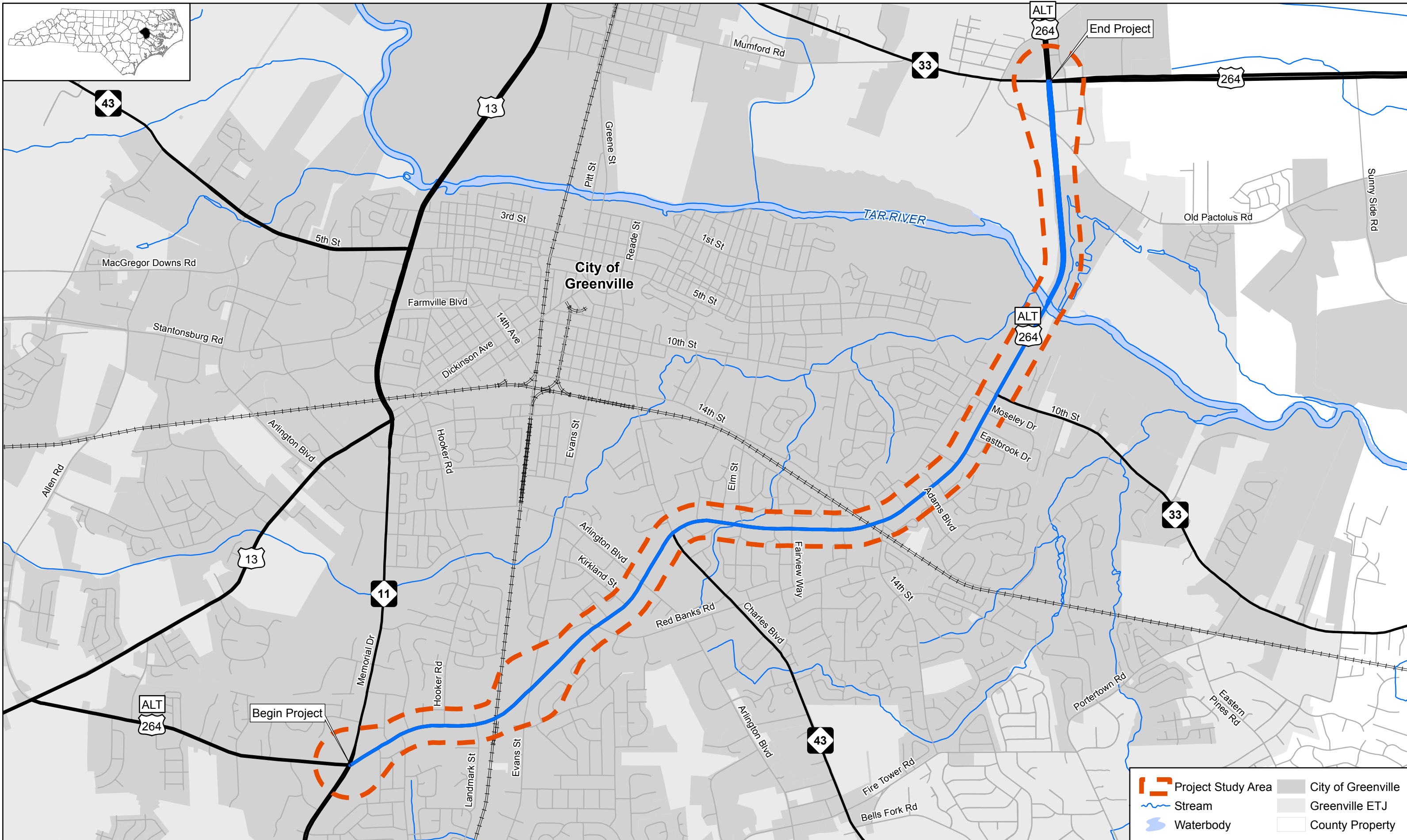
US 264A (Greenville Boulevard) is an important local and regional facility within Greenville, NC as it provides access through an area of the City with dense commercial, residential and institutional developments. Currently, this corridor runs through the southeast portion of the City functioning as a principal arterial. US264A (Greenville Boulevard) has a 5-lane typical section from the project start (NC 11/Memorial Drive) with a center left-turn lane, and maintains this cross section for just over five miles before transitioning to a four-lane divided facility just north of the Tar River. This corridor provides direct access to East Carolina University (ECU) and numerous retail developments, indirect access to major residential areas, and direct connections to key arterials connecting to other parts of the City such as S. Evans Street, Charles Boulevard and 10<sup>th</sup> Street. Because of the importance of access to these areas and efficient movements between major arterials, it is critical that this corridor operates at a functionally acceptable level to serve its users throughout the day. Currently, there is notable congestion at a number of intersections during peak hours, and this congestion is expected to worsen in the future as this thriving city continues to grow.

## 1.2 STUDY AREA

The extent of the study area for this project includes approximately 500 feet on either side of the existing roadway centerline, although this width varies where there are known constraints, environmental concerns, or potential interchange alternatives. The study area, as shown in Figure 1-1, includes existing intersections along US 264A (Greenville Boulevard). These intersections are included as part of the traffic capacity analysis to determine the impact of the proposed improvements on the traffic operations of the corridor.







The following cross streets along US 264A (Greenville Boulevard) are the intersections included in the study area, moving southwest to northeast, as shown in Figure 1-1:

- NC 11/903 (Memorial Drive)
- Hooker Road/Convention Center Drive
- Landmark Street/Walmart Entrance
- SR 1702 (S. Evans Street)
- Red Banks Road
- E. Arlington Boulevard
- SR 1707 (Charles Boulevard)
- Elm Street
- SR 1703 (E. 14<sup>th</sup> Street)
- Eastbrook Drive
- Moseley Drive
- SR 1598 (E. 10<sup>th</sup> Street)
- SR 1534 (Old Pactolus Road)
- US 264 East/Pactolus Highway



Begin Project

End Project

-  Project Study Area
-  Stream
-  Waterbody
-  City of Greenville
-  Greenville ETJ
-  County Property

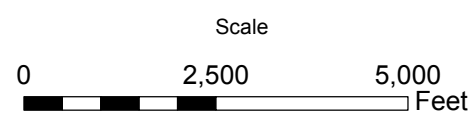


Figure 1-1  
Project Study Area

**US 264 (Greenville Boulevard) Widening and Intersection Improvements**  
 From NC 11 / Memorial Drive to US 264 East  
 FS-1002B





## 1.3 PROJECT ALTERNATIVES

This study analyzed various base year and future year scenarios. These scenarios are based on multiple design alternatives and traffic projections for each condition, as described below.

- **Base Year (2012) – No-Build** – This scenario represents existing roadway conditions and accounts for base year volumes.
- **Base Year (2012) – Build Alternative A: Six/Eight-Lane Cross Section** – This scenario includes the widening the existing roadway to an eight-lane facility from NC 11 (Memorial Drive) to SR 1707 (Charles Boulevard) and widening to a six-lane facility from SR 1707 (Charles Boulevard) to US 264 E. This alternative accounts for conventional widening improvements at most study intersections, with the exception of varying improvements at the following intersections:

- NC 11 (Memorial Drive)
- SR 1702 (S. Evans Street)

Forecasted base year volumes were analyzed in this scenario.

- **Base Year (2012) – Build Alternative B: Six-Lane Cross Section** – This scenario includes upgrading the entire existing facility to a six-lane facility and includes conventional widening improvements at most study area intersections, with the exception of varying improvements at the following intersections:

- NC 11 (Memorial Drive)
- SR 1702 (S. Evans Street)

Forecasted base year volumes were analyzed in this scenario.

- **Design Year (2035) – No-Build:** This scenario projects the traffic conditions along the study corridor with existing roadway conditions and forecasted volumes.
- **Design Year (2035) – Build Alternative A: Six/Eight-Lane Cross Section** – This scenario includes the widening the existing roadway to an eight-lane facility from NC 11 (Memorial Drive) to SR 1707 (Charles Boulevard) and widening to a six-lane facility from SR 1707 (Charles Boulevard) to US 264 E. This alternative accounts for conventional widening improvements at most study intersections, with the exception of varying improvements at the following intersections:

- NC 11 (Memorial Drive)
- SR 1702 (S. Evans Street)

Forecasted design year volumes were analyzed in this scenario.

- **Design Year (2035) – Build Alternative B: Six-Lane Cross Section** – This scenario includes upgrading the entire existing facility to a six-lane facility and includes conventional widening improvements at most study area intersections, with the exception of varying improvements at the following intersections:

- NC 11 (Memorial Drive)
- SR 1702 (S. Evans Street)

Forecasted design year volumes were analyzed in this scenario.

A third alternative, Alternative C, was evaluated for cost purposes only. This alternative assumed the same design as Alternative B when considering side street, or Y-lines, and mainline turning lane improvements, with a reduction in cross section to accommodate only a four-lane typical section being the only design difference. Conceptual designs were not drafted for this scenario; instead, the quantity estimates prepared for right-of-way and construction estimates accounted for the reduced cross section mathematically.

For each of the alternatives outlined above, three different typical sections, each accounting for varying levels of multi-modal accommodations, were considered. The typical sections that were evaluated for each alternative include:

- Typical Section 1 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes, with 14' wide outside lanes to accommodate cyclists
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalks on both sides of the roadway
- Typical Section 2 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalk on one side of the roadway
  - 10' multi-use path on the other side of the roadway
- Typical Section 3 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes, with a 4' paved bike lane on both sides of the roadway
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalks on both sides of the roadway

## **2.0 EXISTING CONDITIONS**

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### **2.1 EXISTING ROADWAY AND TRAFFIC CONDITIONS**

#### **2.1.1 Existing Roadway**

US 264A (Greenville Boulevard) is classified by the North Carolina Department of Transportation (NCDOT) as Other Principal Arterial, providing connectivity within the southeast area of Greenville to commercial, residential and institutional interests. It is primarily a five-lane facility with a center two-way-left-turn lane along most of its length; the northernmost section, beyond the Tar River crossing, is a four-lane divided facility with a grassy median.

#### **2.1.2 Existing Traffic**

The traffic volumes utilized in the traffic capacity analysis were taken from the forecast completed by NCDOT in April 2012 for purpose and use in this project. The volumes utilized for the existing conditions analysis are derived from the Base Year (2012) volumes provided in the forecast.

The 2012 daily volumes vary within the study area between 22,900 and 47,200 vehicles per day (vpd), with the highest mainline volumes generally occurring between Hooker Road and Red Banks Road. Side street volumes within the study area vary greatly, ranging from low volumes (600 – 2,900 vpd) to major cross streets like S. Evans Street (26,100 – 30,000 vpd) and 10th Street (31,800 – 32,000 vpd).

### **2.2 ENVIRONMENTAL FEATURES**

An environmental screening was completed for the project study area utilizing a variety of publically available datasets from federal, state, and local resource agencies. Every effort was made to ensure that the most appropriate and recent datasets were included. Most locations were field verified during a site visit, or confirmed by local stakeholders. This screening analysis indicated areas of possible environmental concern, including streams and wetland areas, community resources, and locations of hazardous waste sites.

The following resource tools were utilized for this feasibility study:

- NC One Map Geospatial Portal
- NC Flood Risk Information System (FRIS)
- NC Green Growth Toolbox
- Conservation Planning Tool (CPT)
- NCRS Web Soil Survey (WSS)
- NC State Historic Preservation Office GIS Web Service

- City of Greenville GIS Data Viewer

The following government agencies contributed datasets that have been utilized for this study:

- NC Department of Cultural Resources – State Historic Preservation Office
- NC Department of Environmental Quality – Division of Coastal Management
- NC Department of Environmental Quality – Division of Waste Management
- NC Department of Environmental Quality – Division of Water Resources
- NC Department of Transportation
- NC Flood Risk Information system
- NC Geodetic Survey
- NC Natural Heritage Program
- NC Wildlife Resource Commission
- US Census
- US Fish and Wildlife Service
- US National Parks Service

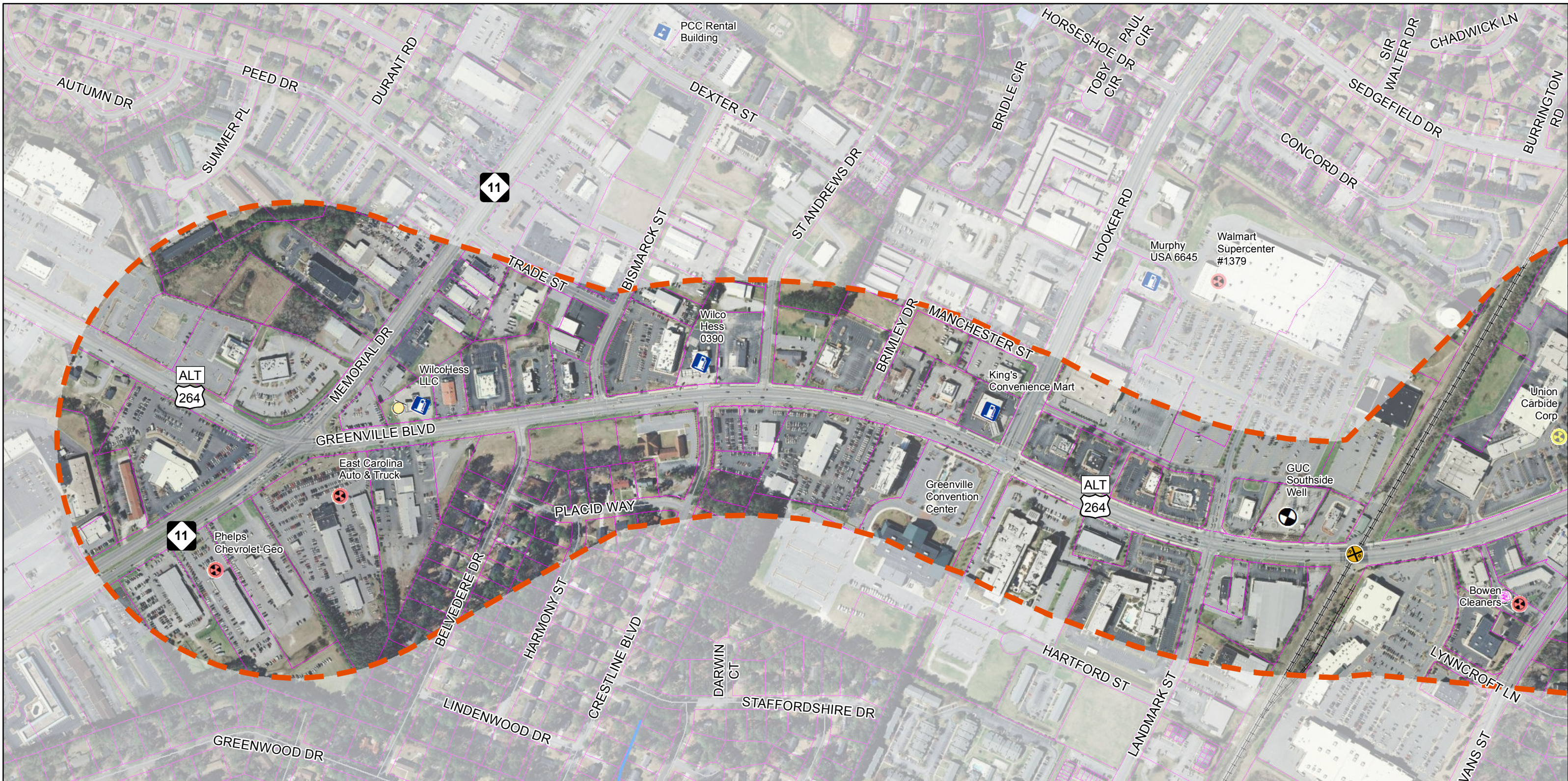
Figures 2-1a through 2-1f illustrate the known environmental features present within the project study area as indicated by the environmental screening process.

### **2.2.1 Historic and Cultural Resources**

A review of cultural resources in the vicinity of the study area identified one State (NC) Study List feature along the corridor. Being placed on the State Study List is the first step towards nomination to the National Register of Historic Places (NRHP). Forest Hill Historic District (ID PT2251) was added to the State Study List in 2010 and fronts US 264A (Greenville Boulevard) for approximately 1,300 feet between Charles Boulevard and Elm Street as shown on Figure 2-1c. The district encompasses a primarily residential area.

### **2.2.2 Streams, Wetlands, and Flood Plains**

The Division of Water Resources (DWR), a subset of the NC Department of Environmental Quality (NCDEQ), is responsible for the protection, classification and enhancement of all streams and water bodies within North Carolina. The project study area is located within the Tar-Pamlico and Neuse River Basins of North Carolina. US 264A (Greenville Boulevard) serves as the boundary between these two river basins for approximately 1.5 miles, between NC-11 (Memorial Drive) and Red Banks Road.



Project Study Area	Property Boundary	Cemetery	Library
Nat. Register of Historic Places Boundary	Wetlands (DCM)	Daycare	Park
Nat. Register of Historic Places Boundary	Waterbody (DWR)	Dry Cleaners	Public Water Source
State Study List Boundary	<b>Flood Hazards</b>	Fire Station	Underground Storage Tank
Managed Natural Area	Floodway	Hazardous Waste Site	Railroad
Natural Heritage Element	1% Annual Chance of Flood Hazard	Hazardous Waste Site (Inactive)	Stream (DWR)
Natural Heritage Area	0.2% Annual Chance of Flood Hazard		

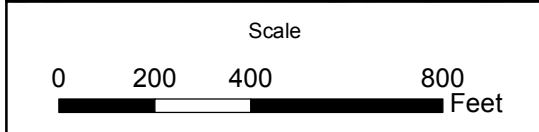


Figure 2-1a  
Environmental Features

FS-1002B US 264 (Greenville Boulevard) Widening and Intersection Improvements  
From NC 11 / Memorial Drive to US 264 East  
Pitt County, NC





	Project Study Area		Property Boundary		Cemetery		Library
	Nat. Register of Historic Places Boundary		Wetlands (DCM)		Daycare		Park
	Nat. Register of Historic Places Boundary		Waterbody (DWR)		Dry Cleaners		Public Water Source
	State Study List Boundary	<b>Flood Hazards</b>			Fire Station		Underground Storage Tank
	Managed Natural Area		Floodway		Hazardous Waste Site		Railroad
	Natural Heritage Element		1% Annual Chance of Flood Hazard		Hazardous Waste Site (Inactive)		Stream (DWR)
	Natural Heritage Area		0.2% Annual Chance of Flood Hazard				

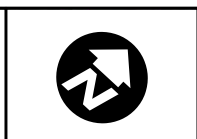
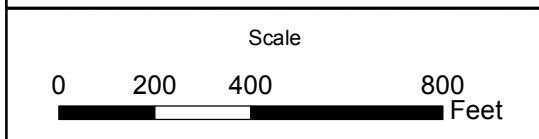


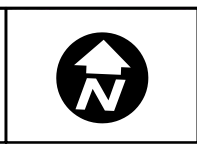
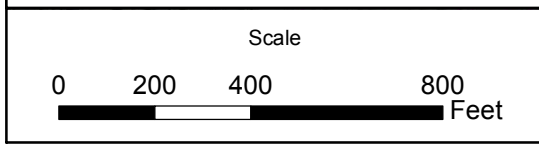
Figure 2-1b  
Environmental Features

FS-1002B US 264 (Greenville Boulevard) Widening and Intersection Improvements  
From NC 11 / Memorial Drive to US 264 East  
Pitt County, NC

