



October 7, 2013

**TO:** Members of the Economic Development Committee

**FROM:** Jim Westmoreland, P.E., Deputy City Manager 

**SUBJECT:** Transmittal of “The East Greensboro Economic Development Site, Land Use, and Transportation Infrastructure Study” and Report by Evans Engineering (and Team)

In follow-up to this morning’s Economic Development Committee meeting, we are providing each of you with a copy of the subject study and report. As you’ll likely recall, this item was requested of staff to respond to key findings and recommendations identified in a previously commissioned Economic Development study of East Greensboro (entitled Balanced Economic Development: A Strategic Plan for East Greensboro) and to further explore economic development opportunities in East Greensboro.

To provide the City with a different perspective and approach on the private development possibilities of the area, we retained the services of Evans Engineering (and Team) to work with us on this first level planning effort. The Evans Team was selected for this important assignment due to their site civil engineering, site development, transportation, and planning expertise and due to their knowledge of both private sector development processes and City technical review processes. In conjunction with input from the City’s key infrastructure departments, we collectively discussed and explored various site, infrastructure, and other pragmatic opportunities that would enhance economic development in the area.

Key findings of the study included:

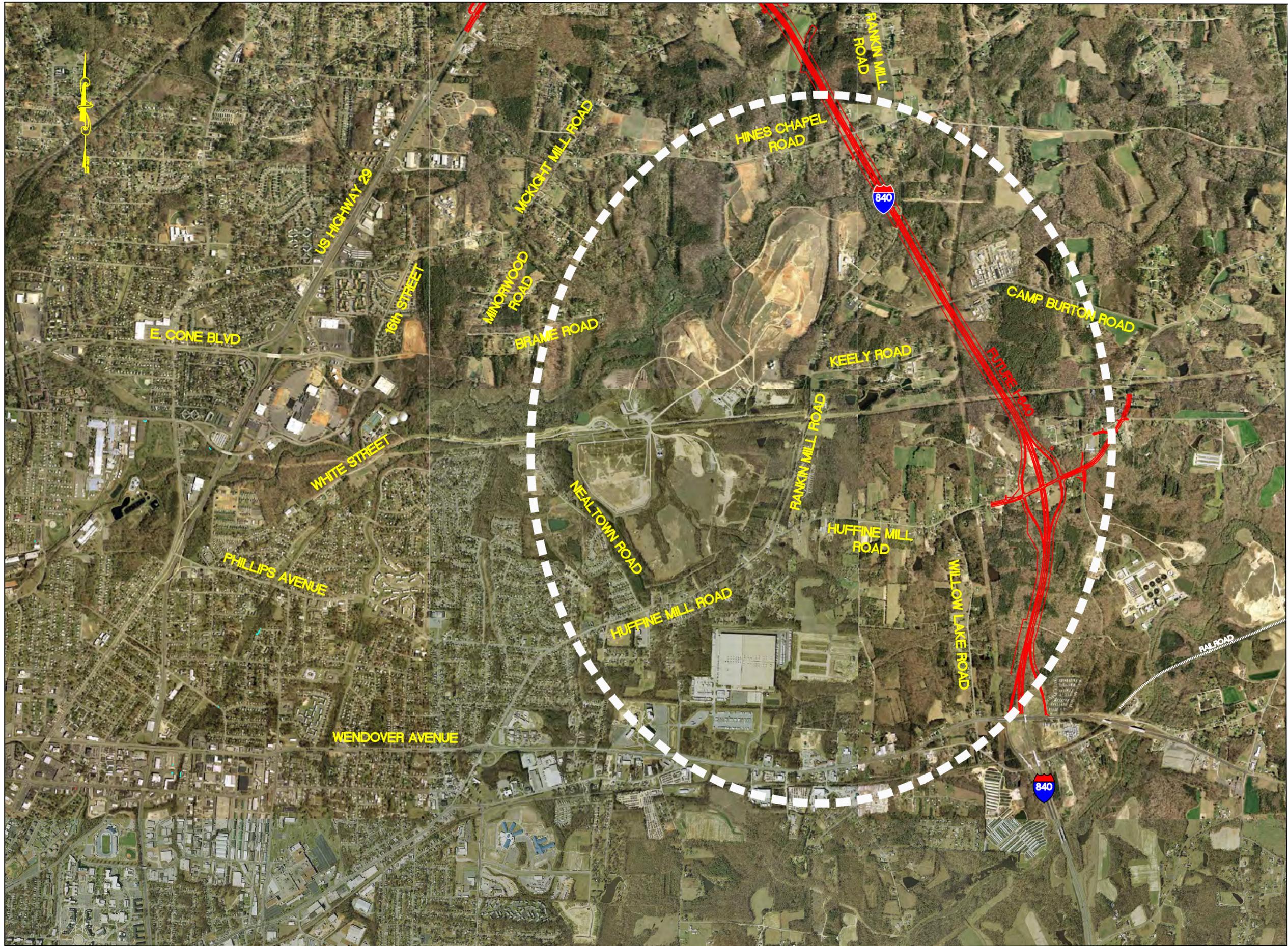
- The identification of multiple sites and areas in East Greensboro that present both near-term and long-term opportunity for industrial/corporate park development,
- The scheduled construction of the Eastern Outer Loop (From US 70 to US 29) in the Spring 2014 will change and enhance roadway/land access (via the facility and a newly planned interchange at Huffine Mill Road) and economic development opportunities in the area,
- And, the Committee vision and discussion around the creation of a High Impact Zone in East Greensboro is intriguing and if properly planned and implemented, could encourage and incentivize growth in specified areas and on priority sites to help diversify the local economy, provide high wage employment opportunities, and support a sustainable, vibrant community.