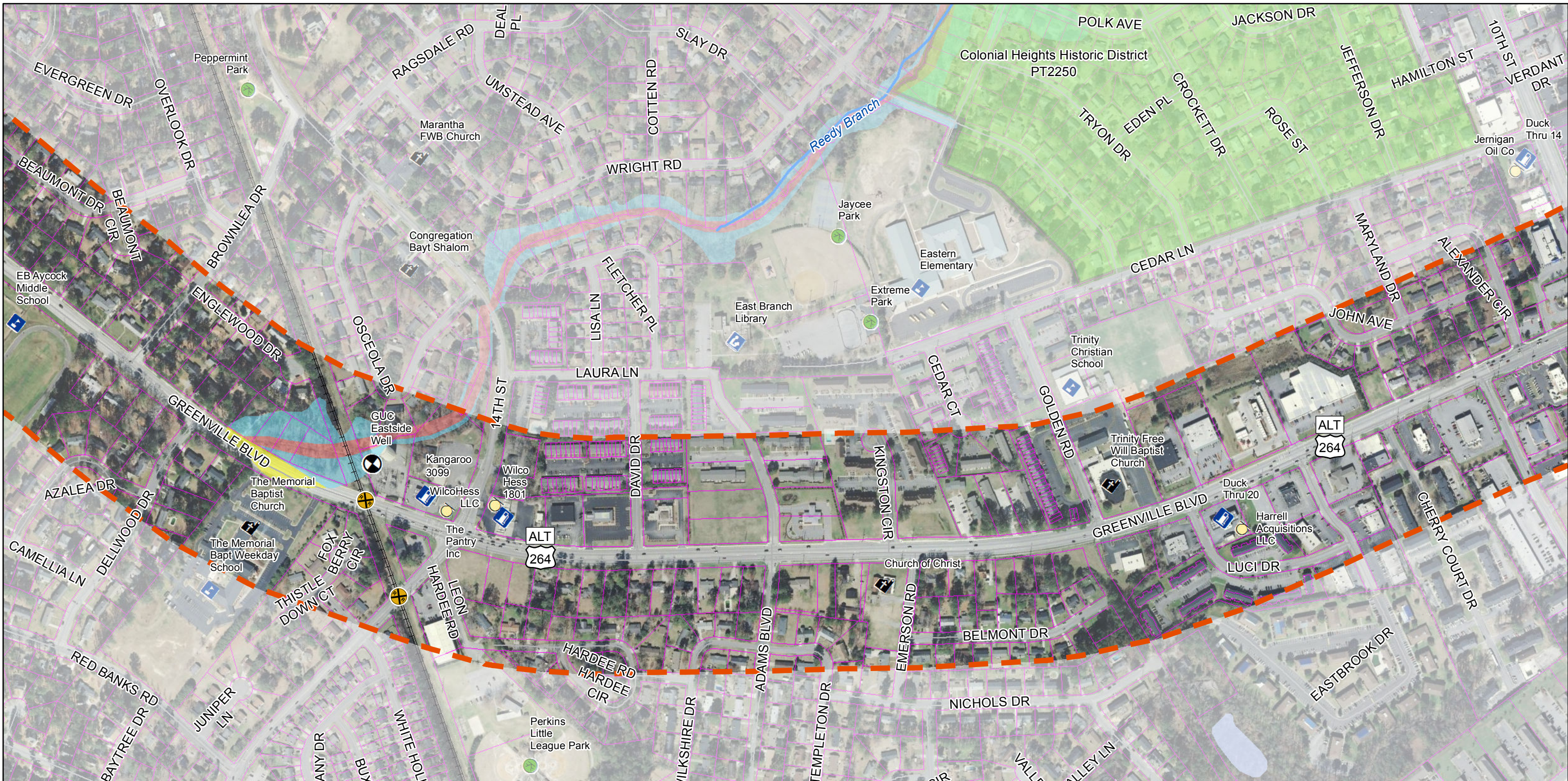




Project Study Area	Property Boundary	Cemetery	Library
Nat. Register of Historic Places Boundary	Wetlands (DCM)	Daycare	Park
Nat. Register of Historic Places Boundary	Waterbody (DWR)	Dry Cleaners	Public Water Source
State Study List Boundary	<b>Flood Hazards</b>	Fire Station	Underground Storage Tank
Managed Natural Area	Floodway	Hazardous Waste Site	Railroad
Natural Heritage Element	1% Annual Chance of Flood Hazard	Hazardous Waste Site (Inactive)	Stream (DWR)
Natural Heritage Area	0.2% Annual Chance of Flood Hazard		



**Figure 2-1c**  
Environmental Features



- |   |                                    |                                 |                          |
|---|------------------------------------|---------------------------------|--------------------------|
| Project Study Area                        | Property Boundary                  | Cemetery                        | Library                  |
| Nat. Register of Historic Places Boundary | Wetlands (DCM)                     | Daycare                         | Park                     |
| Nat. Register of Historic Places Boundary | Waterbody (DWR)                    | Dry Cleaners                    | Public Water Source      |
| State Study List Boundary                 | <b>Flood Hazards</b>               | Fire Station                    | Underground Storage Tank |
| Managed Natural Area                      | Floodway                           | Hazardous Waste Site            | Railroad                 |
| Natural Heritage Element                  | 1% Annual Chance of Flood Hazard   | Hazardous Waste Site (Inactive) | Stream (DWR)             |
| Natural Heritage Area                     | 0.2% Annual Chance of Flood Hazard |                                 |                          |

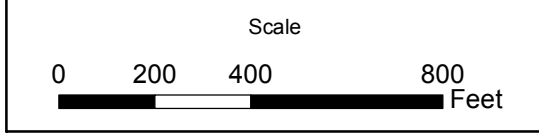
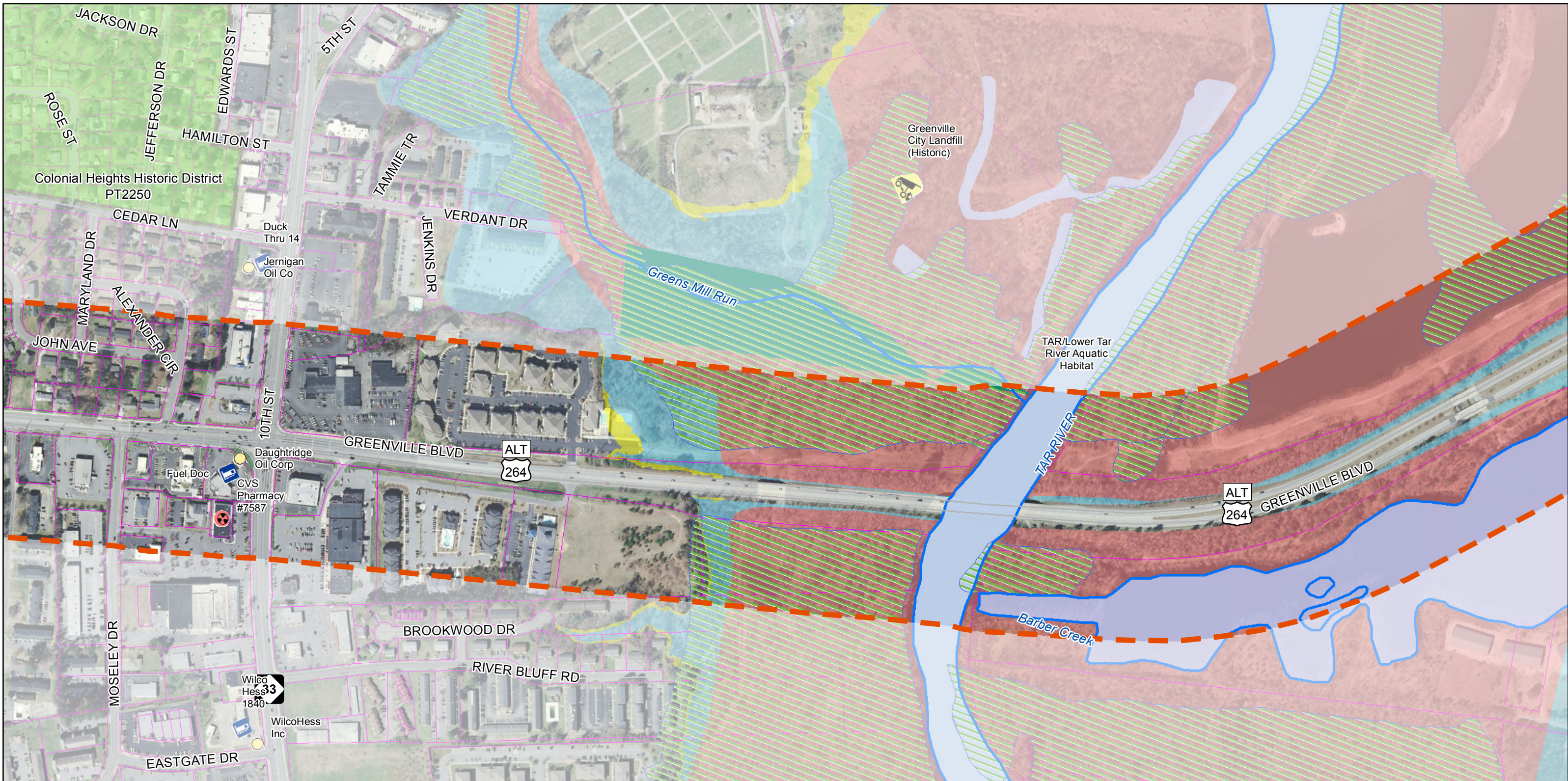


Figure 2-1d  
Environmental Features

FS-1002B US 264 (Greenville Boulevard) Widening and Intersection Improvements  
From NC 11 / Memorial Drive to US 264 East  
Pitt County, NC







Project Study Area	Property Boundary	Cemetery	Library
Nat. Register of Historic Places Boundary	Wetlands (DCM)	Daycare	Park
Nat. Register of Historic Places Boundary	Waterbody (DWR)	Dry Cleaners	Public Water Source
State Study List Boundary	<b>Flood Hazards</b>	Fire Station	Underground Storage Tank
Managed Natural Area	Floodway	Hazardous Waste Site	Railroad
Natural Heritage Element	1% Annual Chance of Flood Hazard	Hazardous Waste Site (Inactive)	Stream (DWR)
Natural Heritage Area	0.2% Annual Chance of Flood Hazard		

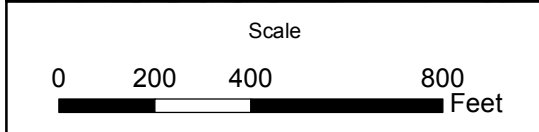
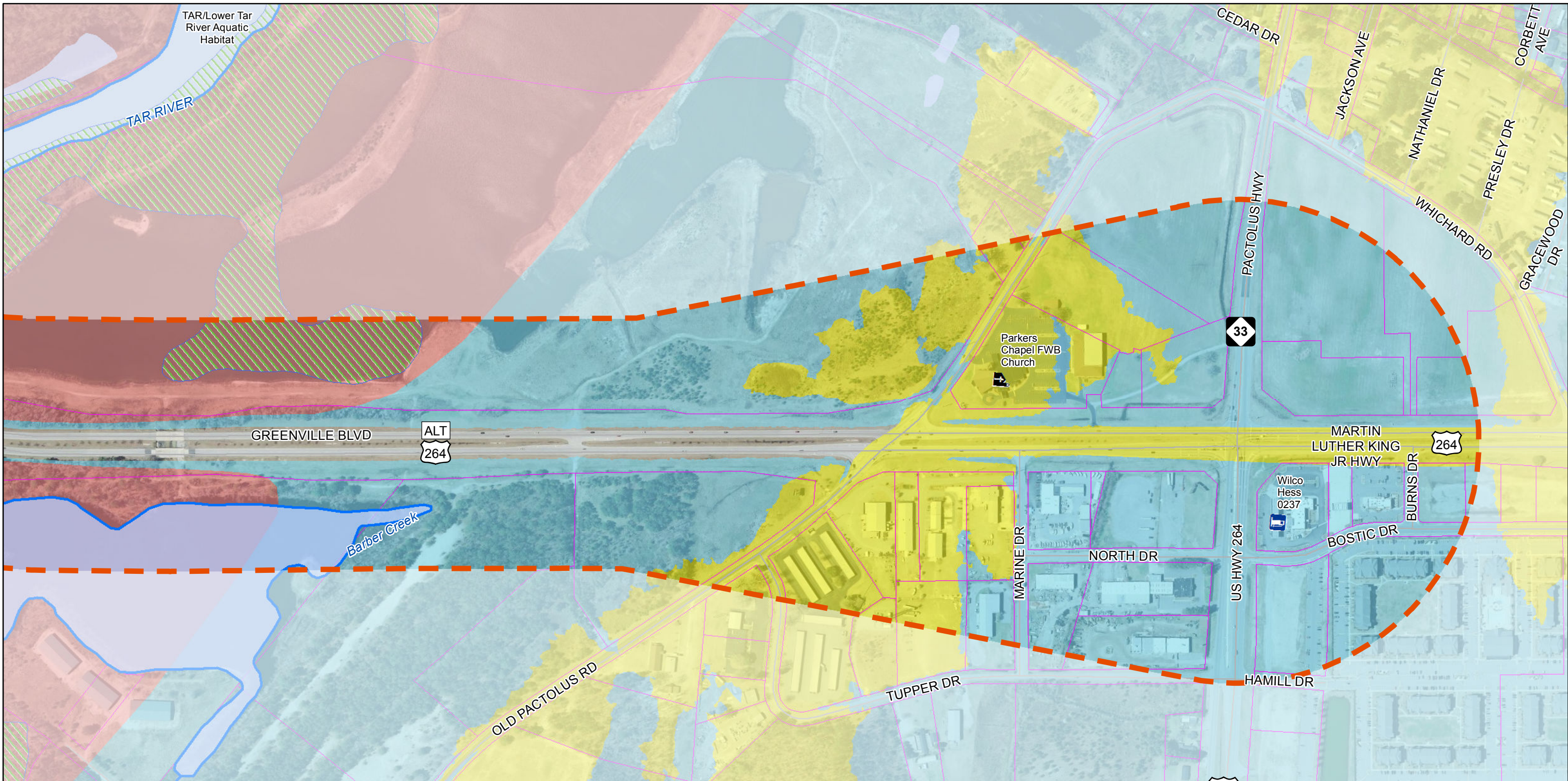


Figure 2-1e  
Environmental Features

FS-1002B US 264 (Greenville Boulevard) Widening and Intersection Improvements  
From NC 11 / Memorial Drive to US 264 East  
Pitt County, NC





Project Study Area	Property Boundary	Cemetery	Library
Nat. Register of Historic Places Boundary	Wetlands (DCM)	Daycare	Park
Nat. Register of Historic Places Boundary	Waterbody (DWR)	Dry Cleaners	Public Water Source
State Study List Boundary	<b>Flood Hazards</b>	Fire Station	Underground Storage Tank
Managed Natural Area	Floodway	Hazardous Waste Site	Railroad
Natural Heritage Element	1% Annual Chance of Flood Hazard	Hazardous Waste Site (Inactive)	Stream (DWR)
Natural Heritage Area	0.2% Annual Chance of Flood Hazard		

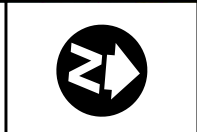
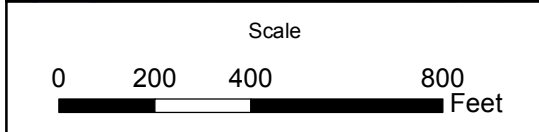


Figure 2-1f  
Environmental Features

FS-1002B US 264 (Greenville Boulevard) Widening and Intersection Improvements  
From NC 11 / Memorial Drive to US 264 East  
Pitt County, NC



There are two existing blue line stream crossings within the study area: Fornes Branch, a tributary of Green’s Mill Run and the Tar River. Two additional streams are located within the study area, but are not crossed by the roadway: Green’s Mill Run and Barber Creek. All four streams are Class C (waters protected for secondary recreational use) and are considered nutrient sensitive waters (NSW). There are areas of designated 100-year and 500-year floodplain within the project study area associated with all four streams. Additionally, while the designated extent of Reedy Branch isn’t within the study area, the floodway and 500-year floodplain for this stream enters the study area near E. 14<sup>th</sup> Street.

**2.2.3 Water Supply Watersheds and Public Water Sources**

The project study area is located primarily in the Middle Tar-Pamlico watershed which has an established local watershed plan in coordination with DWR. The study area, however, is not located within a protected or critical portion of any water supply watersheds.

**2.2.4 Threatened or Endangered Species**

The Lower Tar River Aquatic Habitat, which includes all of the Tar River in the vicinity of the study area, has been designated by the Natural Heritage Program as a Significant Natural Heritage Area (SNHA, Site ID 1928), which “contains ecologically significant natural communities or rare species.” Within this SNHA are several known occurrences of, or habitat for, a number of threatened or endangered species, as detailed in Table 2-1.

**Table 2-1  
Threatened and Endangered Species**

<b>Species Common Name</b>	<b>NC Threat Level</b>	<b>Location from Study Area</b>
Tidewater Mucket	Threatened	Within Study Area
Triangle Floater	Threatened	Within Study Area
Eastern Lampmussel	Threatened	Upstream
Yellow Lampmussel	Special Concern	Within Study Area
Neuse River Waterdog	Special Concern	Within Study Area
Roanoke Slabshell	Endangered	Within Study Area

**2.2.5 Conservation Areas**

There are no dedicated nature preserves, federally owned lands, or managed natural areas within the project study area.

## **2.2.6 Hazardous Materials and NPDES Sites**

According to the most recently available NCDEQ Division of Waste Management GIS data, there are six hazardous waste generator sites located within the project study area, including businesses such as Target, Kmart and CVS as well as auto repair shops. These locations generate an acute amount of hazardous waste that is monitored by NCDEQ; however, this project is not expected to have notable impacts on these locations.

There are two inactive hazardous waste sites within the project study area. Union Carbide Corp was once located in the northwest quadrant of US 264 (Greenville Boulevard) and SR 1702 (S. Evans Street). Union Carbide Corp is currently registered as an archived superfund site by the EPA and does not require any clean up action or further investigation at this time. It has been redeveloped into the University Commons Shopping Center.

The second is Better Look Garment Care, located on the south side of Greenville Boulevard, just west of the Arlington Boulevard intersection. This site was inspected by the NC Superfund Section in April 2011 and was determined to have no groundwater contamination that would warrant any further action. This site is no longer listed on the NCDEQ Inactive Hazardous Sites and Pollutant-Only Sites Inventory list.

There are nine gas stations located within the study area that actively operate underground storage tanks (USTs); however, there is no current indication that these tanks pose an environmental threat.

## **2.2.7 Community Resources**

In general, there is a high potential for residential and business relocations as a part of this project due to the developed nature of much of the corridor. There is one school, Aycock Middle School, directly adjacent to the project corridor; however, impacts to the school are likely to be contained to the edge of playing fields. There are five identified churches located within the study area. Most of these churches are located adjacent to Greenville Boulevard, and the proposed project will likely have property impacts to these resources. The Forest Hill Historic District is adjacent to Greenville Boulevard between Charles Boulevard and Elm Street.

## **2.3 ACCIDENT ANALYSIS**

The accident analysis was derived from five years of available collision data obtained from the NCDOT Safety Planning Group. The data covered the period from April 1, 2009 to March 31, 2014. The summary includes collisions that were reported along the 6.5 mile stretch of US 264A (Greenville Boulevard) from NC 33 (Pactolus Highway) to NC 11 (Memorial Drive) in Pitt County.

The main type of collision in the study area was rear end collisions, which constituted 1172 of the 2268 crashes or approximately 51.7 percent of the overall collisions during the study period. Angle, Left-turn, and Sideswipe collisions were also common, composing 11.6 percent, 18.2 percent, and 9.7 percent of the total collisions in the area, respectively. Table 2-2 summarizes the total number of crashes within 150 feet of each study intersection in the study area.

The NCDOT Safety Planning Group provides calculated rates for facility types based on data collected statewide. For comparison purposes, the analyzed corridor is classified as an Urban US Route with 4 or more lanes (with a continuous left-turn lane). As shown in Table 2-3, the crash rates for the facility are higher than the statewide averages for similar facilities across the state in all categories. There were four fatal crashes in the five year data period.

**Table 2-2 Crash Totals by Study Intersection**

<b>Intersection</b>	<b>Total</b>
NC 11/903 (Memorial Drive)	<b>97</b>
Hooker Road/Convention Center Drive	<b>53</b>
Landmark Street/Walmart Entrance	<b>50</b>
SR 1702 (S. Evans Street)	<b>104</b>
Red Banks Road	<b>84</b>
E Arlington Boulevard	<b>62</b>
SR 1707 (Charles Boulevard)	<b>62</b>
Elm Street	<b>44</b>
SR 1703 (E 14 <sup>th</sup> Street)	<b>76</b>
Eastbrook Drive	<b>72</b>
Moseley Drive	<b>79</b>
SR 1598 (E 10 <sup>th</sup> Street)	<b>145</b>
SR 1534 (Old Pictolus Road)	<b>13</b>
US 264 East/Pictolus Highway	<b>87</b>
<i><b>Total Study Intersection Crashes</b></i>	<i><b>1028</b></i>
<i><b>Total Crashes Between Intersections</b></i>	<i><b>1240</b></i>
<i><b>Total Crashes</b></i>	<i><b>2268</b></i>

**Table 2-3 Crash Rate\* Comparison of Study Area to Statewide Averages**

<b>Rural US Routes</b>	<b>Total Crash Rate</b>	<b>Fatal Crash Rate</b>	<b>Non-Fatal Injury Crash Rate</b>	<b>Night Crash Rate</b>	<b>Wet Crash Rate</b>
US 264A (Greenville Boulevard)	620.79	1.37	175.45	142.06	105.93
4+ Lanes (Cont. Left Turn Lane), Statewide	300.78	1.19	99.21	55.31	48.74
<i>Exceeds Statewide Average?</i>	Y	Y	Y	Y	Y

*\*All crash rates per 100 Million Vehicle Miles Traveled (VMT)*

## **3.0 BACKGROUND TRANSPORTATION AND LAND USE PLANS**

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This section presents an overview of published and adopted transportation and land use plans that include the project study area. A review of these plans builds the framework for the project need and gives insight into the history of the vision for the proposed project.

### **3.1 TRANSPORTATION PLANS**

A review of existing transportation plans that influence the future of the US 70 corridor was completed; each document and recommendations pertinent to the project study area are summarized below.

#### **3.1.1 NCDOT State Transportation Improvement Plan**

NCDOT has established a multi-year schedule for all its transportation projects called the State Transportation Improvement Program (STIP). This project is listed in the currently adopted 2016-2020 STIP (May 2016); the study project is listed as FS-1204A, feasibility study, and is described as an upgrade of the existing facilities along US 264A (Greenville Boulevard) to widen and improve intersections from NC 11 to NC 33.

#### **3.1.2 Greenville Urban Area MPO 2035 Long Range Transportation Plan**

The Greenville Urban Area Metropolitan Planning Organization (MPO) Long Range Transportation Plan Update (LRTP) was published in August 2009. The LRTP “addresses expected growth in the City of Greenville, Town of Winterville, and surrounding areas of Pitt County. The plan calls for relief of congestion on US 264A (Greenville Boulevard) as one of the Top Twenty Priorities for the plan. This plan calls for widening the facility to six lanes and improving intersections from NC 11 (Memorial Drive) to E. 10<sup>th</sup> Street.

#### **3.1.3 Greenville Urban Area MPO 2040 Metropolitan Transportation Plan**

The Greenville Urban Area MPO *Metropolitan Transportation Plan* (MTP) includes land use and planning strategies for the Greenville urbanized area and was adopted in August 2014. This plan includes the proposed project as a candidate transportation project at the regional level, calling for widening the facility to six lanes and improving intersections from NC 11 (Memorial Drive) to E. 10<sup>th</sup> Street.

### **3.1.4 Greenville Urban Area MPO: Bicycle and Pedestrian Master Plan**

The Greenville Urban Area MPO published the *Bicycle & Pedestrian Master Plan* in 2011. The plan outlines how bicycle and pedestrian environments will be improved in the Greenville urban area. This area includes the City of Greenville, Town of Ayden, Town of Winterville, Village of Simpson, and other portions of Pitt County. The goal, as stated in the plan, is for all recommendations and improvements to be implemented within a 30-year time frame.

According to this plan's bicycle recommendations, a greenway path is proposed for the project corridor from NC 11/Memorial Drive to SR 1702 (S. Evans Street) and from Arlington Boulevard to Charles Boulevard. Also a side path is recommended from 10<sup>th</sup> Street to beyond the project end point of US 264E. Additionally, the plan recommends wide outside lanes along the length of the project corridor.

According to this plan's pedestrian recommendations, the project corridor is planned to have sidewalks along both sides of the roadway, bridging the gaps between greenway sections. Additionally, eight major intersections along the corridor are identified needing pedestrian crossing improvements.

### **3.1.5 NCDOT Strategic Highway Corridors: Vision Plan**

The project study area is not included in the *North Carolina Transportation Network and Strategic Transportation Corridors Framework* that was published in August 2015. US 264 is included in the plan as Corridor V, but, the included corridor is the loop around Greenville, not the project corridor which is US 264A.

### **3.1.6 Pitt County Comprehensive Transportation Plan**

The project study area along US 264A is not included in the *Pitt County Comprehensive Transportation Plan* that was adopted by NCDOT in July 2006.

## **3.2 LAND USE AND ZONING**

### **3.2.1 Pitt County Comprehensive Land Use Plan**

The *Pitt County Comprehensive Land Use Plan* discusses the growth strategy for the County and in so doing designates general land use areas. The project corridor is located within the City of Greenville's limits and will continue to support a mix of commercial, institutional and residential uses.

## 4.0 TRAFFIC FORECAST

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The traffic volumes utilized in the traffic capacity analysis were taken from the forecasts completed by NCDOT in April 2012 for purpose and use in this project. The volumes utilized for the existing conditions analysis were derived from the Base Year (2012) volumes provided in the April 2012 forecast. The Build Year (2035) volumes were also taken from the April 2012 forecast.

The forecasts were derived from travel demand model projections which accounted for the fiscally constrained assumptions in the latest approved LRTP for the area. The Greenville Urban Area Metropolitan Planning Organization (MPO) LRTP was published in August 2009. That plan included the widening of SR 1702 (S. Evans Street) to the south of US 264A (U-2817), widening SR 1703 (E 14<sup>th</sup> Street), widening SR 1707 (S Charles Boulevard) to the south of US 264A (Greenville Boulevard), E 14<sup>th</sup> Street – Railroad Grade Separation (U-3839), and the Greenville SW Bypass – 4 lanes divided new location (R-2250).

According to the City of Greenville Community Development Department, there are no planned and approved developments that will affect the traffic in the project area.

The Greenville Area MPO travel demand model has been updated since the original forecast was developed. The new model has less aggressive growth and shows lower volumes at some of the critical intersections under the new Build scenarios. An updated forecast was completed in February 2016 based on this revised model. The revised forecast included a Base Year (2015) and Build Year (2040). The purpose of the revised forecast was to evaluate future travel demand on the project corridor based on Greenville's most current MTP, adopted August 5, 2014. Based on this most recent MTP, projected volumes for a four- or six-lane cross section are generally lower for the Build Year (2040) scenarios when compared to the originally forecasted Build Year (2035) volumes (from April 2012 report), but higher for an eight-lane cross section.

Table 4-1 summarizes forecasted daily traffic volumes along the corridor as shown in each forecast. As shown in this table, the average reduction in volume when comparing the original Build 2035 volumes to Build 2040 4-lane volumes is 27%, with the highest reductions occurring between NC 11 and Red Banks Road. When evaluating the Build 2040 6-lane volumes, they average only 8% lower than the original forecast, with some locations projecting no change or higher volumes than projected in the Build 2035 scenario. Finally, the Build 2040 8-lane scenario averages higher volumes than the original forecast by an average 3%.



**Table 4-1 Comparison of Forecast Volumes (2012 vs. 2016)**

Volume Location	2012 Forecast	Updated 2016 Forecast					
	Build 2035	Build 2040 4-Lane	% reduction	Build 2040 6-Lane	% reduction	Build 2040 8-Lane	% reduction
W of NC 11 (Memorial Drive)	285	186	35%	212	26%	241	15%
W of Hooker Road	630	398	37%	518	18%	595	6%
W of Landmark Street	611	410	33%	532	13%	612	0%
W of SR 1072 (Evans Road)	762	439	42%	570	25%	656	14%
W of Red Banks Road	620	423	32%	550	11%	632	-2%
W of E. Arlington Boulevard	460	355	23%	461	0%	530	-15%
W of SR 1707 (Charles Boulevard)	450	395	12%	513	-14%	590	-31%
W of Elm Street	358	328	8%	426	-19%	490	-37%
W of SR 1703 (E. 14th Street)	412	298	28%	388	6%	446	-8%
W of Eastbrook Drive	569	414	27%	501	12%	537	6%
W of SR 1598 (E. 10th Street)	558	397	29%	480	14%	514	8%
S of SR 1534 (Old Pictolus Road)	465	378	19%	429	8%	450	3%
S of US 264 East (Pactolus Highway)	434	342	21%	388	11%	407	6%
<b>Average Reduction (2016 forecast vs. 2012 forecast)</b>			<b>27%</b>		<b>8%</b>		<b>-3%</b>

The lowered volume variations seen in the four- and six-lane scenarios are attributable to two primary differences between the forecast reports. First, the April 2012 report only forecasted a single Build Year scenario, accounting for a six-lane future cross section of US 264A (Greenville Boulevard) as was fiscally constrained in the August 2009 LRTP. The revised forecast evaluated three Build Year scenarios, including a four-lane, six-lane, and eight-lane cross section of the project corridor. In the practice of traffic forecasting using regional models, it is common to see a major travel corridor attract higher volumes as the capacity of that corridor is made higher. Thus, in the revised “2040 Future Year Build 4-lanes” scenario, US 264A (Greenville Boulevard) is “less attractive” due to lowered capacity, resulting in lower forecasted travel demand than it is in the six- and eight-lane counterparts. This comparison can also be made between the 2040 Future Year Build 4-Lanes scenario and the 2035 Future Year Build scenario from the original forecast. Because the revised forecast allowed the model to adjust demand based on the lower capacity of a four-lane Build Alternative, lower overall volumes are projected for the corridor.

While the four-lane Build forecast does project lower volumes by approximately 20% when compared to the six-lane build scenario, it should be noted that the overall travel demand for the model area doesn’t change, meaning that traffic that isn’t attracted to US 264A (Greenville Boulevard) due to decreased capacity is being placed on other routes in the vicinity that may also already be congested or nearing capacity. This byproduct of varying build scenarios is not directly accounted for in the operational traffic analysis for this revised forecast, but is a major factor in determining where to invest funding for future capacity improvements. As already detailed in this report, US 264A (Greenville Boulevard) is a critical corridor for the City, providing

commercial, residential and institutional access and should be a high priority for future improvements. In the revised forecast, as the Build scenario changes and US 264A (Greenville Boulevard) has increased capacity, it is seen that the model continues to place enough volume on that route to bring it to or beyond that allowable capacity, as indicated by numerous failing intersections in all scenarios. This shows that the lower capacity four-lane cross section is not meeting the regional need for this corridor.

Another factor in the lowered volumes for the 2040 Future Year Build 4-Lanes scenario as compared to the 2035 Future Year Build scenario is the use of the more recently adopted MTP, adopted August 5, 2014. There are differences in the projects which were included in the model as the more recent MTP included a revised fiscally constrained project list and less aggressive developmental growth. The revised model may be overstating the traffic shift due to improvements on these facilities.

For the purpose of this report, the original forecast was used for the intersection operational capacity analyses as the difference between the 2012 and 2016 forecasts is considered minimal when comparing the six-lane alternatives.

Both of the traffic forecasts for this project can be found in Appendix A. All peak hour turning movement volumes used in the capacity analysis efforts were derived using the NCDOT Intersection Analysis Utility (IAU) tool.

## 5.0 NO-BUILD ALTERNATIVES

A capacity analysis was performed for each of the alternative scenarios, examining operations at key intersections within the project area. Intersection capacity analyses were conducted for the AM and PM peak hours. Levels of service range from A through F, based on the average control delay experienced by vehicles traveling through the intersection during the peak hour. Control delay represents the portion of total delay attributed to traffic control devices (e.g., signals or stop signs). Table 5-1 provides a general description of the various levels of service categories and delay ranges for the intersection levels of service.

**Table 5-1 Level of Service Descriptions for Intersections**

Level of Service	Description	Signalized Intersection	Unsignalized Intersection
A	Little or no delay	<= 10 sec.	<= 10 sec.
B	Short traffic delay	10-20 sec.	10-15 sec.
C	Average traffic delay	20-35 sec.	15-25 sec.
D	Long traffic delay	35-55 sec.	25-35 sec.
E	Very long traffic delay	55-80 sec.	35-50 sec.
F	Unacceptable delay	> 80 sec.	> 50 sec.

Intersection capacity analysis was completed using the *Synchro, Version 9* software package, within which signal timings were optimized. Analyzed intersections included key intersections along US 264A to quantify the impact the proposed project would have on the surrounding roadway network. The following intersections were analyzed for AM and PM peak hour operations, where applicable.

- US 264A (Greenville Boulevard) and NC 11/903 (Memorial Drive)
- US 264A (Greenville Boulevard) and Hooker Road/Convention Center Drive
- US 264A (Greenville Boulevard) and Landmark Street/Walmart Entrance
- US 264A (Greenville Boulevard) and SR 1702 (S. Evans Street)
- US 264A (Greenville Boulevard) and Red Banks Road
- US 264A (Greenville Boulevard) and E. Arlington Boulevard
- US 264A (Greenville Boulevard) and SR 1707 (Charles Boulevard)
- US 264A (Greenville Boulevard) and Elm Street
- US 264A (Greenville Boulevard) and SR 1703 (E. 14<sup>th</sup> Street)
- US 264A (Greenville Boulevard) and Eastbrook Drive

- US 264A (Greenville Boulevard) and Moseley Drive
- US 264A (Greenville Boulevard) and SR 1598 (E. 10<sup>th</sup> Street)
- US 264A (Greenville Boulevard) and SR 1534 (Old Pactolus Road)
- US 264A (Greenville Boulevard) and US 264 East/Pactolus Highway

## **5.1 BASE YEAR (2012) NO-BUILD**

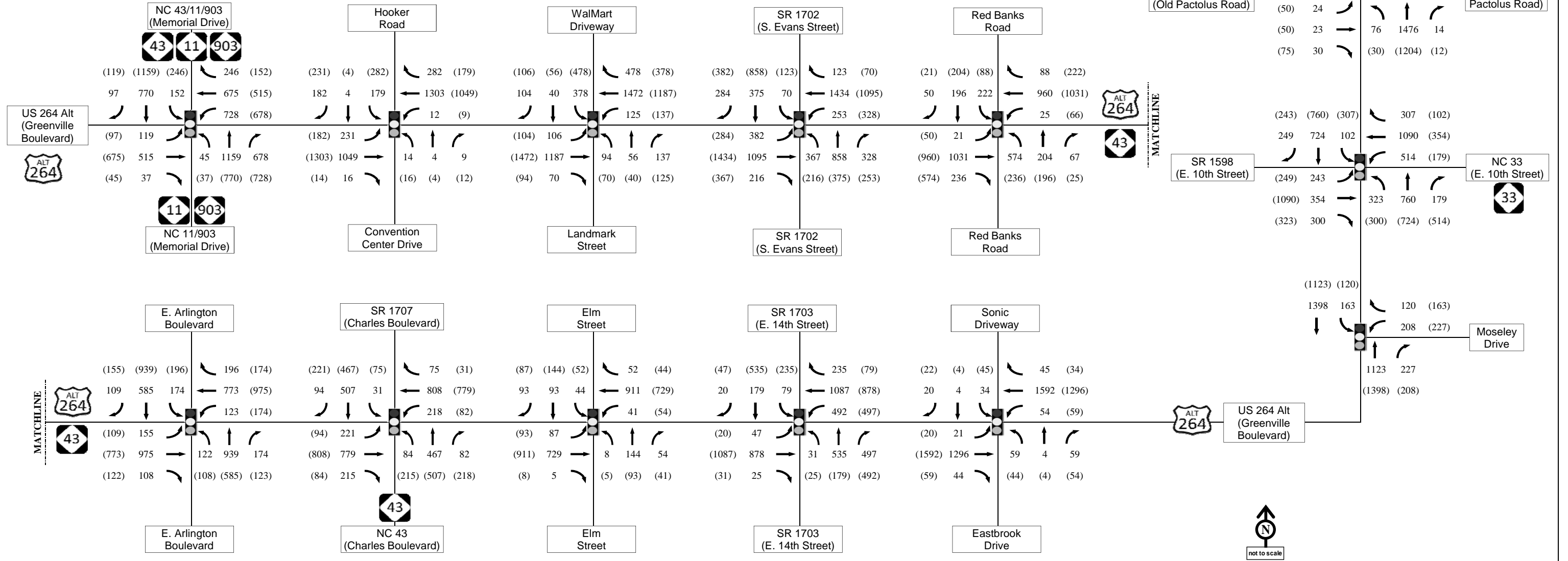
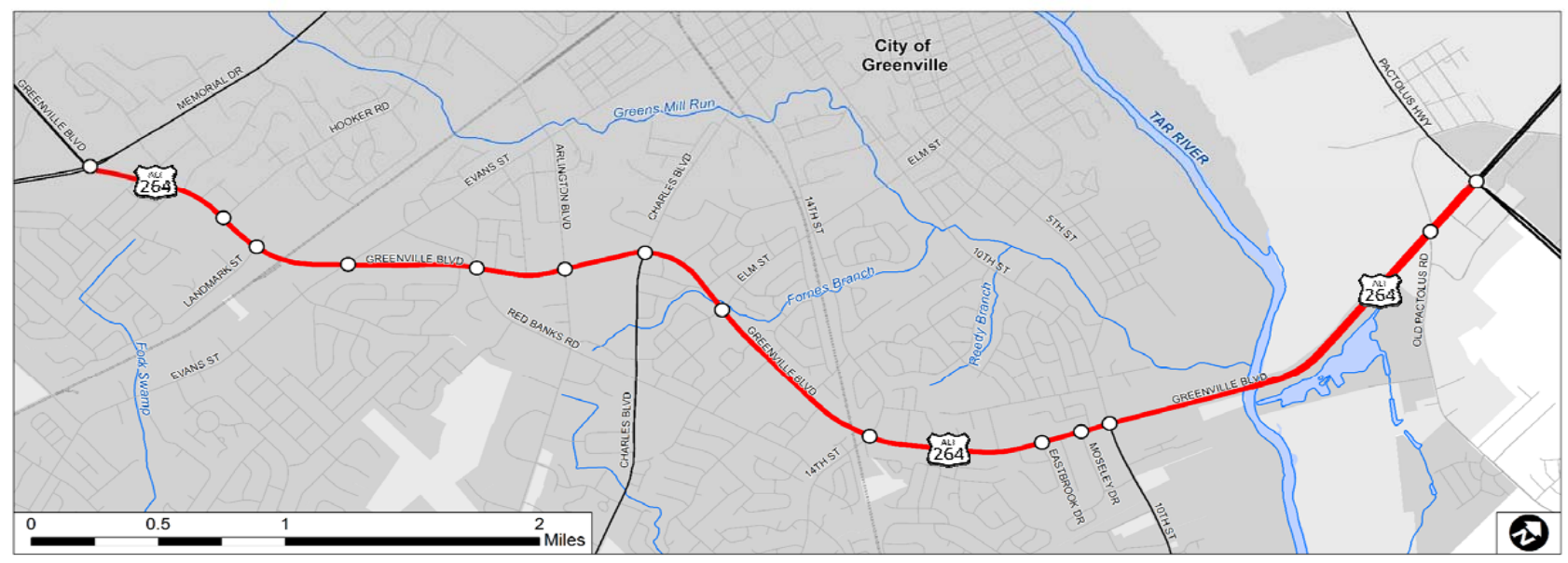
This scenario takes into account the existing roadway conditions at the time of a field visit in July 2014. The volumes used in this analysis scenario were derived from the original 2012 forecast provided by the Transportation Planning Branch (TPB) and discussed previously by using the NCDOT IAU tool. Figures 5-1 and 5-2 summarize the volumes and lane geometrics, respectively, used in the analysis.