Being a first level planning effort, this study did not include any direct public involvement or outreach so the information provided in the report should be viewed as preliminary and conceptual in nature. Given the economic development potential of the study's key findings however, we believe there are certain items that merit more detailed planning and public involvement to gain a better sense of their feasibility and ability to help support economic development in East Greensboro. Therefore, we would request the Economic Development Committee to officially accept this report as a useful informational resource at your October 17<sup>th</sup> meeting and to follow-up on this effort, request City staff (via City Council resolution at an upcoming City Council meeting) to conduct a more detailed economic development analyses and planning effort to help advance this important work.

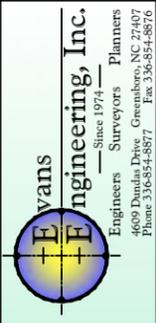
Thank you for your good leadership and for allowing us to use this unique public-private planning approach to conduct this study. The effort and study approach provided our City team with good focus on several near-term economic development opportunities in East Greensboro and we are excited about the next steps. Please let me know if you have questions.

JW

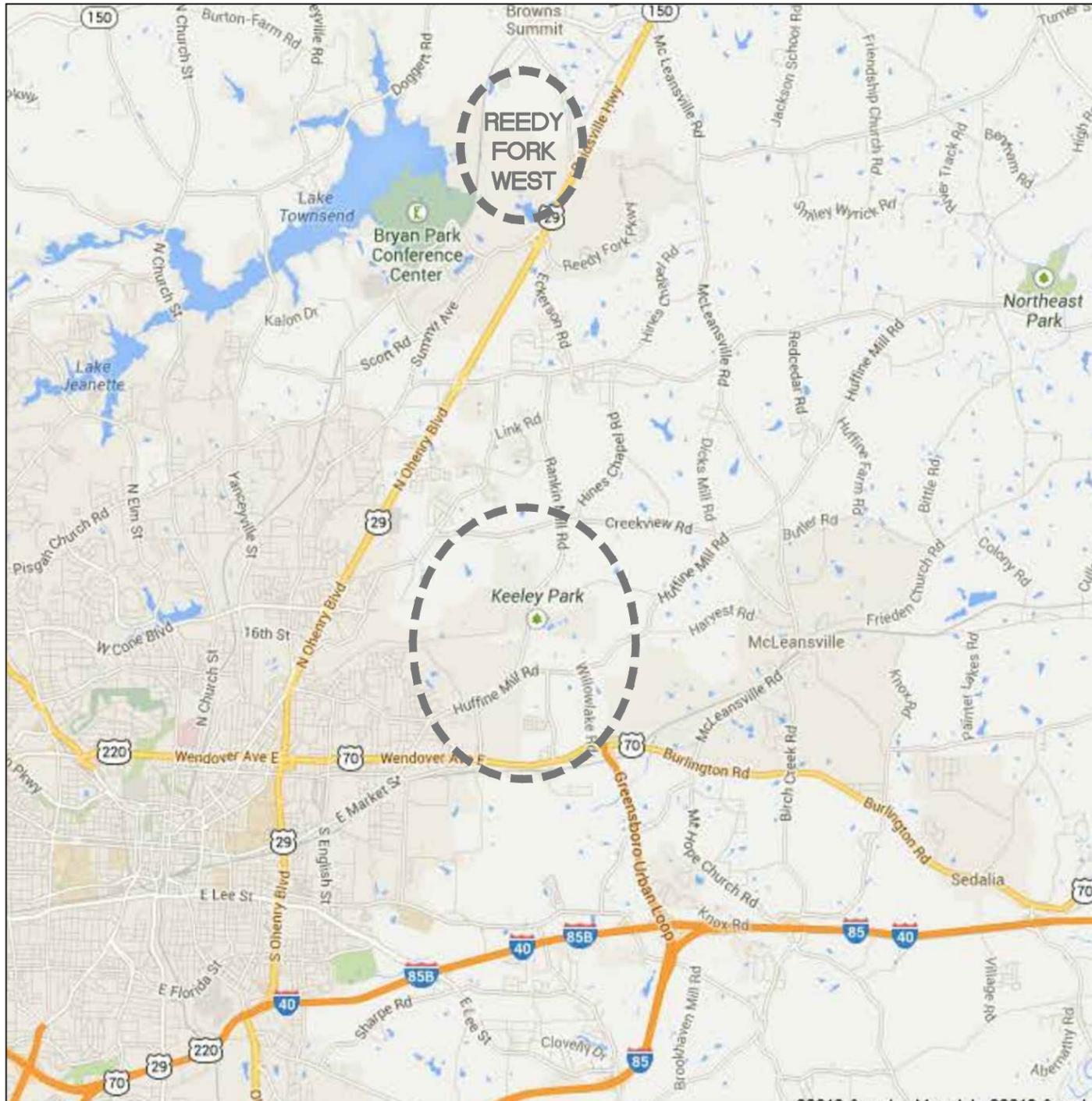
cc: Denise Turner Roth, City Manager  
Andy Scott, Assistant City Manager