Based on the results of the intersection capacity analysis, seven (7) study area intersections operate unacceptably under the Base Year (2012) No-Build conditions during at least one of the AM or PM peak hours. The intersections with unacceptable LOS are:

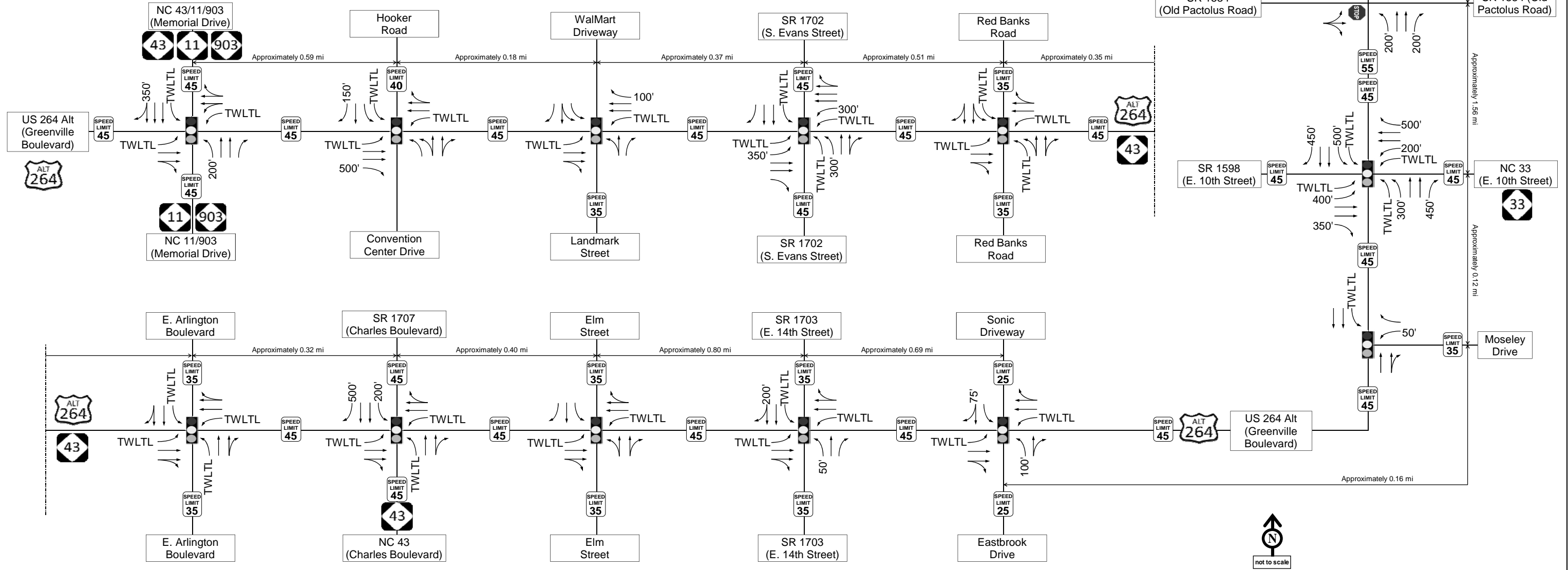
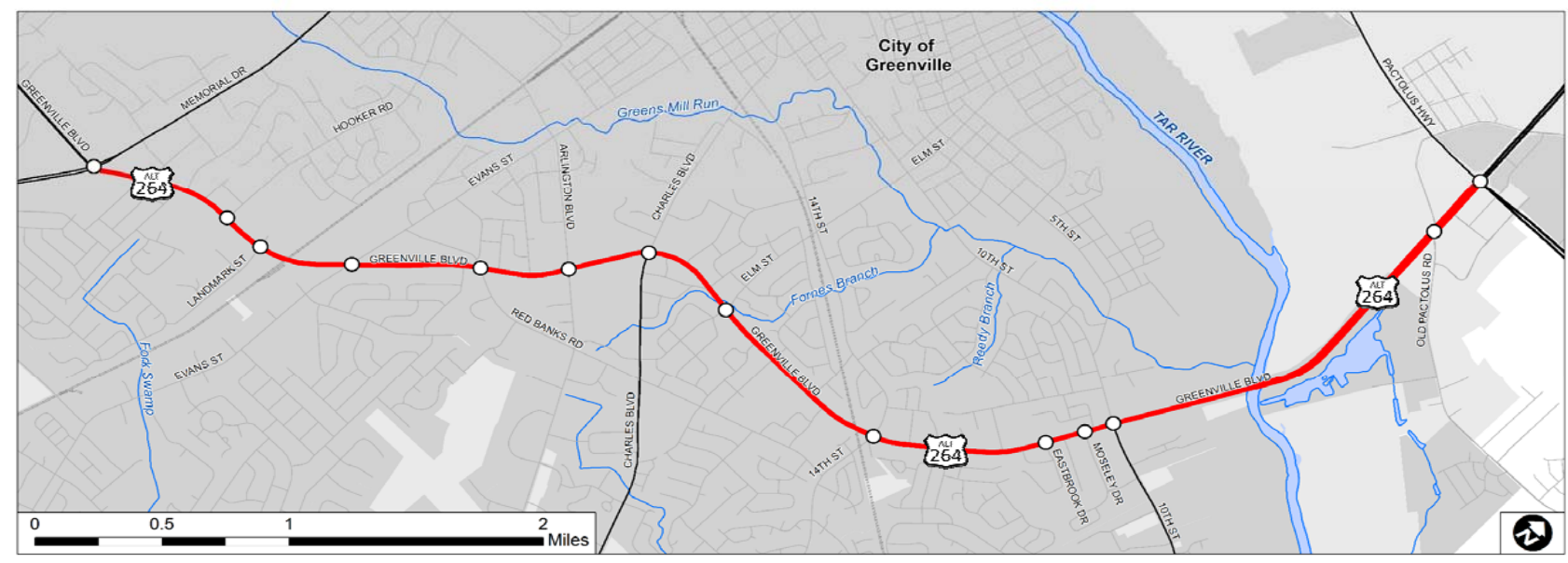
- SR 1702 (Evans Street) - LOS E (AM & PM peak)
- Arlington Boulevard - LOS E (AM & PM peak)
- SR 1703 (E 14th Street) - LOS E (AM & PM peak)
- NC 11 (Memorial Drive) - LOS F (AM and PM peak)
- Old Pactolus Road - LOS F (AM and PM peak)
- E. 10th Street - LOS E (AM peak)
- Landmark Street - LOS F (AM peak)

In addition to the failing intersections, three more intersections are operating at LOS D during at least one peak hour. While this is considered acceptable in the existing year, it indicates that the intersection is approaching its capacity and is likely to drop below those operations in the future without any improvements. Table 5-2 summarizes the LOS results for the Base Year (2012) No-Build scenario.

Legend	
	Existing Roadway
	Future Roadway
	Turning Movement
	Existing Signalized Intersection
XX	AM Peak Hour Turning Movement Volume
(XX)	PM Peak Hour Turning Movement Volume



Legend	
	Existing Roadway
	Future Roadway
	Lane Configuration
	Existing Signalized Intersection
	Existing Stop Controlled Approach



**Figure 5-2**  
Base Year (2012) No-Build Lane Geometrics and Traffic Control

**FS-1002B US 264 (Greenville Boulevard)**  
Widening and Intersection Improvements  
from NC 11/Memorial Drive to US 264 East/NC 33  
Greenville, NC

**Table 5-2 Base Year (2012) No-Build LOS Results**

Intersection	Traffic Control	Base Year (2012) No-Build	
		AM	PM
US 264A (Greenville Blvd) and NC 11 (Memorial Drive)	Signalized	F (EB-F)	F (EB-F)
US 264A (Greenville Blvd) and SR 1701 (Hooker Rd)	Signalized	C (NB-E)	C (NB-D)
US 264A (Greenville Blvd) and Landmark Street/WalMart Driveway	Signalized	F (SB-F)	D (SB-F)
US 264A (Greenville Blvd) and SR 1702 (S. Evans St)	Signalized	E (NB-F)	E (SB-E)
US 264A (Greenville Blvd) and Red Banks Rd	Signalized	D (SB-F)	C (NB-E)
US 264A (Greenville Blvd) and Arlington Blvd	Signalized	E (NB-F)	E (SB-E)
US 264A (Greenville Blvd) and SR 1707 (Charles Blvd)	Signalized	D (NB-E)	D (NB-D)
US 264A (Greenville Blvd) and Elm St	Signalized	B (SB-E)	B (SB-D)
US 264A (Greenville Blvd) and SR 1703 (E. 14th St)	Signalized	E (EB-F)	E (SB-F)
US 264A (Greenville Blvd) and Eastbrook Drive	Signalized	B (NB-E)	A (NB-E)
US 264A (Greenville Blvd) and Moseley Dr	Signalized	C (WB-E)	B (WB-E)
US 264A (Greenville Blvd) and E. 10th Street	Signalized	E (SB-E)	D (EB-E)
US 264A (Greenville Blvd) and Old Pactolus Rd	Unsignalized	(EB/WB-F)	(EB/WB-F)
US 264 (Greenville Blvd) and US 264 East/NC 33	Signalized	D (EB-E)	D (EB-E)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

## 5.2 DESIGN YEAR (2035) NO-BUILD

This scenario takes into account the existing roadway conditions at the time of a field visit in July 2014 (see Figure 5-2). The volumes used in this analysis scenario were derived from the forecasts provided by the NCDOT Transportation Planning Branch (TPB) for the Design Year (2035) No-Build scenario and, as discussed previously, calculated by using the NCDOT IAU tool. Figure 5-3 summarizes the volumes used in the analysis.

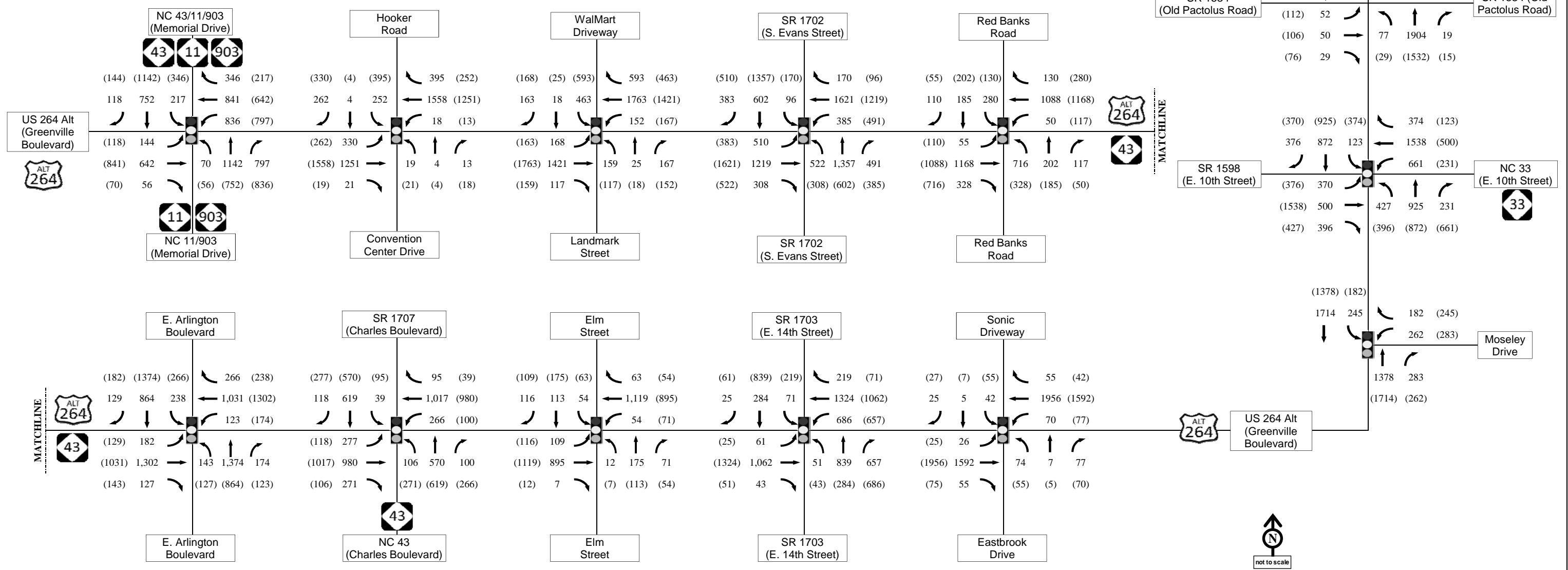
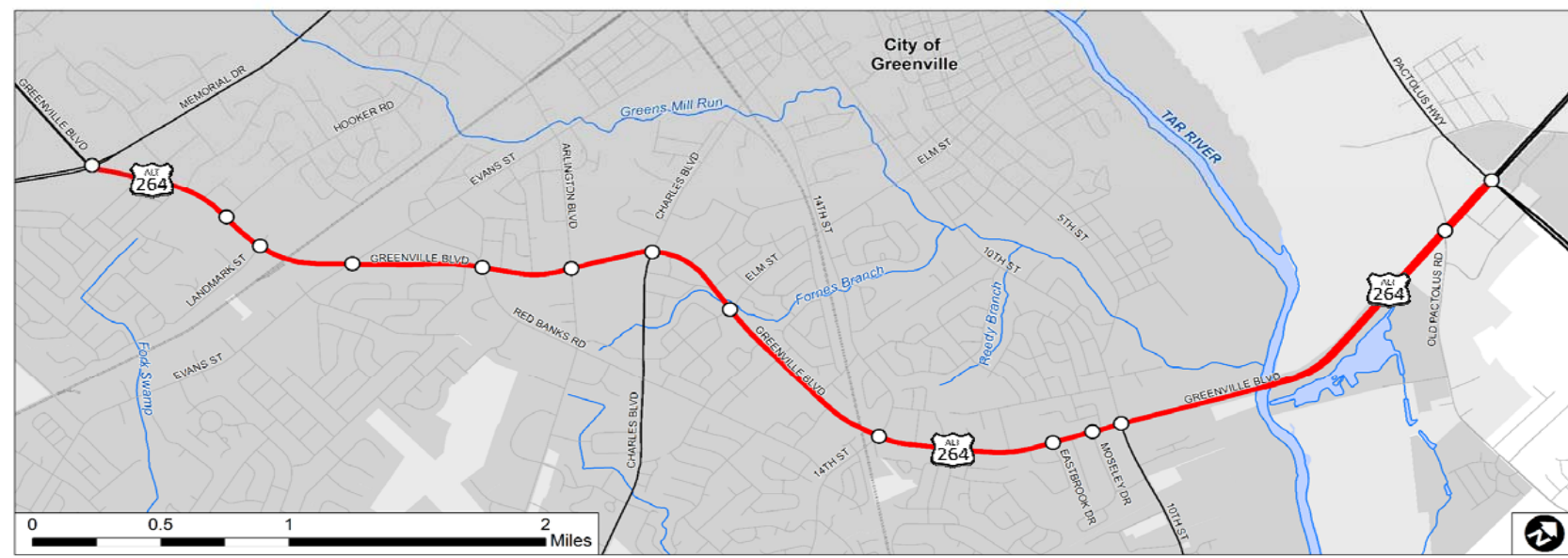
Based on the results of the intersection capacity analysis, only three (3) signalized intersections operate acceptably under the Design Year (2035) No-Build conditions during the AM and PM peak hours. All other intersections operate below LOS D during at least one peak hour with many dropping to LOS F. The intersections with unacceptable LOS are:

- Red Banks Road - LOS E (AM & PM peak)
- SR 1707 (Charles Boulevard) - LOS E (AM & PM peak)
- US 264/NC 33 – LOS E (AM & PM peak)
- NC 11 (Memorial Drive) – LOS F (AM and PM peak)
- SR 1702 (S. Evans Street) – LOS F (AM and PM peak)
- Arlington Boulevard – LOS F (AM and PM peak)
- SR 1703 (E. 14<sup>th</sup> Street) – LOS F (AM and PM peak)
- E. 10<sup>th</sup> Street – LOS F (AM and PM peak)
- Old Pictolus Road – LOS F (AM and PM peak)
- SR 1701 (Hooker Road) – LOS F (AM peak)
- Wal-Mart Driveway/Landmark Street – LOS E (AM peak); LOS F (PM peak)
- Moseley Drive – LOS E (PM peak)

Table 5-3 summarizes the LOS results for the Design Year (2035) No-Build scenario.



Legend	
	Existing Roadway
	Future Roadway
	Turning Movement
	Existing Signalized Intersection
XX	AM Peak Hour Turning Movement Volume
(XX)	PM Peak Hour Turning Movement Volume



**Table 5-3 Design Year (2035) No-Build LOS Results**

Intersection	Traffic Control	Design Year (2035) No-Build	
		AM	PM
US 264A (Greenville Blvd) and NC 11 (Memorial Drive)	Signalized	F (WB-F)	F (WB-F)
US 264A (Greenville Blvd) and SR 1701 (Hooker Rd)	Signalized	F (WB-F)	D (SB-E)
US 264A (Greenville Blvd) and Landmark Street/WalMart Driveway	Signalized	E (SB-F)	F (SB-F)
US 264A (Greenville Blvd) and SR 1702 (S. Evans St)	Signalized	F (WB-F)	F (SB-F)
US 264A (Greenville Blvd) and Red Banks Rd	Signalized	E (SB-F)	E (NB-F)
US 264A (Greenville Blvd) and Arlington Blvd	Signalized	F (NB-F)	F (WB-F)
US 264A (Greenville Blvd) and SR 1707 (Charles Blvd)	Signalized	E (NB-E)	E (NB-E)
US 264A (Greenville Blvd) and Elm St	Signalized	C (NB-D)	C (NB-D)
US 264A (Greenville Blvd) and SR 1703 (E. 14th St)	Signalized	F (EB-F)	F (EB-F)
US 264A (Greenville Blvd) and Eastbrook Drive	Signalized	B (NB-E)	C (NB-E)
US 264A (Greenville Blvd) and Moseley Dr	Signalized	C (WB-E)	E (NB-F)
US 264A (Greenville Blvd) and E. 10th Street	Signalized	F (WB-F)	F (EB-F)
US 264A (Greenville Blvd) and Old Pactolus Rd	Unsignalized	(EB/WB-F)	(EB/WB-F)
US 264A (Greenville Blvd) and US 264 East/NC 33	Signalized	E (EB-F)	E (EB-F)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

## 6.0 BUILD ALTERNATIVES

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There are two build alternatives that were developed for evaluation of impacts; a third alternative was evaluated for cost implications only. This section presents each alternative and describes the design criteria used to develop the conceptual designs.

### 6.1 DESIGN CRITERIA

The design criteria for this project account for upgrading the facility to a median divided facility with a 50 mph design speed and 45 mph posted speed. The proposed future right-of-way would be between approximately 150 and 170 feet, depending on the selected alternative. The facility was designed with no control of access (except at locations where grade separated alternatives are presented) and varying widths sidewalks and bicycle lanes depending on the typical section selected. The same design criteria, summarized in Table 6-1, applies to all alternatives.

### 6.2 TYPICAL SECTIONS

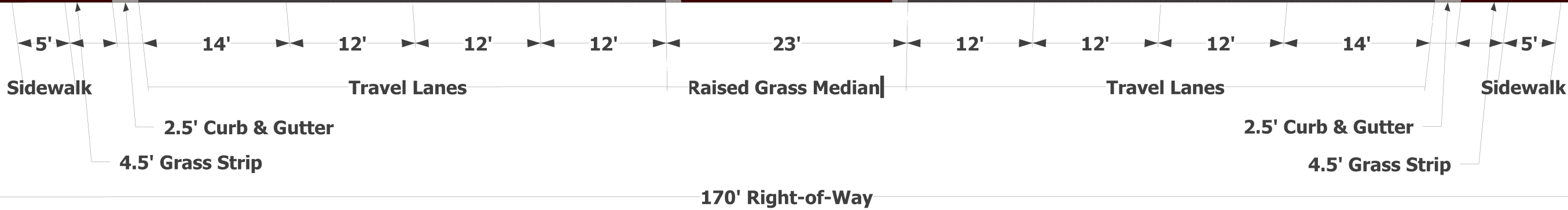
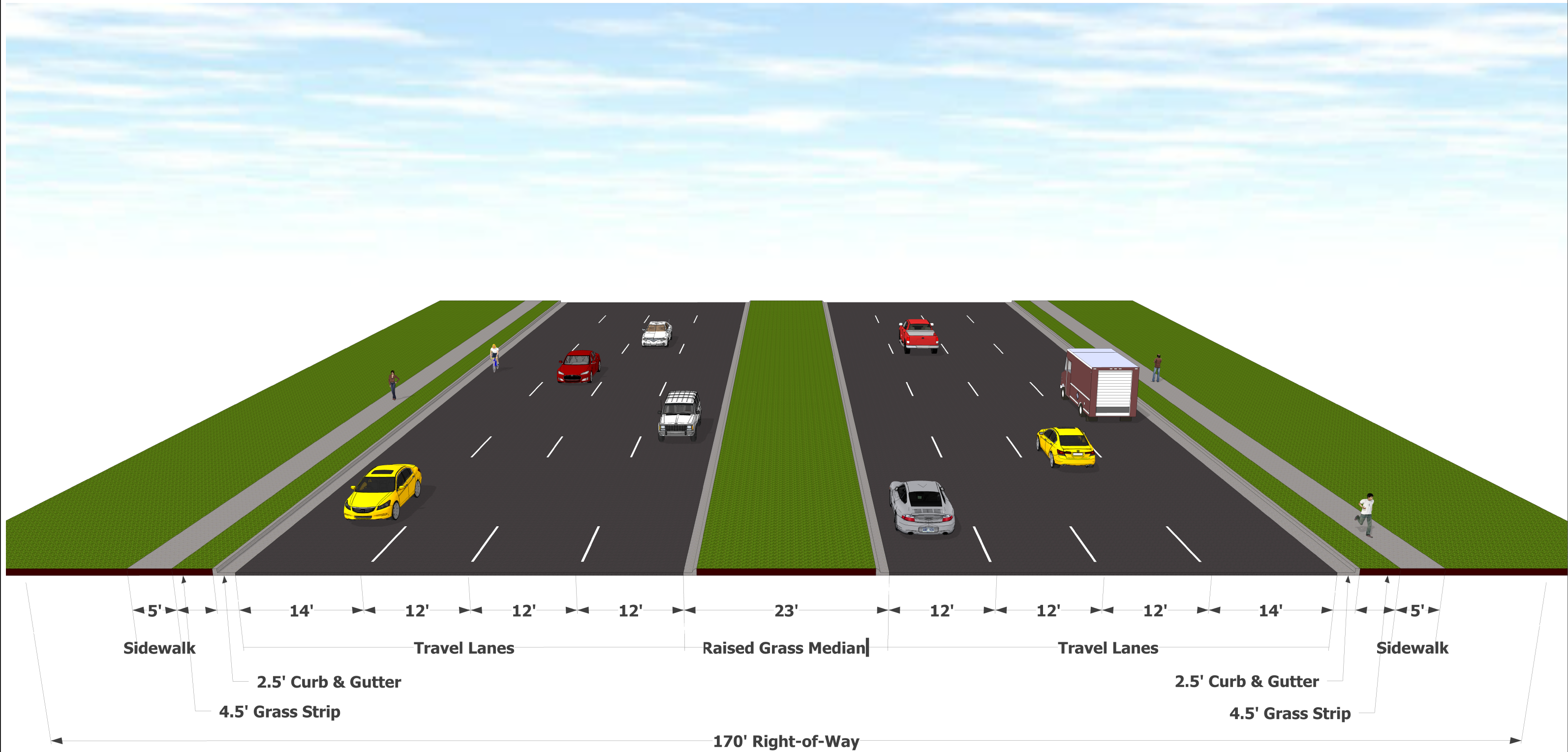
As discussed in Section 1.3, there are three typical sections under consideration for this project:

- Typical Section 1 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes, with 14' wide outside lanes to accommodate cyclists
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalks on both sides of the roadway
- Typical Section 2 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalk on one side of the roadway
  - 10' multi-use path on the other side of the roadway
- Typical Section 3 – Accommodates the prescribed through lanes, depending on the Alternative, as well as:
  - 12' travel lanes, with a 4' paved bike lane on both sides of the roadway
  - 23' grass median (narrowed as needed at intersections for turn lanes)
  - Curb and Gutter
  - 5' sidewalks on both sides of the roadway

Table 6-1 Design Criteria

ROUTE	US 264E	REFERENCE
LINE	-L-	OR REMARKS
<b>TRAFFIC DATA</b>		
ADT LET YR = 2012	45,500	
ADT DESIGN YR = 2035	62,000	
TTST	1%	
DUALS	2%	
DHV	8%	
DIR	55%	
<b>CLASSIFICATION</b>		
	Arterial	
<b>TERRAIN TYPE</b>		
	Level	
DESIGN SPEED km/hr or mph	50	
POSTED SPEED km/hr or mph	45	
PROP. R/W WIDTH m or ft	200	
<b>CONTROL OF ACCESS</b>		
	N	
RUMBLE STRIPS (Y/N)	N	
<b>TYPICAL SECTION TYPE</b>		
	Raised Median	
LANE WIDTH m or ft	12	
SIDEWALKS (Y/N)	Y	
BICYCLE LANES (Y/N)	Y	
MEDIAN WIDTH m or ft	23ft	
MED. PROTECT. (GR/BARRIER)	N/A	
<b>SHOULDER WIDTH (total)</b>		
MEDIAN m or ft	N/A	
OUTSIDE w/o GR m or ft	10ft	
OUTSIDE w/ GR m or ft	14ft	
<b>PAVED SHOULDER</b>		
OUTSIDE TOTAL/FDPS m or ft	N/A	
MEDIAN TOTAL/FDPS m or ft	N/A	
<b>GRADE</b>		
MAX.	6%	AASHTO 7-4
MIN.	0.3%	AASHTO 3-119
<b>K VALUE</b>		
SAG	95	AASHTO 3-161
CREST	84	
<b>HORIZ. ALIGN.</b>		
MAX. SUPER.	4%	
MIN. RADIUS m or ft	926	
SPIRAL (Y/N)	N	
<b>CROSS SLOPES</b>		
PAVEMENT	.02	
PAVED SHOULDER	N/A	
TURF SHOULDER	.02	
MEDIAN DITCH	N/A	
DITCH TYPICAL (A,B,C)	N/A	
CLEAR ZONE m or ft	20-22ft	
<b>TYPICAL SECTION NO.</b>		

The typical sections were all designed such that they can be constructed within the right-of-way (ROW) for a given alternative, meaning the ROW and impacts for each typical section are relatively the same within an alternative. The varying typical sections were evaluated primarily for cost estimates, as each provides a different level of multi-modal accommodations. Figures 6-1 through 6-3 illustrate the three various typical sections, assuming an eight-lane cross section. For sections with a six-lane cross section, the typical section looks identical, only with the inner most travel lane was removed.



Not to Scale

Figure 6-1  
Potential Typical Section 1

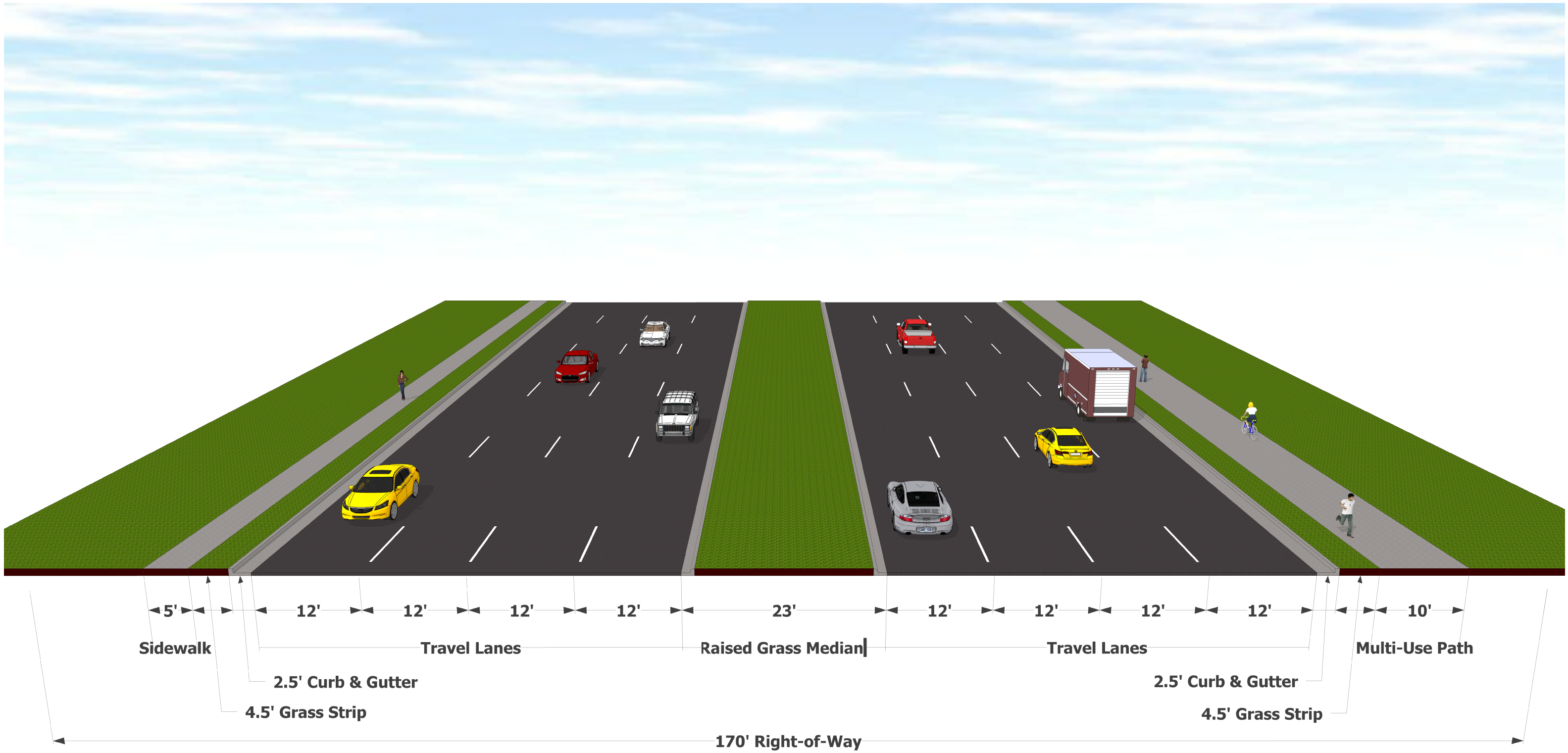
US 264 (Greenville Boulevard) Widening and Intersection Improvements

From NC 11 / Memorial Drive to US 264 East

FS-1002B



May 2014



Not to Scale

Figure 6-2  
 Potential Typical Section 2

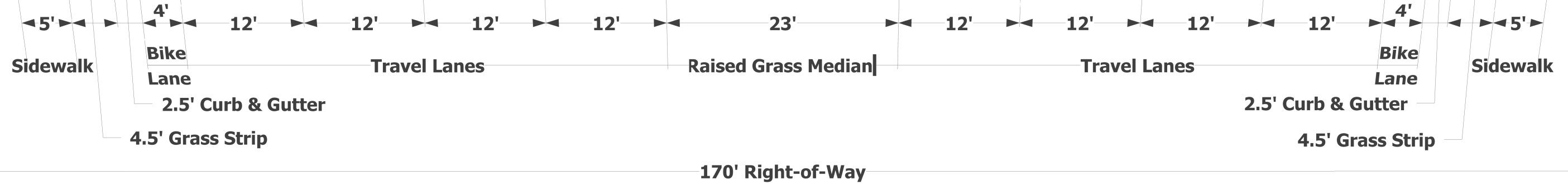
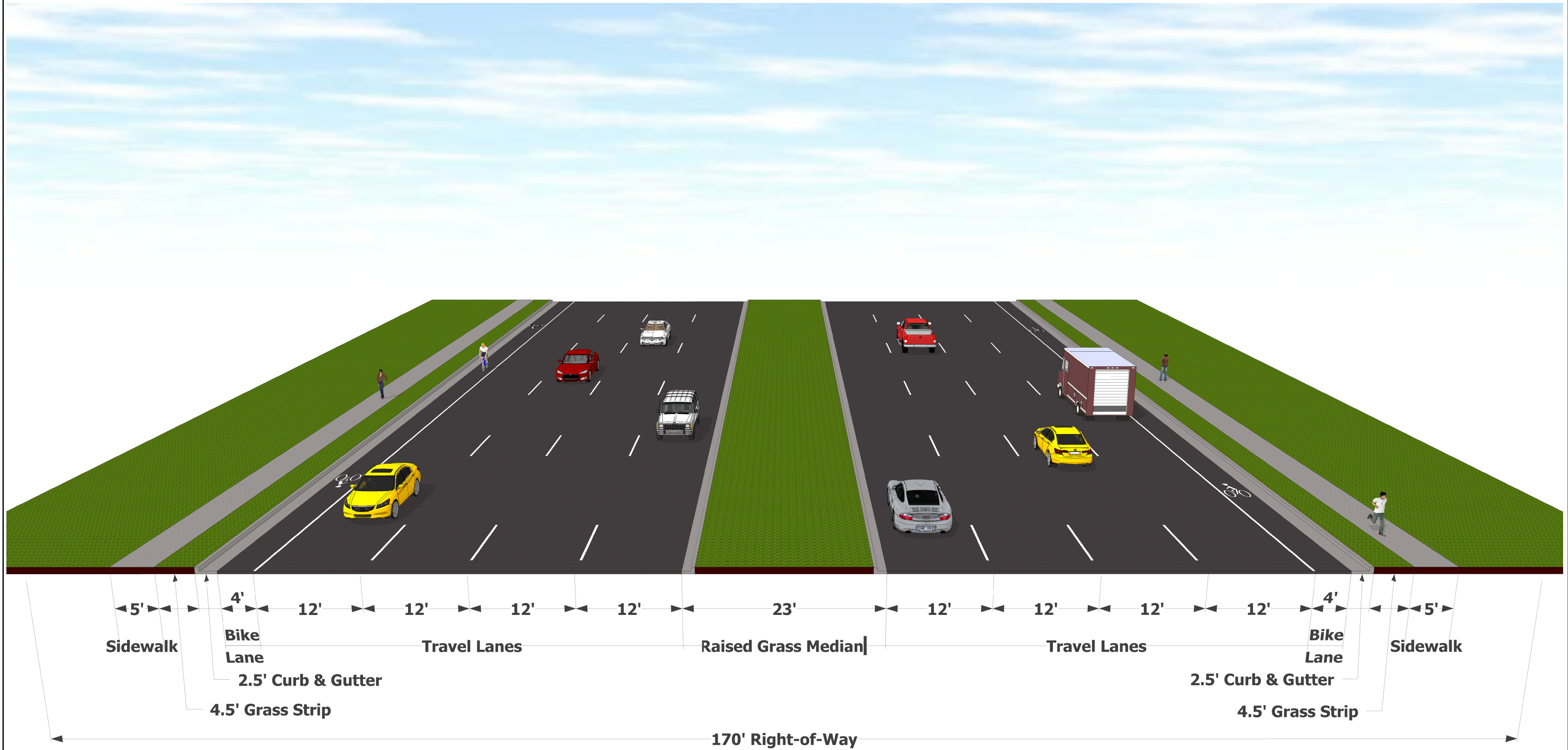
US 264 (Greenville Boulevard) Widening and Intersection Improvements

From NC 11 / Memorial Drive to US 264 East

FS-1002B



May 2014



Not to Scale

Figure 6-3  
 Potential Typical Section 3

US 264 (Greenville Boulevard) Widening and Intersection Improvements

From NC 11 / Memorial Drive to US 264 East

FS-1002B



May 2014



## 6.3 DEVELOPMENT OF ALTERNATIVES

In an effort to upgrade the current US 264A (Greenville Boulevard) facility from NC 11 (Memorial Drive) to US 264 East, two alternatives were developed, with a third alternative evaluated for cost implications only. The main difference between the alternatives is focused on the number of through lanes along US 264A (Greenville Boulevard). Alternative A accounts for conventional widening of US 264A (Greenville Boulevard) to an eight/six-lane divided facility; Alternative B accounts for conventional widening of US 264A (Greenville Boulevard) to a six-lane divided facility. Alternative C accounts for a four-lane divided facility; conceptual designs were not drafted for this scenario, but rather, the quantity estimates prepared for right-of-way and construction estimates accounted for the reduced cross section mathematically.

In each of the Alternatives, the evaluated improvements were constituted by conventional widening improvements, such as additional turn lanes or extensions of existing turn bay storage lengths. Superstreet improvements along the corridor were preliminarily evaluated; however, early analysis of the high cross street volumes at a number of intersections led to the conclusion that a superstreet corridor was not feasible for this facility. Instead conventional improvements at intersections are projected to result in acceptable operations along the corridor under future conditions. The following intersections had variations in potential improvements or recommendations went beyond “conventional” improvements.

### NC 11 (Memorial Drive)

At NC 11 (Memorial Drive), two improvement concepts configurations were evaluated. The first included conventional improvements such as additional exclusive turn lanes on multiple approaches and lengthening turn bays already in place. The second configuration considered included an elevated left-turn lane from US 264A (Greenville Boulevard) westbound to NC 11 (Memorial Drive) southbound. When comparing the costs of these two considered concepts, it is clear that that the flyover concept is not feasible from a cost perspective. While Right-of-Way and Utility costs for these two concepts are comparable, the construction estimate for the flyover concept is approximately \$10.5 million higher than the at-grade conventional improvements. As will be discussed in more detail later, the conventional improvements offer a cost effective solution to congestion at this intersection that is projected to bring operations back to acceptable levels. The additional cost of the flyover concept is not met with significant additional operational benefit. The flyover improvement was conceptually designed for Alternative A and B for costing purposes, however due to the high cost of such a concept, it was not considered feasible and was dropped from further study.

#### SR 1702 (S. Evans Street)

There were four concepts evaluated at this intersection. Improvements at this intersection included an unconventional at-grade concept which would remove left-turn movements from S. Evans Street and reroute them through a U-turn point between S. Evans Street and Red Banks Road (northbound lefts) as well as using Red Banks Road as a corner cut (southbound lefts). In addition to the at-grade concept, a partial clover interchange, with loops and ramps in the northwest and southeast quadrants was considered. Just west of this intersection is a railroad crossing; concepts for maintaining this as an at-grade concept were evaluated as well as upgrading to a grade separated crossing. The combination of these concepts resulted in the following four alternatives at this intersection:

- a) At-Grade Intersection with Grade Separated Railroad Crossing
- b) Grade Separated Interchange with Grade Separated Railroad Crossing
- c) At-Grade Intersection with At-Grade Railroad Crossing
- d) Grade Separated Interchange with At-Grade Railroad Crossing

Each of these four concepts was taken to a conceptual design level and evaluated for cost estimates. Design option "b," which includes both of the grade separation concepts, was evaluated within each Alternative for environmental impacts as this concept has the largest overall footprint.

From a traffic only perspective, two other interchange design configurations were preliminarily evaluated for feasibility at this location including a Diverging Diamond Interchange design and a single quadrant interchange design. These concepts were not taken to a design level or evaluated for impacts as the partial clover design constituted the largest footprint and therefore greatest impacts, which is needed at this level of analysis. However, the traffic operation results for these other configurations are discussed in Section 6.4.3.