**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



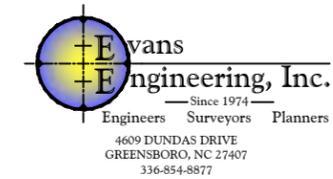
Evans Engineering, Inc.  
— Since 1974 —  
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**VICINITY MAP**  
NOT TO SCALE

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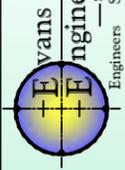
# INTRODUCTION AND SUMMARY

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INTRODUCTION AND SUMMARY

**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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## THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND INFRASTRUCTURE IDENTIFICATION STUDY

### INTRODUCTION

On December 7, 2011, the City of Greensboro received a report prepared by Red Rock Global and Colliers International entitled, "Balanced Economic Development: A Strategic Plan for East Greensboro." The Market Overview portion of the report concluded that, "East Greensboro has experienced a considerably sharper economic decline than any other part of the City". The report went on to point out that East Greensboro has the highest rate of poverty and the lowest median household income at \$21,617 versus \$42,927 when compared to the rest of the City.

The Greensboro City Council held a work session on September 25, 2012 to review and discuss elements of a new economic development strategic work plan for the City. This work plan was titled "Recommendations for Raising the Game: City Council Work Session." At that meeting, 9 sites in Greensboro were identified as "City of Greensboro Potential Future Growth Areas" by the Timmons Group and shown as potential candidates for industrial development.

Started in March of 2013, The East Greensboro Economic Development Site, Land Use, and Transportation Infrastructure Identification Study was started to specifically look at the industrial development potential of two sites identified by the Timmons Group in East Greensboro:

1. Shown as Site 6: Reedy Fork West Area
2. Shown as Site 7: White Street Landfill Area

With the permission of the landowners and without public comment, this study concentrated on two large tracts within these areas in East Greensboro. Unlike what was presented at the Council Work Session, this study shows specific conceptual development plans similar to the type used by private developers and site selection professionals.

Conceptual development plans were prepared for the two large tracts that can be assembled and developed within the study area. This process consisted of defining the assemblage tracts and assessing pertinent land features and development constraints such as access points, road connectivity, streams, stream buffers, flood plains and steep slopes to define the developable acreage. Conceptual development plans were then prepared to maximize potential build out for these tracts. Please note, specific costs and availability of water, sewer, and roads were not included in this Study, however, City of Greensboro staff has calculated some initial estimates.

In addition to the above, this study adds three additional emphasis modules that we believe are necessary for the creation of site ready development in East Greensboro:

1. A Land Planning Study for the area around the landfill and Huffine Mill Rd.
2. A Pilot process to evaluate the Transportation infrastructure projects necessary to develop a specific tract as now mandated by changes at NCDOT.
3. An Area Transportation Plan

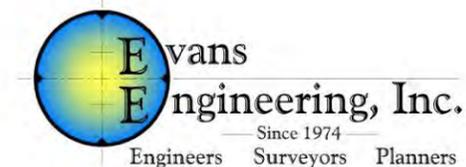
On behalf of our team, we wish to thank the City Managers Office, City Staff, and members of Council for your assistance during this study.

Sincerely,

Robert S. Dischinger, P. E.  
Evans Engineering  
(336)854-8877  
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### REFERENCES

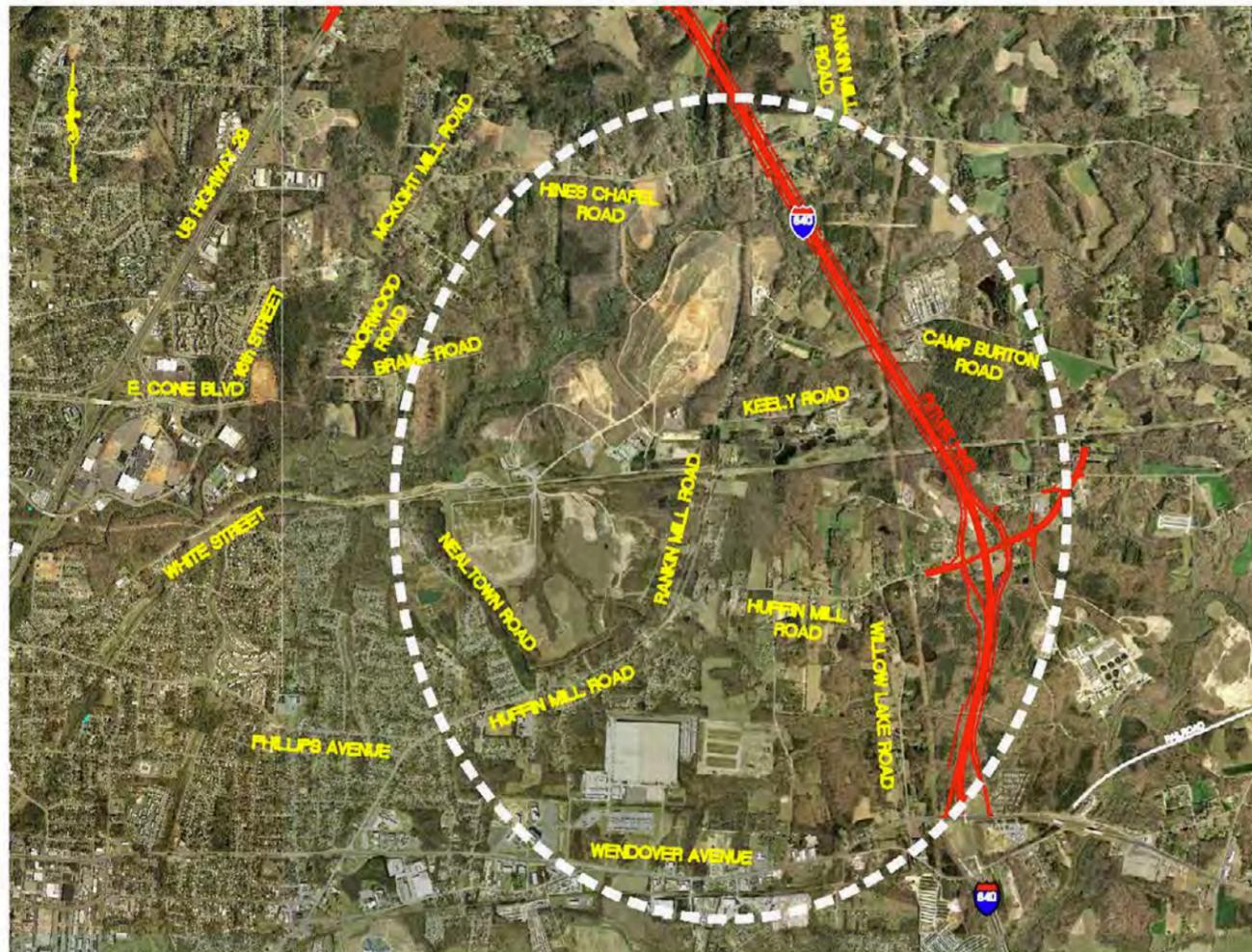
- 1 Mike Neal and Michael Tabb, **Balanced Economic Development: A Strategic Plan for East Greensboro** (Red Rock Global, Colliers International), p. 10.
- 2 Andy Scott, **Recommendations for Raising the Game: City Council Work Session** (City of Greensboro ED Staff), p.12-14.
- 3 Mike Solomon, **Greensboro Industrial Developable Sites** (Timmons Group) August 13, 2012.



## THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY

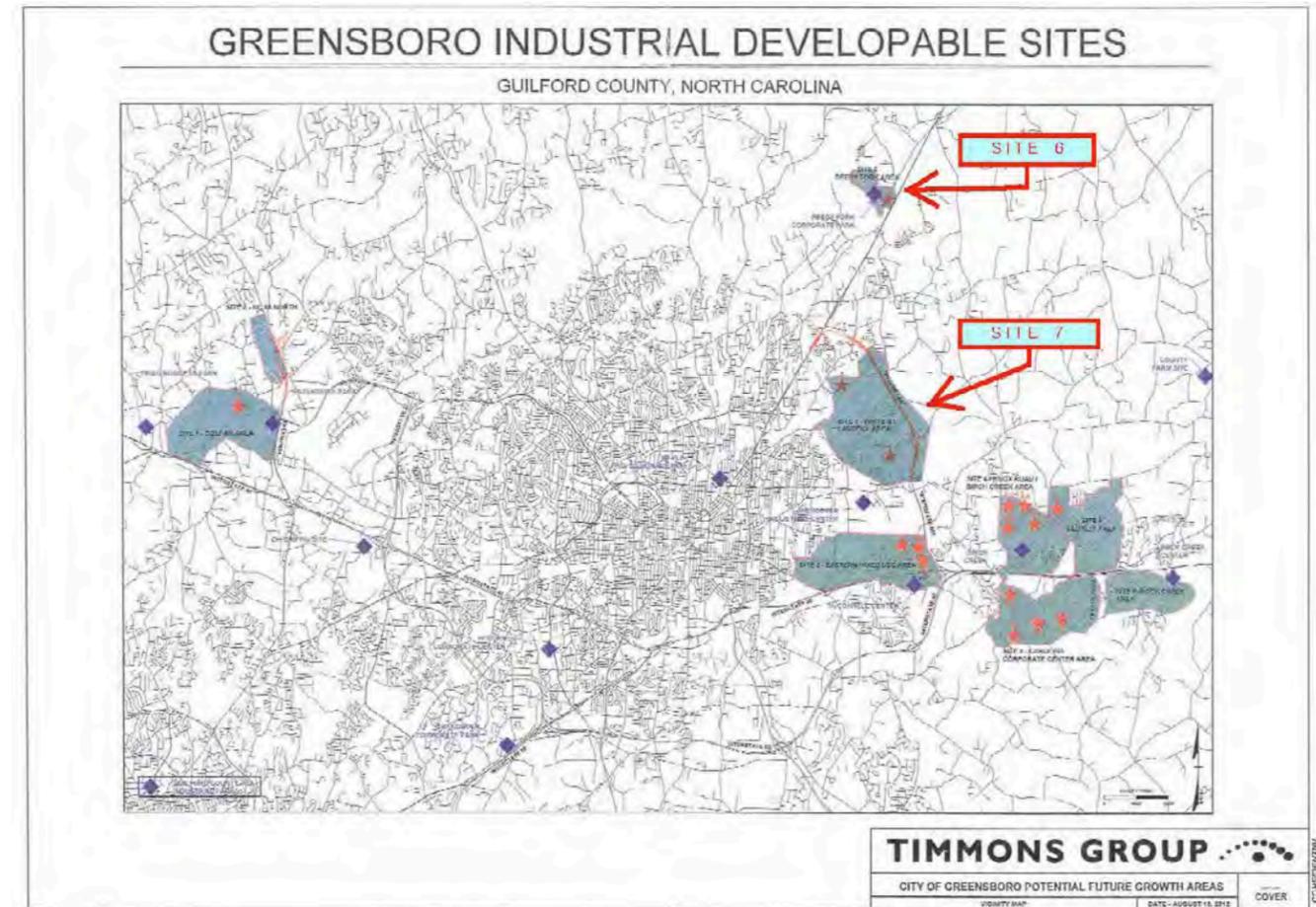
### SUMMARY

The East Greensboro Economic Development Site, Land Use, and Transportation Infrastructure Identification Study is focused on a smaller area in East Greensboro than the report entitled, "Balanced Economic Development: A Strategic Plan for East Greensboro" completed and received by the City of Greensboro December 7, 2011 and prepared by Red Rock Global and Colliers International. In addition to Reedy Fork West, our Study focused on the area bounded by the new I-840, Wendover Avenue (US HWY 70 East), and US HWY 29 North, as shown by the map inserted below.



Our Study focuses specifically on this area, due in part, because the report prepared by Red Rock Global and Colliers International cited on page 23 under the "Discussion of Parity" pointed out that: "3. Transportation from the study area to other trade areas is very difficult, meaning more dollars stay in the trade area due to the resident's inability to exit the trade area." Also, Red Rock Global and Colliers International concludes in that same "Discussion of Parity" that: "Transportation is a very interesting, yet well known issue for East Greensboro. While the area has good road access, and should be the centerpiece of several attractive entrances into Greensboro, its connectivity through interstates and major roads is perhaps the worst in the City and effectively cuts off access to the entire eastern and northern part of Greensboro. E. Cone's ability to connect to E. Florida (through Nealtown and Ward) and I-840's ability to connect from the southeast are both needed to improve access from and to the east and make the east an attractive retail environment. Without adequate access, the east will never be considered a destination area."

In conjunction with the Red Rock Study, the Timmons Group (August 13, 2012), points out that there are several large areas for potential industrial development in east Greensboro in their briefing to The Greensboro City Council entitled, "Greensboro Industrial Developable Sites".



Our Study took the above findings and looked specifically at two areas in East Greensboro:

1. Shown as Site 6: Reedy Fork West Area
2. Shown as Site 7: White Street Landfill Area

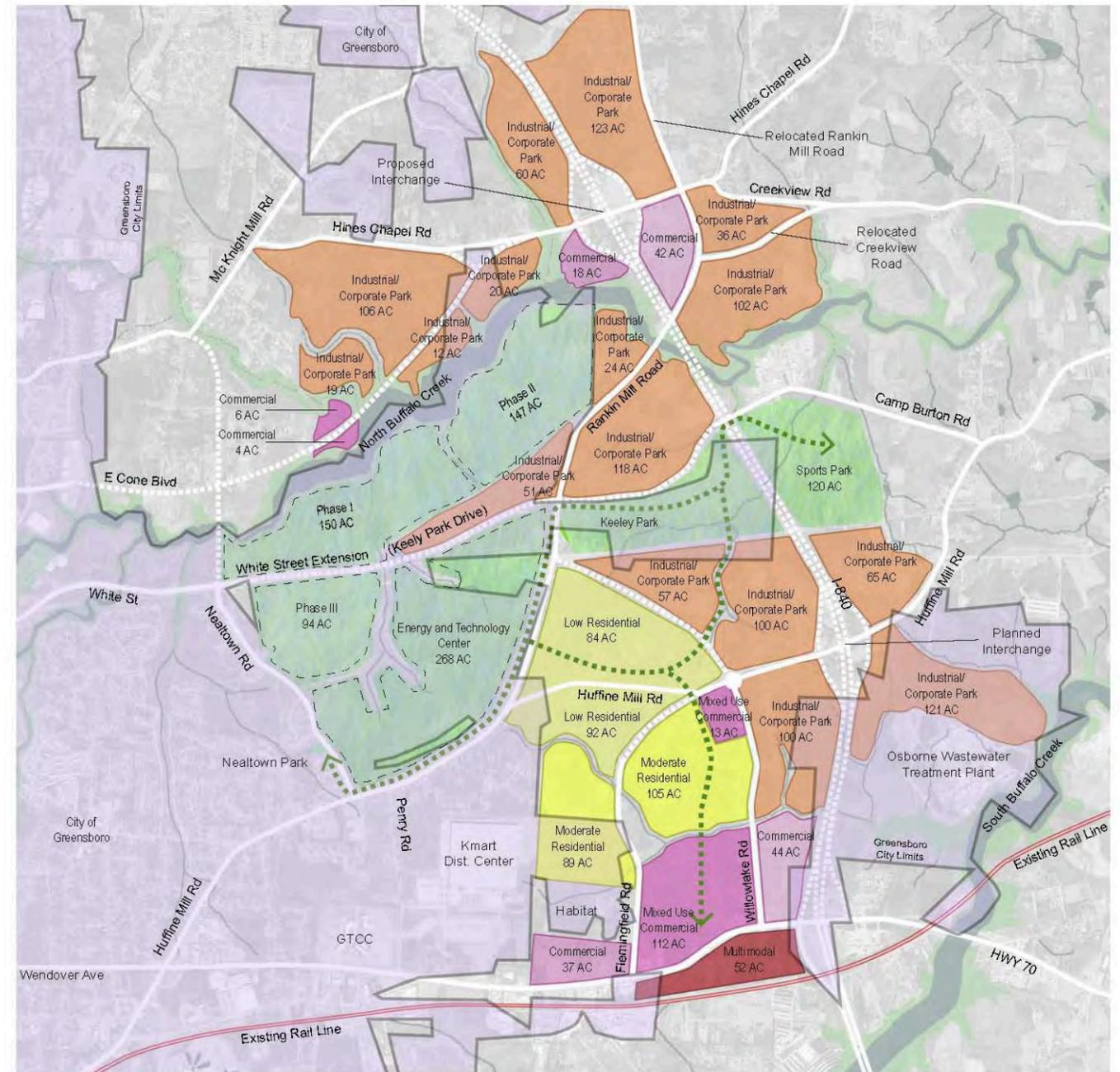
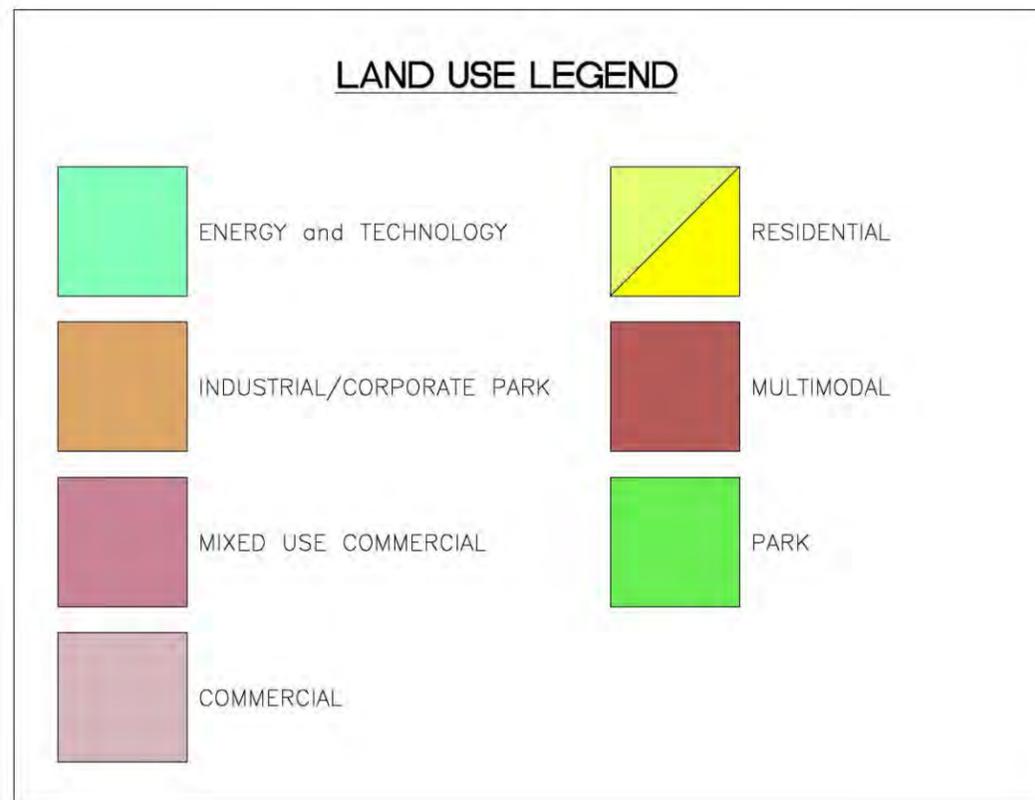
**The East Greensboro Economic Development Site, Land Use, and Transportation Infrastructure Identification Study** is divided into four emphasis modules:

1. Huffine Mill Road Future Land Use and Transportation Planning Concept
2. Conceptual Development Plan Studies
3. Pilot Evaluation of Transportation Infrastructure Project
4. East Greensboro Transportation Infrastructure Identification Study

**1. Huffine Mill Road Future Land Use and Transportation Planning Concept**

The Huffine Mill Road Future Land Use and Transportation Planning Concept was conducted by Walter Havener, ASLA, with the award winning firm of Lappas + Havener, PA., Durham, NC. It was felt that having an outside look at the area may yield a different perspective for East Greensboro. This was an attempt to gain fresh perspective.

The major point that Havener makes is the realization the area adjacent to the existing and proposed I-840 interchange with Hwy 70 should be viewed as a major Gateway to East Greensboro. His approach is to promote mixed use development with moderately spaced residential adjacent to light industrial and commercial. The addition of a multimodal center near the existing road and rail infrastructure is highlighted for future discussion.



**Huffine Mill Road Future Land Use and Transportation Planning Concept**  
2013-08-30

## 2. Conceptual Development Plan Studies

Evans Engineering, Inc., a locally owned and operated engineering firm, took the lead on the entire process of the area Study. This portion of East Greensboro includes several large tracts that, coupled with infrastructure investments by the City of Greensboro, could present several industrial site ready opportunities. Bob Dischinger, P.E., managed the effort to study two specific tracts and prepare Conceptual Development Plans for each tract.