#### SR 1703 (E. 14<sup>th</sup> Street)

Proposed improvements at this intersection included a grade separated design due to the proximity to a future bridged railroad crossing. The improvement at this location included a grade separation of the railroad immediately west of the intersection which continues as a bridge over E. 14<sup>th</sup> Street. A quadrant roadway is proposed in the northeast quadrant with signalized T-intersections at US 264A (Greenville Boulevard) and E. 14<sup>th</sup> Street to facilitate all movements between these two roadways.

## 6.4 ALTERNATIVE A

Alternative A proposes to upgrade the existing roadway to a six/eight-lane divided section and make conventional intersection improvements at all intersections except the intersections of US 264A (Greenville Boulevard) at SR 1702 (S. Evans Street) and US 264A (Greenville Boulevard) at SR 1703 (E. 14<sup>th</sup> Street).

### 6.4.1 Roadway Improvements

The roadway improvements along this corridor are conventional except at the US 264A (Greenville Boulevard) intersections with S. Evans Street and E. 14<sup>th</sup> Street. The improvements at the S. Evans Street intersection associated with this alternative include restricting left-turns from S. Evans Street onto US 264A (Greenville Boulevard). The southbound left-turns would be displaced to the Red Banks Road intersection, while the northbound left-turns would be required to turn right and make a U-turn approximately 1,600 feet east of the intersection. The intersection of US 264A (Greenville Boulevard) and E. 14<sup>th</sup> Street would be updated to a single quadrant interchange in the northeast quadrant of that intersection. Improvements and lane configurations for this alternative include:

#### US 264A (Greenville Boulevard) at NC 11/903 (Memorial Drive)

- Exclusive southbound right-turn lane with at least 200 feet of storage and appropriate taper;
- Additional exclusive southbound left-turn lane with at least 450 feet of storage and appropriate taper;
- At least 350 feet of storage and appropriate taper on exclusive eastbound left-turn lane;
- Two additional eastbound through lanes with at least 500 feet of storage and appropriate taper;
- Exclusive eastbound right-turn lane with at least 150 feet of storage and appropriate taper;
- At least 250 feet of storage and appropriate taper on northbound left-turn lane;
- Second exclusive northbound right-turn lane, both with at least 550 feet of storage and appropriate taper;
- One additional westbound through lane;
- Third exclusive westbound left-turn lane, two with at least 450 feet of storage and appropriate taper and one remaining continuous from the intersection of US 264A (Greenville Boulevard) and Hooker Road/Convention Center Drive; and
- Two exclusive westbound right-turn lanes with at least 350 feet of storage and appropriate taper.

US 264A (Greenville Boulevard) at Hooker Road/Convention Center Drive

- Two additional eastbound and westbound through lanes;
- At least 500 feet of storage and appropriate taper on exclusive southbound right-turn;
- Second exclusive eastbound left-turn lane, both with at least 250 feet of storage and appropriate taper;
- At least 100 feet of storage and appropriate taper on exclusive westbound left-turn lane; and
- Exclusive westbound right-turn lane with at least 100 feet of storage and appropriate taper.

US 264A (Greenville Boulevard) at Landmark Street/Walmart Entrance

- Two additional eastbound and westbound through lanes;
- Second exclusive southbound left-turn lane;
- At least 400 feet of storage and appropriate taper on exclusive eastbound left-turn;
- Exclusive eastbound right-turn lane with at least 150 feet of storage and appropriate taper;
- At least 450 feet of storage and appropriate taper on exclusive westbound left-turn; and
- At least 200 feet of storage and appropriate taper on exclusive westbound right-turn lane.

US 264A (Greenville Boulevard) at Railroad Crossing just west of SR 1702 (S. Evans Street)

This railroad crossing is currently at-grade. This project may either widen the existing crossing or upgrade to a grade separated crossing.

US 264A (Greenville Boulevard) at SR 1702 (S. Evans Street)

*Grade Separated Interchange Option*

- Construct a partial clover interchange with loops in the northwest and southeast quadrants
- Signalized dual rights extending the length of the loop connecting S. Evans Street to US 264A (Greenville Boulevard) westbound
- Signalized dual rights extending the length of the loop connecting S. Evans Street to US 264A (Greenville Boulevard) eastbound
- Signalize intersection of US 264A (Greenville Boulevard) westbound off loop and S. Evans Street
  - Exclusive dual northbound left-turns with one being continuous and the other with at least 400 feet of storage and appropriate taper

- Exclusive southbound right-turn with at least 350 feet of storage and appropriate taper
- Exclusive left- and right- turn lanes on the US 264A (Greenville Boulevard) westbound off loop approach
- Signalize intersection of US 264A (Greenville Boulevard) eastbound off loop and S. Evans Street
  - Exclusive southbound left-turn with 100 feet of storage and appropriate taper
  - Exclusive northbound right-turn with at least 350 feet of storage and appropriate taper
  - Exclusive left- and right- turn lanes on the US 264A (Greenville Boulevard) westbound off loop approach

*At-Grade Unconventional Improvement Option*

- At least 500 feet of storage and appropriate taper on exclusive southbound right-turn;
- At least 400 feet of storage and appropriate taper on eastbound exclusive dual left-turn;
- Additional exclusive eastbound right-turn lane with at least 250 feet of storage and appropriate taper;
- Dual northbound exclusive right-turn lanes at least 850 feet of storage and appropriate taper;
- At least 500 feet of storage and appropriate taper on exclusive dual westbound left-turns;
- At least 150 feet of storage and appropriate taper on exclusive westbound right-turn;
- Restrict northbound and southbound left-turns off of S. Evans Street;
- Redirect the southbound left-turns to the intersection of Red Banks Road; and
- Construct a median break approximately 1,500 feet east of the intersection to allow drivers diverted from making a northbound left-turn to U-turn.
  - Two eastbound u-turn lanes should be constructed at the median opening with at least 325 feet of storage and appropriate taper.
  - Note – the City has also considered diverting northbound U-turns through the intersection to Red Banks Road, and utilizing this quadrant for northbound lefts as well as the southbound lefts

**Note:** When the railroad crossing improvement is combined with one of the two improvement options for the S. Evans Street intersection, there are four potential improvement options for the S. Evans Street intersection area. While cost estimates were

completed for each individual design option, this report evaluates the grade separated railroad crossing plus the interchange alternative (design option b) for impacts as this is the alternative most likely to have the highest impacts to businesses and the highest overall cost.

US 264A (Greenville Boulevard) at SR 1707 Red Banks Road

- Two additional eastbound and westbound through lanes;
- At least 250 feet of storage and appropriate taper for exclusive eastbound left-turn lane;
- Second exclusive eastbound right-turn lane, both with 350 feet of storage and appropriate taper; and
- At least 200 feet of storage and appropriate taper for exclusive westbound left-turn lane.

US 264A (Greenville Boulevard) at E. Arlington Boulevard

- Two additional eastbound and westbound through lanes;
- Second exclusive southbound left-turn lane, at least 350 feet of storage and appropriate taper for one and the other operates as a two-way left-turn lane;
- Exclusive southbound right-turn lane with at least 200 feet of storage and appropriate taper;
- At least 300 feet of storage and appropriate taper for exclusive eastbound left-turn lane;
- Exclusive eastbound right-turn lane with at least 100 feet of storage and appropriate taper;
- Second exclusive northbound left-turn lane with at least 200 feet of storage and appropriate taper;
- Exclusive northbound right-turn lane with at least 200 feet of storage and appropriate taper;
- At least 350 feet of storage and appropriate taper for exclusive westbound left-turn lane; and
- Two exclusive westbound right-turn lanes both with at least 150 feet of storage and appropriate taper.

US 264A (Greenville Boulevard) at SR 1707 (Charles Boulevard)

- One additional eastbound and westbound through lane;
- At least 450 feet of storage and appropriate taper for exclusive southbound right-turn lane;

- At least 350 feet of storage and appropriate taper for exclusive southbound left-turn lane;
- Second exclusive eastbound left-turn lane both with at least 250 feet of storage and appropriate taper;
- Exclusive right-turn lane with at least 150 feet of storage and appropriate taper on eastbound approach;
- At least 400 feet of storage and appropriate taper for exclusive westbound left-turn lane; and
- Exclusive right-turn lane with at least 100 feet of storage and appropriate taper on westbound approach.

US 264A (Greenville Boulevard) at Elm Street

- One additional eastbound and westbound through lane;
- Exclusive left-turn lane with at least 250 feet of storage and appropriate taper on eastbound approach; and
- At least 200 feet of storage and appropriate taper for exclusive westbound left-turn.

US 264A (Greenville Boulevard) at SR 1703 (E. 14th Street)

- Construct a new single quadrant interchange in the northeast quadrant;
- Propose ramp intersections to be under signal control; and
- Grade separate railroad crossing just west of the intersection

The City of Greenville proposes that future planning and design phases of the project consider utilizing Laura Lane and Adams Boulevard for this quadrant concept. As part of that concept, Laura Lane would extend to connect to Cedar Lane along the southern edge of Jaycee Park.

US 264A (Greenville Boulevard) at Eastbrook Drive

- One additional eastbound and westbound through lane;
- At least 100 feet of storage and appropriate taper for exclusive eastbound left-turn lane; and
- At least 300 feet of storage and appropriate taper for exclusive westbound left-turn lane.

US 264A (Greenville Boulevard) at Moseley Drive

- One additional southbound and northbound through lane;
- At least 350 feet of storage and appropriate taper on exclusive southbound left-turn lane; and

- At least 500 feet of storage and appropriate taper on exclusive westbound left-turn lane.

US 264A (Greenville Boulevard) at SR 1598 (E 10<sup>th</sup> Street)

- Additional through lane on all approaches;
- At least 350 feet of storage and appropriate taper on both exclusive southbound left-turn lanes;
- Second exclusive southbound right-turn lane with at least 250 feet of storage and appropriate taper for both lanes;
- Second exclusive eastbound right-turn lane with at least 250 feet of storage and appropriate taper for both lanes;
- At least 450 feet of storage and appropriate taper on both exclusive left-turn lanes on northbound approach;
- Second exclusive northbound right-turn lane with at least 450 feet of storage and appropriate taper for both lanes;
- At least 700 feet of storage and appropriate taper on exclusive westbound left-turn lane; and
- At least 300 feet of storage and appropriate taper on exclusive westbound right-turn lane.

US 264A (Greenville Boulevard) at SR 1534 (Old Pactolus Road)

- One additional southbound and northbound through lane;
- Signalize intersection at the point when traffic warrants. The timing for this signal implementation should be based on completion of a full signal warrant analysis;
- At least 200 feet of storage and appropriate taper on southbound exclusive right-turn;
- At least 250 feet of storage and appropriate taper on southbound exclusive left-turn;
- Add exclusive left-turn lane with at least 300 feet of storage and appropriate taper on eastbound approach;
- At least 150 feet of storage and appropriate taper on northbound exclusive right-turn; and
- Add exclusive left-turn lane with at least 150 feet of storage and appropriate taper on westbound approach.

US 264A (Greenville Boulevard) at US 264 East/Pactolus Highway

- One additional southbound through lane;



- At least 250 feet of storage and appropriate taper on both southbound exclusive left-turns;
- At least 150 feet of storage and appropriate taper on southbound exclusive right-turn;
- At least 200 feet of storage and appropriate taper on eastbound exclusive left-turn;
- Add eastbound exclusive right-turn with at least 350 feet of storage and appropriate taper;
- At least 350 feet of storage and appropriate taper on northbound exclusive left-turn;
- At least 550 feet of storage and appropriate taper on one northbound exclusive right-turn; and
- One northbound exclusive right-turn to remain continuous from SR 1534 intersection.

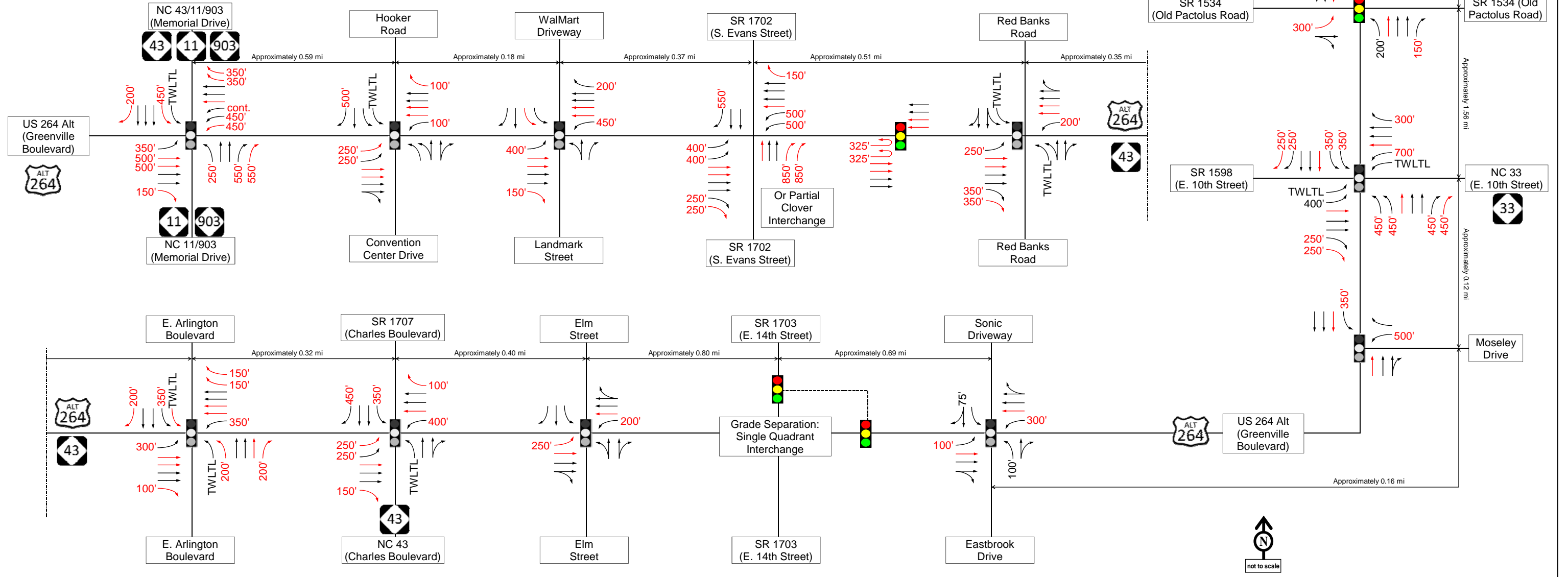
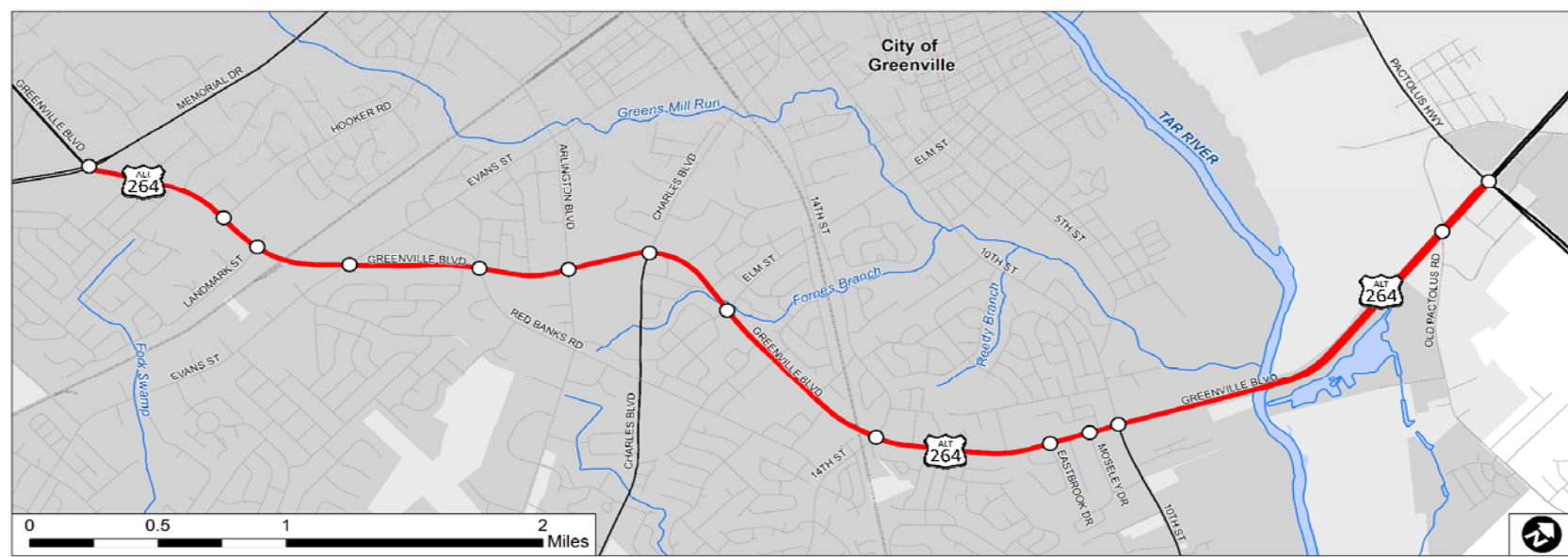
The conceptual sketch for this alternative, including these improvements, is illustrated in Figure 6-4 and conceptual designs are included as Appendix B.

#### **6.4.2 Base Year (2012) Build – Alternative A Analysis**

This scenario represents operations at the network intersections given the base year volumes and accounting for the construction of intersection improvements along US 264A (Greenville Boulevard). This scenario accounts for all roadway improvements detailed in Section 6.4.1.

Traffic capacity analysis indicates that all intersections are expected to operate at acceptable levels of service under this scenario. Table 6-2 summarizes the LOS results for Alternative A and Figure 6-5 illustrates the volumes used in this scenario analysis.

Legend	
	Existing Roadway
	Future Roadway
	Existing Lane Configuration
	Recommended Future Lane Configuration
	Existing Signalized Intersection
	Recommended Future Signalized Intersection
	Existing Stop Controlled Approach



**Figure 6-4**  
**Design Year (2035) Build - Alternative A Recommended Lane Geometrics and Traffic Control**

**FS-1002B US 264 (Greenville Boulevard)**  
**Widening and Intersection Improvements**  
 from NC 11/Memorial Drive to US 264 East/NC 33  
 Greenville, NC

**Table 6-2 Base Year (2012) Build – Alternative A LOS Results**

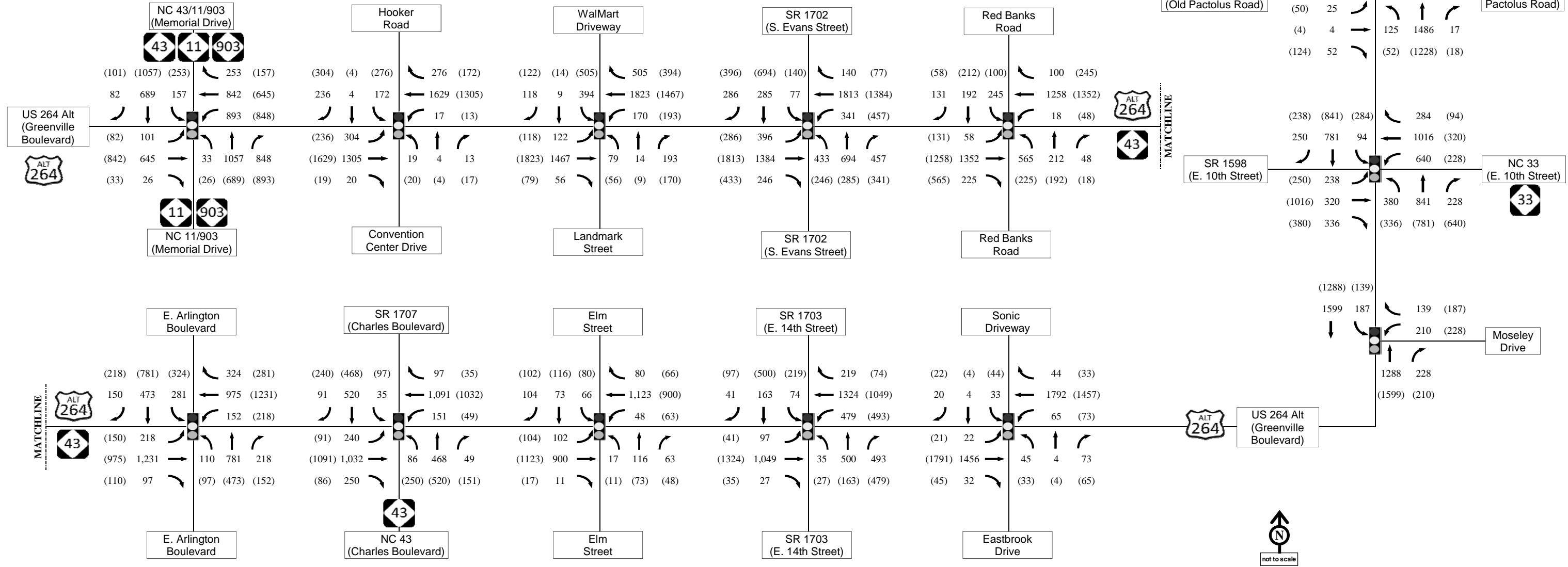
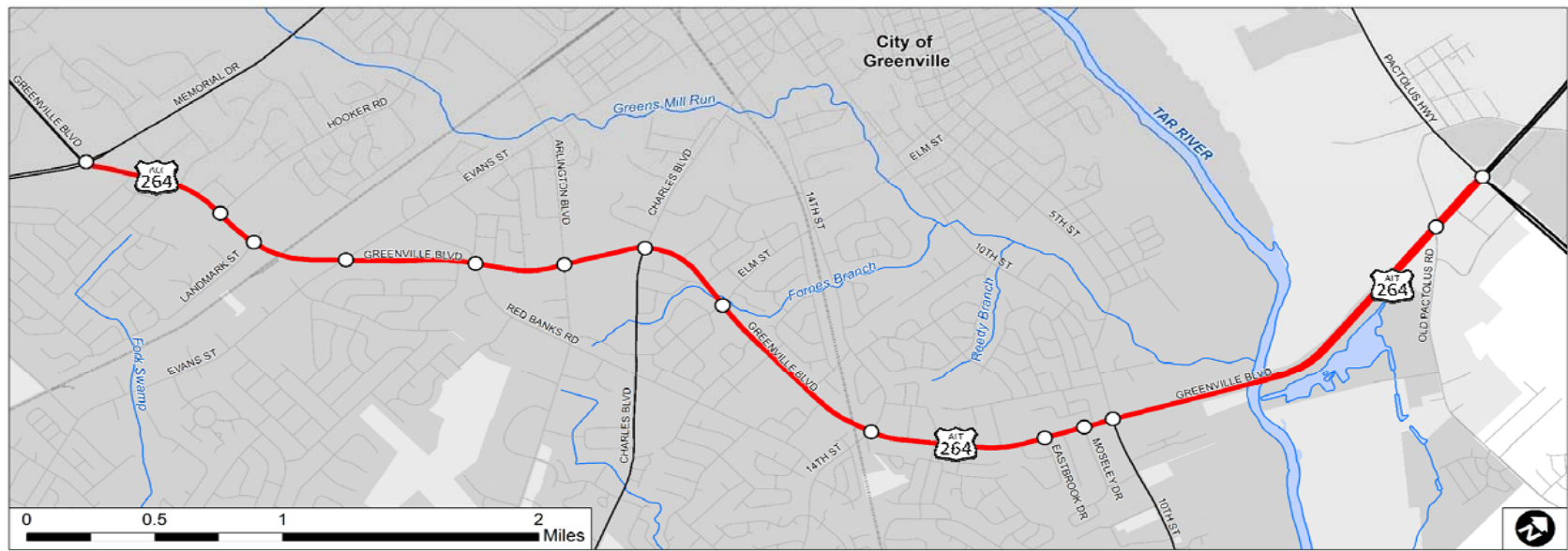
Intersection	Traffic Control	Base Year (2012) Build – Alternative A	
		AM	PM
US 264A (Greenville Blvd) & NC 11 (Memorial Drive)	Signalized	C (EB-D)	C (EB-D)
US 264A (Greenville Blvd) & SR 1701 (Hooker Rd)	Signalized	B (NB-D)	B (NB-D)
US 264A (Greenville Blvd) & WalMart Driveway	Signalized	C (SB-D)	C (SB-D)
US 264A (Greenville Blvd) & SR 1702 (S. Evans St)	Signalized	C (NB-C)	B (SB-C)
US 264A (Greenville Blvd) & Eastern U-Turn	Signalized	A (EB-A)	A (EB-A)
US 264A (Greenville Blvd) & Red Banks Rd	Signalized	C (NB-D)	C (SB-D)
US 264A (Greenville Blvd) & Arlington Blvd	Signalized	C (NB-D)	C (SB-D)
US 264A (Greenville Blvd) & SR 1707 (Charles Blvd)	Signalized	C (NB-D)	C (NB-D)
US 264A (Greenville Blvd) & Elm St	Signalized	A (NB-D)	B (NB-C)
SR 1703 (E. 14th St) & Quadrant Ramps	Signalized	B (EB-E)	C (EB-D)
US 264A (Greenville Blvd) & Quadrant Ramps	Signalized	B (SB-C)	B (SB-B)
US 264A (Greenville Blvd) & Driveway	Signalized	B (NB-D)	B (NB-D)
Moseley Dr & US 264A (Greenville Blvd)	Signalized	B (WB-D)	B (WB-D)
E. 10th Street & US 264A (Greenville Blvd)	Signalized	C (WB-C)	C (WB-D)
Old Pactolus Rd & US 264A (Greenville Blvd)	Signalized	B (WB-D)	B (EB-D)
NC 33 US 264 East & US 264A (Greenville Blvd)	Signalized	D (NB-D)	C (WB-D)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

Legend	
	Existing Roadway
	Future Roadway
	Turning Movement
	Existing Signalized Intersection
XX	AM Peak Hour Turning Movement Volume
(XX)	PM Peak Hour Turning Movement Volume



**Figure 6-5**  
Base Year (2012) Build AM and PM Peak Hour Turning Movement Volumes

**FS-1002B US 264 (Greenville Boulevard)**  
Widening and Intersection Improvements  
from NC 11/Memorial Drive to US 264 East/NC 33  
Greenville, NC

### 6.4.3 Design Year (2035) Build – Alternative A Analysis

This scenario represents operations at the network intersections given the design year volumes and accounting for the improvements made to the existing roadway. To be consistent with the provided traffic forecasts, this scenario does account for the completion of background projects within the study area as included in the LRTP. All other roadway improvements are consistent with those detailed in Section 6.5.1. Signal timings were optimized in *Synchro* for this scenario.

Traffic capacity analysis indicates that all study intersections are projected to operate at an acceptable level of service during the AM and PM peak hours though some individual movements are expected to operate at an unacceptable LOS E or F. The signalized intersections at the interchange ramps (design options b and d at S. Evans Street) also operate acceptably under this scenario. Table 6-3 summarizes the LOS results and Figure 6-6 illustrates the volumes used in this scenario analysis.

As mentioned in Section 6.3, two other interchange configurations were preliminarily evaluated from a traffic operations perspective including a diverging diamond interchange (DDI) and a single quadrant interchange.

#### *Diverging Diamond Interchange*

In a diverging diamond interchange configuration, two directions of traffic on the more minor roadway cross to the opposite sides on both sides of the bridge over the major roadway to make their turns onto the major roadway. This configuration would bridge SR 1702 (S. Evans Street) over US 264A (Greenville Boulevard), with all DDI movements occurring on SR 1702 (S. Evans Street).

Under the DDI concept, the US 264A (Greenville Boulevard) and SR 1702 (S. Evans Street) interchange would operate acceptably at the signalized points of the DDI during both peak hours.

#### *Single Quadrant Interchange*

In the evaluated single quadrant interchange configuration, the intersection of US 264A (Greenville Boulevard) and SR 1702 (S. Evans Street) would be grade separated with all turning movements occurring along a quadrant road located in the northwest quadrant. This configuration would limit the major right-of-way impacts to this quadrant, and traffic would flow through two three-phase signals, one each on US 264A (Greenville Boulevard) and SR 1702 (S. Evans Street).

Under the single quadrant concept, the US 264A (Greenville Boulevard) and SR 1702 (S. Evans Street) interchange would operate acceptably at the signalized ramp intersections during both peak hours.

**Table 6-3 Design Year (2035) Build – Alternative A LOS Results**

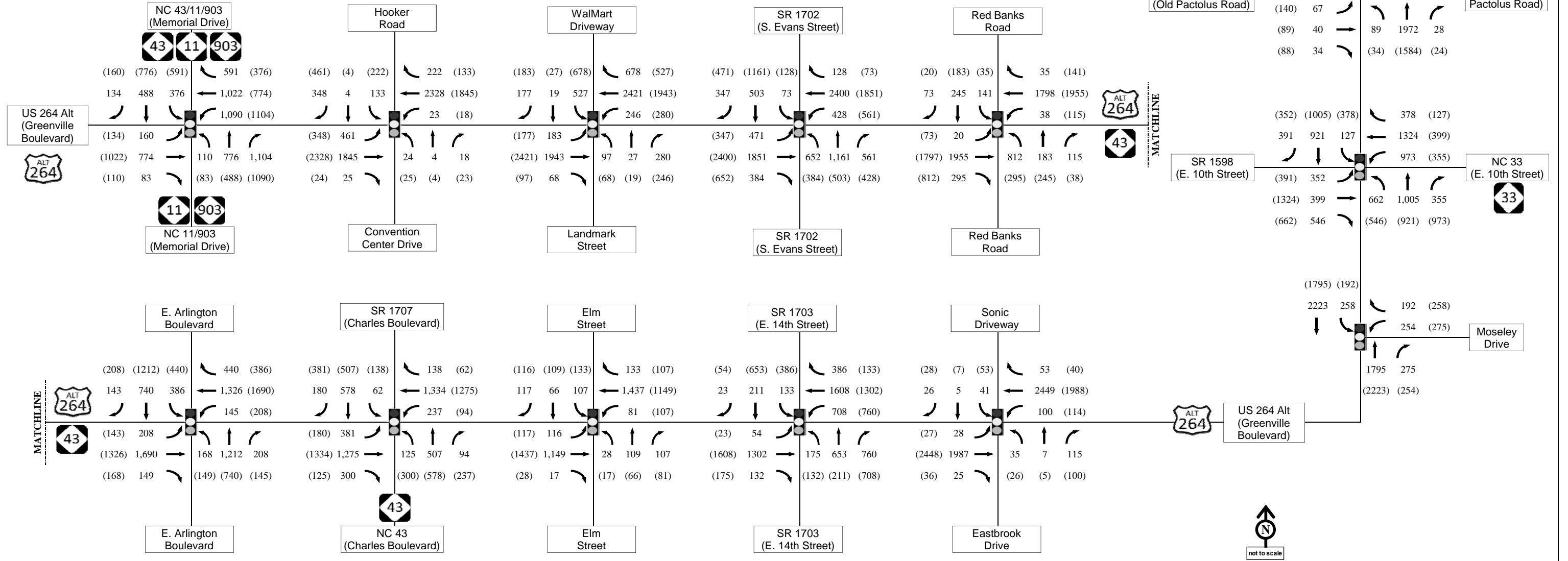
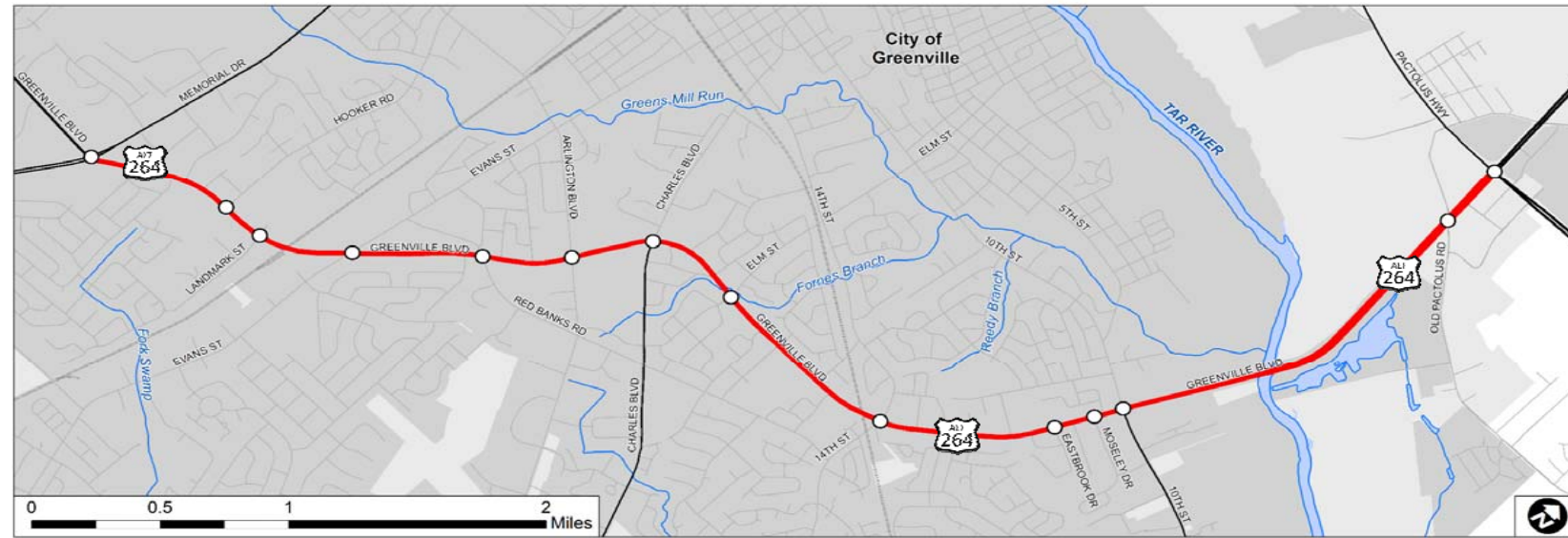
Intersection	Traffic Control	Design Year (2035) Build – Alternative A	
		AM	PM
US 264A (Greenville Blvd) & NC 11 (Memorial Drive)	Signalized	D (EB-E)	D (EB-E)
US 264A (Greenville Blvd) & SR 1701 (Hooker Rd)	Signalized	B (SB-E)	B (NB-E)
US 264A (Greenville Blvd) & WalMart Driveway	Signalized	C (NB-E)	D (SB-F)
US 264A (Greenville Blvd) & SR 1702 (S. Evans St)	Signalized	D (NB-E)	D (SB-F)
US 264A (Greenville Blvd) & Eastern U-Turn	Signalized	A (WB-A)	A (WB-A)
US 264A (Greenville Blvd) & Red Banks Rd	Signalized	D (SB-E)	C (SB-E)
US 264A (Greenville Blvd) & Arlington Blvd	Signalized	D (NB-E)	D (SB-E)
US 264A (Greenville Blvd) & SR 1707 (Charles Blvd)	Signalized	C (NB-E)	D (NB-E)
US 264A (Greenville Blvd) & Elm St	Signalized	C (SB-D)	C (SB-D)
SR 1703 (E. 14th St) & Quadrant Ramps	Signalized	C (EB-E)	C (EB-E)
US 264A (Greenville Blvd) & Quadrant Ramps	Signalized	C (SB-C)	C (SB-C)
US 264A (Greenville Blvd) & Driveway	Signalized	B (NB-E)	C (SB-E)
Moseley Dr & US 264A (Greenville Blvd)	Signalized	B (WB-E)	B (WB-E)
E. 10th Street & US 264A (Greenville Blvd)	Signalized	D (WB-E)	D (WB-D)
Old Pactolus Rd & US 264A (Greenville Blvd)	Signalized	B (WB-E)	B (WB-E)
NC 33 US 264 East & US 264A (Greenville Blvd)	Signalized	D (WB-E)	D (EB-E)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

Legend	
	Existing Roadway
	Future Roadway
	Turning Movement
	Existing Signalized Intersection
XX	AM Peak Hour Turning Movement Volume
(XX)	PM Peak Hour Turning Movement Volume



#### 6.4.4 Comparison of Operational Results Between Forecasts

As was discussed in Section 4.0, NCDOT completed a revised forecast in February 2016, accounting for the fiscally constrained project list included in the more recently adopted 2040 GUAMPO MTP (August 2014). This revised forecast resulted in lower future traffic projections along the project corridor for a four-lane build alternative, when compared to the six lane cross section that is included in the original forecast's Build scenario.

A planning level comparison of the operational results between the originally forecasted volumes and the revised four-lane volumes was completed to determine if the corridor could operate acceptably with only the addition of a median for access management and multi-modal amenities, and no additional capacity.

To complete this analysis, the *Synchro* model for Alternative A was adjusted to account for only four through lanes along US 264A (Greenville Boulevard). All recommended turn lanes described in Section 6.4.1, from the main line and all y-line improvements, were maintained. The projected peak hour turning movement volumes from the revised forecast were then entered into the *Synchro* model and signal timings were optimized.

Approximately half of the analyzed intersections maintained similar overall operations to those reported in Section 6.4.3 (which assumes a 6/8 lane hybrid typical section), while the other half showed a noticeable decline in operations. Specifically four intersections are projected to operate at unacceptable LOS (below LOS D) during at least one peak hour, as compared to zero in Alternative A. These poorly operating intersections include:

- US 264A (Greenville Boulevard) and E. Arlington Boulevard - LOS E (PM peak)
- US 264A (Greenville Boulevard) and SR 1707 (Charles Boulevard) – LOS F (AM peak); LOS E (PM peak)
- US 264A (Greenville Boulevard) and SR 1598 (E. 10<sup>th</sup> Street) – LOS F (AM peak); LOS E (PM peak)
- US 264A (Greenville Boulevard) and US 264 East - LOS E (AM peak)

These intersections comprise the major cross streets along US 264A (Greenville Boulevard), providing access from this critical thoroughfare to major commercial, residential and institutional areas of the City. It is critical that these major intersections operate acceptably to facilitate these connections.

In addition to these failing intersections, there are a number of key intersections that operate at noticeably lower operations than those reported in Alternative A; while these are not projected to operate at failing operations, they are closer to reaching their capacity than they are under the Alternative A improvements scenario. These locations include:

- US 264A (Greenville Boulevard) and Hooker Road/Convention Center Drive



- US 264A (Greenville Boulevard) and Red Banks Road
- US 264A (Greenville Boulevard) and SR 1534 (Old Pactolus Road)

While the revised forecast does result in lower project volumes along the corridor, assuming a four-lane cross-section, than the originally analyzed forecast, the volume reduction is not enough to result in acceptable peak hour operations at all key intersections. Under Build Alternative A, which accommodates a six/eight-lane hybrid cross section, the recommended improvements (Section 6.4.1) do provide acceptable peak hour operations at all key intersections along the corridor. Thus, for the purpose of this Feasibility Study, the original forecasted volumes and ensuing Build Alternatives were used to determine the environmental impacts and cost estimations for use in project prioritization.

## **6.5 ALTERNATIVE B**

This alternative proposes to widen the existing US 264A (Greenville Boulevard) to a six-lane roadway along the entire corridor length.

### **6.5.1 Roadway Improvements**

The roadway improvements in this alternative are identical to those recommended in Alternative B with the exception of the number of through lanes recommended between NC 11 (Memorial Drive) and SR 1707 (Charles Boulevard). In Alternative B, the entire corridor is designed to have six through lanes, three in each direction as opposed to the having eight lanes between NC 11 (Memorial Drive) and SR 1707 (Charles Boulevard) as in Alternative A. Y-line improvements and turning lengths are assumed to remain the same for all intersections. The conceptual designs for this Alternative can be found in Appendix B.