For the purposes of this Study, Evans Engineering did not hold public hearings or solicit input from the Study area citizens. Using the Timmons Group document entitled, "Greensboro Industrial Developable Sites," Evans Engineering focused on Site 6 (Reedy Fork West) and a portion of Site 7 (Hines Chapel Road adjacent to the Landfill) by approaching the property owners in these locations in an effort to evaluate and prepare Conceptual Development Plans. With the respective owner's permission, Evans Engineering prepared plans that resulted in an estimate of potential industrial development building square footage for each site. The feasibility study for each of these tracts included an analysis of existing land features and development constraints such as access points, road connectivity, streams, stream buffers, flood plain and steep slopes to define the developable acreage if these tracts were to be developed under current City of Greensboro standards. Public and private utility infrastructure readiness for these two tracts was not considered at this time. The following maps show the result from each individual tract.

- ◆ Reedy Fork West Conceptual Development Plan
  - Reedy Fork is a 400 acre site on HWY 29 North
  - Producing an estimated 3,305,000 square feet of potential industrial development



- ◆ Hines Chapel Road Conceptual Development Plan
  - 288 acres adjacent to Buffalo Creek and the White Street Landfill
  - Producing an estimated 1,765,00 square feet of potential industrial development

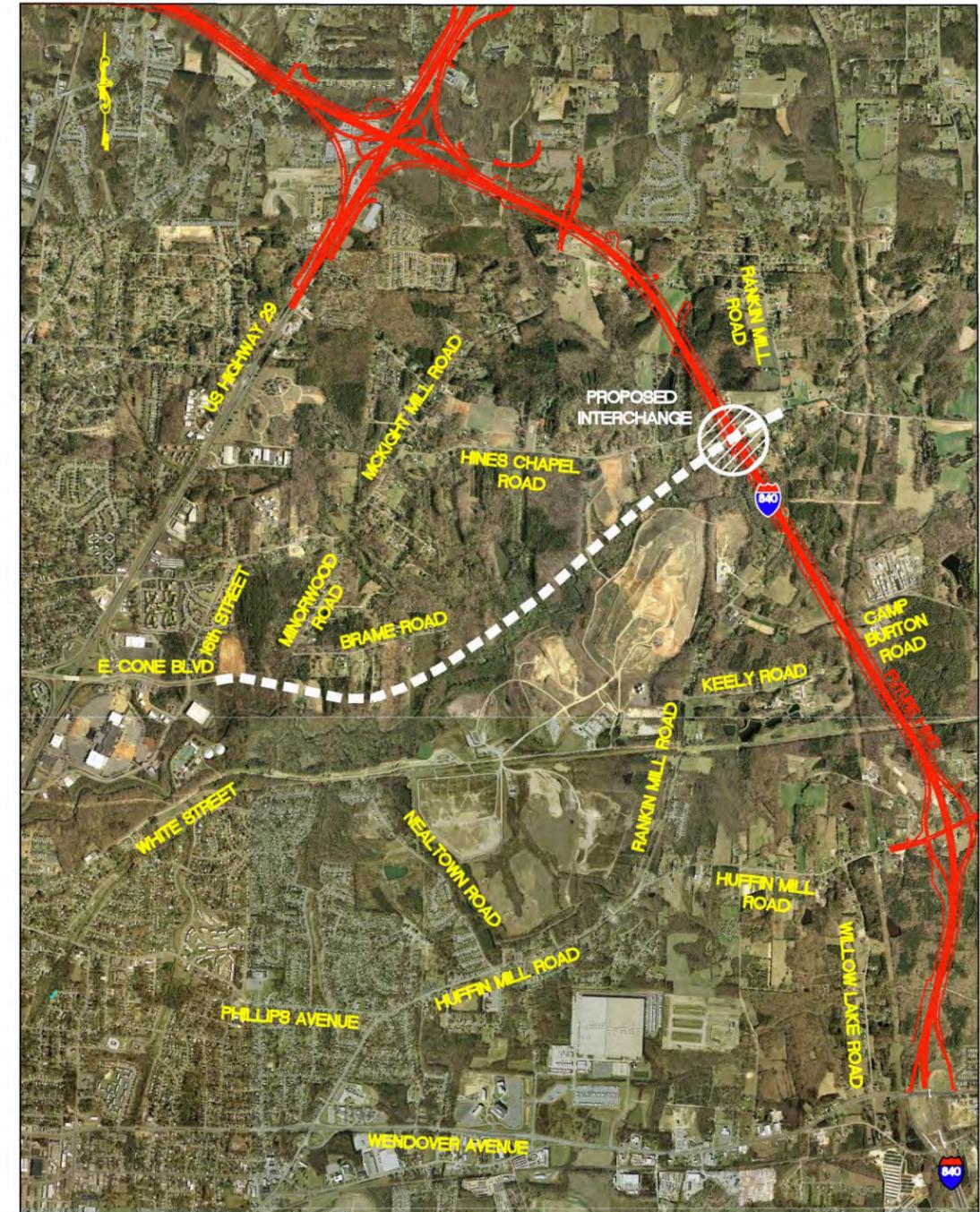


### 3. Pilot Evaluation of Transportation Infrastructure Project

During the spring of 2013, Governor McCrory shared insights for an Associated Press published article that indicated that transportation infrastructure enhancements would be viewed more as a tool to improve the economy than merely improving mobility and safety in the future. In June 2013, the NC General Assembly adopted the Strategic Mobility Formula as a new way to fund and prioritize transportation projects for maximum benefit to the State.