### **6.5.2 Base Year (2012) Build – Alternative B Analysis**

This scenario represents operations at the network intersections given the base year volumes and accounting for the construction of intersection improvements along US 264A (Greenville Boulevard). This scenario accounts for all Y-line and turn lane improvements detailed in Section 6.4.1, with the only difference being the reduction from eight lanes to six between NC 11 (Memorial Drive) and SR 1707 (Charles Boulevard). The volumes used in this scenario analysis are the same as those used in the Base Year (2012) Build – Alternative A analysis (Figure 6-5). Signal timings were optimized within *Synchro* for this scenario.

Traffic capacity analysis indicates that all intersections are expected to operate at acceptable levels of service under this scenario. Table 6-4 summarizes the LOS results for Alternative B.

**Table 6-4 Base Year (2012) Build – Alternative B LOS Results**

Intersection	Traffic Control	Base Year (2012) Build – Alternative B	
		AM	PM
US 264A (Greenville Blvd) & NC 11 (Memorial Drive)	Signalized	D (EB-E)	C (EB-D)
US 264A (Greenville Blvd) & SR 1701 (Hooker Rd)	Signalized	B (NB-D)	B (NB-D)
US 264A (Greenville Blvd) & WalMart Driveway	Signalized	C (SB-D)	C (SB-E)
US 264A (Greenville Blvd) & SR 1702 (S. Evans St)	Signalized	C (NB-C)	C (SB-D)
US 264A (Greenville Blvd) & Eastern U-Turn	Signalized	A (EB-A)	A (EB-A)
US 264A (Greenville Blvd) & Red Banks Rd	Signalized	D (NB-E)	C (SB-D)
US 264a (Greenville Blvd) & Arlington Blvd	Signalized	C (NB-D)	C (SB-D)
US 264A (Greenville Blvd) & SR 1707 (Charles Blvd)	Signalized	C (NB-D)	C (NB-D)
US 264A (Greenville Blvd) & Elm St	Signalized	A (NB-D)	B (NB-D)
SR 1703 (E. 14th St) & Quadrant Ramps	Signalized	B (EB-E)	C (EB-D)
US 264A (Greenville Blvd) & Quadrant Ramps	Signalized	B (SB-C)	B (WB-C)
US 264A (Greenville Blvd) & Driveway	Signalized	B (NB-D)	B (NB-D)
Moseley Dr & US 264A (Greenville Blvd)	Signalized	B (WB-D)	B (WB-D)
E. 10th Street & US 264A (Greenville Blvd)	Signalized	C (WB-C)	C (WB-D)
Old Pactolus Rd & US 264A (Greenville Blvd)	Signalized	B (WB-D)	B (WB-D)
NC 33 US 264 East & US 264A (Greenville Blvd)	Signalized	D (NB-D)	C (EB-D)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

### **6.5.3 Design Year (2035) Build – Alternative B Capacity Analysis**

This scenario represents operations at the network intersections given the design year volumes and accounting for the improvements made to the existing roadway. This scenario accounts for all Y-line and turn lane improvements detailed in Section 6.4.1, with the only difference being the reduction from eight through lanes to six through lanes between NC 11 (Memorial Drive) and SR 1707 (Charles Boulevard). The volumes used in this scenario analysis are the same as those used in the Design Year (2035) Build – Alternative A analysis (Figure 6-6), and signal timings were optimized within *Synchro* for this scenario.

Traffic capacity analysis indicates that under Design Year (2035) Build – Alternative B conditions, the overall LOS at three (3) intersections are projected to operate at unacceptable levels of service during at least one peak hour. As expected, these intersections occur in the segment of the corridor that is reduced to six-lanes from Alternative A. These intersections include Wal-Mart Driveway/Landmark Street, SR 1702 (S. Evans Street), and Arlington Boulevard. Table 6-5 summarizes the LOS results.

**Table 6-5 Design Year (2035) Build – Alternative B LOS Results**

Intersection	Traffic Control	Design Year (2035) Build – Alternative B	
		AM	PM
US 264A (Greenville Blvd) & NC 11 (Memorial Drive)	Signalized	D (EB-E)	D (EB-E)
US 264A (Greenville Blvd) & SR 1701 (Hooker Rd)	Signalized	B (SB-E)	C (SB-E)
US 264A (Greenville Blvd) & WalMart Driveway	Signalized	D (SB-F)	E <b>(SB-F)</b>
US 264A (Greenville Blvd) & SR 1702 (S. Evans St)	Signalized	F <b>(WB-F)</b>	E <b>(SB-F)</b>
US 264A (Greenville Blvd) & Eastern U-Turn	Signalized	A (EB-A)	A (EB-A)
US 264A (Greenville Blvd) & Red Banks Rd	Signalized	D (NB-F)	C (NB-F)
US 264A (Greenville Blvd) & Arlington Blvd	Signalized	D (NB-E)	E <b>(SB-E)</b>
US 264A (Greenville Blvd) & SR 1707 (Charles Blvd)	Signalized	C (NB-E)	D (NB-E)
US 264A (Greenville Blvd) & Elm St	Signalized	B (SB-D)	C (SB-D)
SR 1703A (E. 14th St) & Quadrant Ramps	Signalized	C (EB-F)	C (EB-E)
US 264A (Greenville Blvd) & Quadrant Ramps	Signalized	C (SB-D)	C (SB-C)
US 264A (Greenville Blvd) & Driveway	Signalized	B (NB-E)	C (NB-E)
Moseley Dr & US 264A (Greenville Blvd)	Signalized	B (WB-E)	B (WB-E)
E. 10th Street & US 264A (Greenville Blvd)	Signalized	D (WB-E)	D (WB-D)
Old Pactolus Rd & US 264A (Greenville Blvd)	Signalized	B (WB-E)	B (WB-E)
NC 33 US 264 East & US 264A (Greenville Blvd)	Signalized	D (WB-E)	D (EB-E)

LEGEND:

X = Overall intersection LOS

(XB-X) = Lowest operating approach and approach LOS

## 7.0 STRUCTURES AND HYDROLOGY

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According to the NCDOT Bridge and Culvert Inventory, US 264A (Greenville Boulevard) has three crossings over the Tar River and the Tar River overflows. No other major hydraulic structures with a diameter of at least 72 inches are within the feasibility study area. The proposed feasibility study considers grade separation alternatives for the railroad west of S. Evans Street, S. Evans Street, a pedestrian bridge east of Charles Boulevard, the railroad west of E. 14<sup>th</sup> Street, and E. 14<sup>th</sup> Street.

### 7.1 HYDRAULIC STRUCTURES

#### 7.1.1 Culverts

Alternatives A and B for US 264A (Greenville Boulevard) would require the lengthening of the existing culvert near Elm Street, which is a pipe with less than a 72-inch diameter, in order to accommodate the proposed widening. This culvert carries Fornes Branch under Elm Street and US 264A (Greenville Boulevard) and would need to be lengthened on the south side of US 264A (Greenville Boulevard). No widening would be required on Elm Street. There are no other culverts carrying perennial streams within the feasibility study area.

#### 7.1.2 Tar River Bridge and Tar River Overflow Bridges

There are three crossings of the Tar River and Tar River Overflows along US 264A (Greenville Boulevard). Bridge Number 730002 is an existing bridge over the Tar River Overflow located about 0.4 miles east of the E. 10<sup>th</sup> Street intersection. This bridge is approximately 120 feet long and has a sufficiency rating of 84. Bridge Number 730034 is an existing bridge over the Tar River located about 0.5 miles east of the E. 10<sup>th</sup> Street intersection. This bridge is approximately 460 feet long and has a sufficiency rating of 73. Bridge Number 730055 is the existing eastbound lane bridge over the other Tar River Overflow located about 1.0 mile east of the E. 10<sup>th</sup> Street intersection. This bridge is approximately 120 feet long and has a sufficiency rating of 89.2. Bridge Number 730058 is the existing westbound lane bridge for this overflow. This bridge is also approximately 120 feet long and has a sufficiency rating of 98.8.

Because of the high sufficiency ratings for these bridges, the cost estimates assume these existing bridges would only require widening. The bridge widths will vary depending on the typical section alternative.

## 7.2 BRIDGE STRUCTURES

Grade separations with interchanges are proposed as alternatives to at grade intersection designs on US 264A (Greenville Boulevard) at the intersection of S. Evans Street and E. 14<sup>th</sup> Street.

- US 264A (Greenville Boulevard) over S. Evans Street will require a bridge approximately 260 feet long.
- US 264A (Greenville Boulevard) over the railroad and E. 14<sup>th</sup> Street will require dual bridges approximately 610 feet and 640 feet long.

A grade separation alternative over the railroad west of S. Evans Street will require a bridge approximately 260 feet long. The widths of this bridge and the bridges for the interchange alternatives will vary depending on the typical section alternative.

This feasibility study includes a pedestrian bridge over US 264A (Greenville Boulevard) just east of Charles Boulevard. This proposed bridge is estimated to be 112 feet to 136 feet long depending on the typical section of US 264A (Greenville Boulevard). Stairwells and ADA compliant ramps are included in the cost estimate for this pedestrian bridge.

## 8.0 OPINION OF PROBABLE COST

### 8.1 CONSTRUCTION AND RIGHT-OF-WAY ESTIMATES

Cost estimates for construction, utility relocation, and right-of-way were completed for each build alternative. These estimates are based on the conceptual designs prepared for the improvements. Table 8-1 summarizes the cost estimates for each component of each Alternative and provides a total of estimated cost per alternative. This table includes cost estimates for an Alternative C, which accounts a four-lane divided cross section. This scenario was included for cost estimation purposes only and conceptual designs were not drafted. For the purpose of comparison, the costs in the table assume no left-turn flyover at NC 11 (Memorial Drive) and Design Option b (Grade Separated railroad crossing and Interchange option) at SR 1702 (S. Evans Street). They also assume Typical Section 1, accommodating wide outside lanes for bikes and continuous five foot sidewalks on both sides of the road. Typical Section 1 represents a mid-range cost option among the evaluated typical sections. Appendix C contains all cost estimates in more detail.

**Table 8-1 Estimated Costs for Each Alternative**

Description	Alternative A (6/8-lanes)	Alternative B (6-lanes)	Alternative C (4-lanes)
Right-of-Way	\$ 123,120,000	\$ 119,210,000	\$ 111,700,000
Utility Relocation	\$ 4,500,000	\$ 4,500,000	\$ 3,920,000
Construction	\$ 88,400,000	\$ 82,000,000	\$ 65,200,000
<b>Total</b>	<b>\$ 216,000,000</b>	<b>\$ 207,000,000</b>	<b>\$ 181,000,000</b>

As shown in the table, regardless of the alternative selected, improvements to this corridor are going to be costly and should be considered for phased construction with multiple project segments. It is also clear that a major contributor to the overall cost of the project is the high right-of-way costs. There are nearly 100 relocatees assumed in all Alternatives (45% residential, 55% businesses). To potentially curb this cost in the future, if any parcels along the corridor undergo major redevelopment in the future, the City could consider requiring setbacks from the road that would allow for the future widening to occur without displacing the revitalized development.

### 8.2 BENEFIT-COST ANALYSIS

A benefit-cost analysis was completed using the NCDOT Redbook Wizard tool, which is based on the *User Benefit Analysis for Highways* publication (AASHTO, 2003). Inputs for the benefit analysis include base year and projected future year traffic volumes, average travel speeds, and

crash statistics and result in three types of benefits: user value of time, user operating cost, and user crash reduction benefits. The sum of these benefits constitutes the overall project benefit. Project costs are taken directly from cost estimates for right-of-way, utility relocation, and construction. The crashes anticipated due to past history along the existing corridor were also taken into account, with countermeasure factors applied to account for the future year improvements such as a median and improved turn lanes. The benefit and the cost of implementation are then weighed against one another to determine the “benefit-cost ratio” for a specific alternative. This tool also allows the user to compare this ratio among alternatives under review, providing a benefit-cost ranking for the alternatives. An additional use for this ratio is to allow for comparison between potential projects within a given vicinity and to aid in prioritizing funding for multiple projects in the same area.

The benefit-cost analysis assumes 2015 as the opening year and therefore the benefits are calculated for the years between Base Year (2015) and Design Year (2035).

The benefit-cost ratio for Alternative A was calculated to be 0.40; Alternative B was calculated to be 0.41. These ratios are very similar as the bulk of the user benefit comes from a reduction in crashes. This reduction is fueled by the partial access control introduced by a median as well as turn lane improvements at the intersections. These improvements are nearly identical between the compared alternatives. The user value of time benefit is slightly higher for Alternative A, however the lower cost of Alternative B is enough to negate that extra benefit, giving Alternative B the slight edge in the final ratio comparison. However, given the minor difference between the Alternatives in terms of user benefit, the selection of an Alternative should be weighted more toward the capacity needs of the corridor.



## 9.0 MULTIMODAL CONSIDERATIONS

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As part of the alternative development process, various levels of multimodal amenities were discussed and evaluated. Currently, only portions of US 264A (Greenville Boulevard) have sidewalk, and they are not continuous between the end points of this study. In addition, there are only three marked crosswalk locations along the study corridor. There are currently no accommodations for cyclists along US 264A (Greenville Boulevard); there are no designated bike lanes or wide outside lanes.

There are a number of existing bus routes that either cross US 264A (Greenville Boulevard) or follow it for some distance, including Routes 1, 3, 5, and 6. Specifically Route 5 follows US 264A (Greenville Boulevard) from Charles Boulevard to E. 10th Street, with approximately eight existing bus stops within that distance.

As US 264A (Greenville Boulevard) is improved to address critical capacity issues, NCDOT and the City of Greenville want to ensure that other modes of transportation are supported so that all users of the corridor can be accommodated. To address this, the various typical sections discussed in Section 6.2 were developed. As the future vision for US 264A (Greenville Boulevard) is realized, the level of accommodation for various user groups should be assessed and designed accordingly.

Additionally, a pedestrian overpass bridge was conceptually designed and placed just east of Charles Boulevard to facilitate heavy pedestrian movements between Pirates Point Shopping Center and the East Carolina University Campus. The construction only cost estimate for this bridge is approximately \$1.4 million (without contingencies, right-of-way or utilities included). Construction of this bridge was assumed in the cost estimates prepared for each alternative.

The City of Greenville requests that the project design consider pedestrian tunnels under the intersection instead of traditional pedestrian bridges. These should be considered during later planning and design phases of this project.

# 10.0 ALTERNATIVES EVALUATION AND RECOMMENDATIONS

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This section details and evaluates the quantitative impacts of the presented alternatives such as stream impacts, relocations and cost estimates. It also includes a discussion comparing the alternatives, resulting in the recommendation of a preferred alternative.

## 10.1 IMPACTS OF ALTERNATIVES

Each of the presented alternatives improves the intersection level of service for all study intersections. Table 10-1 provides a comparison of the quantitative impacts to each resource for each alternative.

As described in Section 6.3, this study evaluated various design alternatives at both NC 11 (Memorial Drive) intersection and the S. Evans Street intersection. Similar to the cost estimates, for Alternative comparisons, the at-grade conventional improvements were assumed at NC 11 (Memorial Drive) and design option b (grade separated railroad crossing and partial clover interchange) was assumed at S. Evans Street.

The impacted wetland acreage, floodplain acreage and linear feet of stream impact estimates are derived from data publicly available through NCDENR-DCM and Pitt County GIS resources.

Parcel information was obtained through the Pitt County's GIS resources and are not the product of project specific surveys.

As shown in Table 10-1, there are minimal differences between Alternative A and Alternative B. There are slightly more relocations associated with Alternative A as it requires the wider eight-lane cross-section between NC 11 (Memorial Drive) and Charles Boulevard. As for the natural resources such as wetlands, floodplain, and stream impacts, the Alternatives are identical in impacts as those impacts all occur east of Charles Boulevard in the sections where the design is identical between the Alternatives. Alternative A is slightly higher in projected cost due again to the eight-lane sections that are part of that Alternative.

**Table 10-1  
Alternatives Major Impact Comparison**

<b>Impact</b>	<b>Alternative A 6/8-lanes</b>	<b>Alternative B 6-lanes</b>
Relocations - Businesses	56	52
Relocations - Churches	0	0
Relocations - Residences	43	44
Wetlands Impacted (acres)	0.38	0.38
Stream Crossings (USGS Blue Line)	2	2
Stream Crossing (ft)	565	565
Floodplain 100-Yr (acres)	9.99	9.99
Floodplain 500-Yr (acres)	2.21	2.21
Probable USTs	1	0
National Register of Historic Places Sites	0	0
Potential Grave Site Impacts	0	0
Right-of-Way (acres)	63	58
Right-of-Way Costs*	\$ 123,120,000	\$ 119,210,000
Utility Relocation Cost*	\$ 4,500,000	\$ 4,500,000
Construction Cost*	\$ 88,400,000	\$ 82,800,000
<b>Total Cost*</b>	\$ 216,000,000	\$ 207,000,000

*\*The cost calculations assume no left-turn flyover at NC 11 (Memorial Drive) and design option b (Grade Separated RR crossing and Interchange) at SR 1702 (S. Evans Street). Typical Section 1 is included in the reported costs. Appendix C contains all cost estimates in more detail.*

## **10.2 CONCLUSIONS AND RECOMMENDATIONS**

Based on the data presented in this study, it is recommended that Alternative A be considered for programming with a formal decision on the preferred alternative and specific design options at S. Evans Street and multimodal amenities being deferred to later during the NEPA process. This alternative includes widening the existing facility to a median divided roadway with eight lanes from NC 11 (Memorial Drive) to Charles Boulevard and six lanes from Charles Boulevard to US 264E. All intersections studied for Alternative A are expected to operate at an acceptable LOS in Design Year 2035.

The recommendation of this alternative is based on several aspects of the project, including environmental impacts and cost. While the overall impacts and project costs are highest for this alternative, the magnitude of differences is small and Alternative A provides the better traffic operations.

### **10.2.1 Environmental Impacts**

Environmental impacts between the two alternatives are relatively similar due to the natural resources occurring along the sections of the project that are identical in design (Charles Boulevard to US 264E). There are slightly more relocations associated with Alternative A as the widened cross section on the western end of the project requires additional ROW.

Neither project alternative is expected to impact the Study List district mentioned in Section 2.2.1 or any of its properties or structures.

Section 2.2.4 listed a number of threatened or endangered species potentially present in the project study area, specifically within the Tar River; however, it is not expected that either alternative would directly impact these species as the Tar River is already traversed by US 264A (Greenville Boulevard). Caution should be taken, though, to reasonably protect the habitats of these species within study area during construction.

It is possible that Alternative A could impact the UST associated with the Wilco Hess station located in the northeast quadrant of Greenville Boulevard and NC 11/Memorial Drive mentioned in Section 2.2.6; however, refinement in design at a later stage of study may be able to avoid this impact. No other USTs are expected to be impacted by the proposed project.

### **10.2.2 Estimated Cost**

The estimated project cost for Alternative A (\$216 million) is approximately \$9 million more than Alternative B; however, this translates to only a four percent (4%) difference in total estimated costs. For such a small difference in cost, Alternative A provides better traffic operations along the busiest sections of the corridor.

### **10.2.3 Benefit-Cost Analysis**

The benefit-cost ratio for Alternative A was calculated to be 0.40; Alternative B was calculated to be 0.41. These ratios are very similar as the bulk of the user benefit comes from a reduction in crashes. This reduction is fueled by the partial access control introduced by a median as well as turn lane improvements at the intersections. These improvements are nearly identical between the compared alternatives. The user value of time benefit is slightly higher for Alternative A, however the lower cost of Alternative B is enough to negate that extra benefit, giving Alternative B the slight edge in the final ratio comparison. However, given the minor difference between the

Alternatives in terms of user benefit, the selection of an Alternative should be weighted more toward the capacity needs of the corridor.