The primary intent of this pilot process is to provide the City and the MPO a consistent, flexible framework to assess community needs on a more holistic basis by evaluating multiple desired project outcomes. Written in a way that can be used by the layman or the transportation professional, this pilot process can be used as a guide to evaluate transportation infrastructure investments under multiple scenarios. This process should lead to a more balanced decision making process while acknowledging existing transportation deficiencies and potential economic development opportunities.

Richard Atkins, P.E., President of Triad Transportation, along with 8 other current and retired Highway Planners developed this matrix to evaluate transportation infrastructure improvements for economic development. We used the model to evaluate two alternatives: 1) the extension of East Cone Boulevard generally from 850 feet east of Sixteenth Street to Rankin Mill Road and 2) to extend East Cone Boulevard generally from 850 feet east of Sixteenth Street to Rankin Mill Road plus construct a new interchange at I-840. The resulting economic impact is impressive and validates the approach for other projects. This model is designed to assist elected officials in evaluating roadway improvements for economic development purposes.



#### 4. East Greensboro Transportation Infrastructure Identification Study

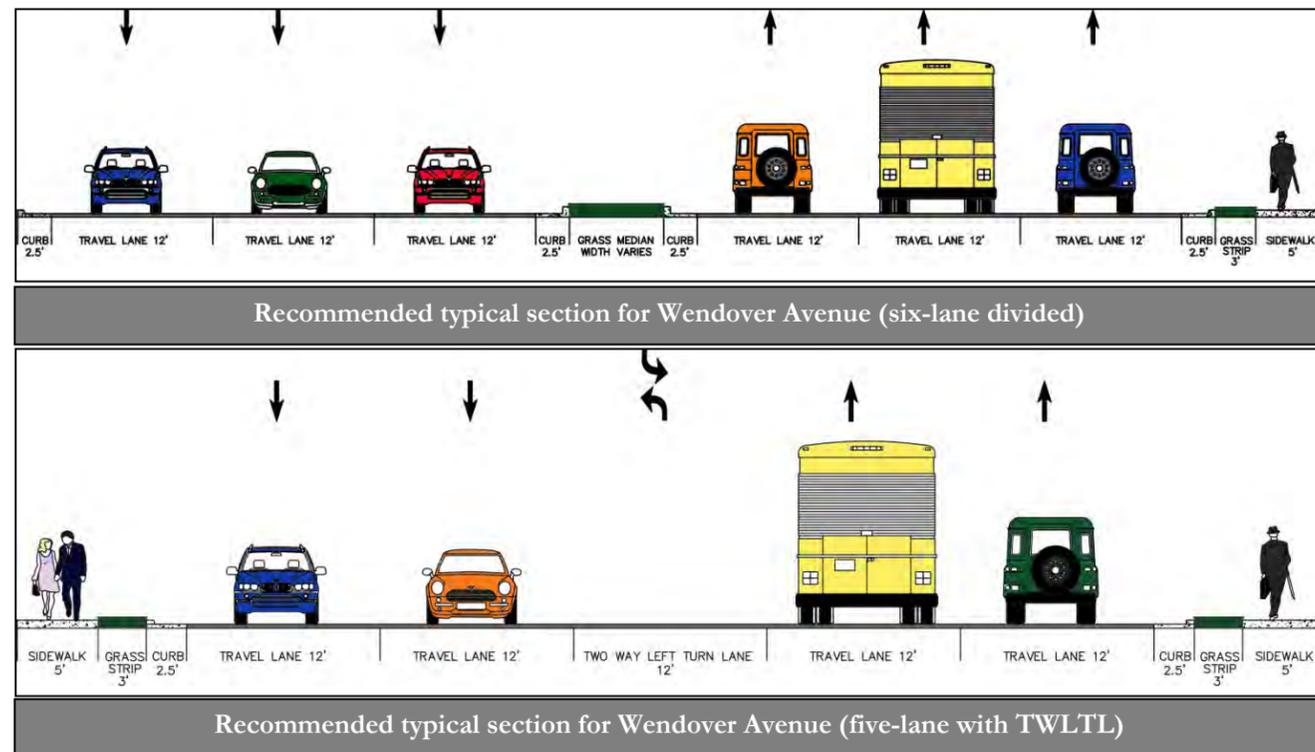
##### Transportation Study Summary

Davenport is a locally owned, M/SDBE certified company providing transportation services for the Triad. Frank Amenya, PE, PTOE took the lead for the firm. Davenport was asked to take the development study by Havener and comment on ways to increase connectivity, access, pedestrian utilization and existing roads and interchanges. The transportation study analyzed traffic volumes that can be expected in the future with the development of the East Greensboro Economic Development Site, and gave recommendations on the roadway cross-sections that will be needed to accommodate future traffic volumes. Also, the section of Wendover Avenue in the vicinity of Willowlake Road will serve as a “gateway” to the site, and hence was reviewed to determine the improvements that may be needed to provide access on Wendover Avenue. This study also reviewed the feasibility of a roundabout at the future intersection of Keeley Park Road (formerly known as White St) at Rankin Mill Road. The following is a summary of the recommendations from this transportation study.

##### Recommendations

##### US 70 (Wendover Avenue)

We recommend providing a six-lane divided to the east of Flemingfield Road. This includes three (3) travel lanes and curb and gutter in each direction, and a grass strip and sidewalk on one side due to limited right of way. To the west of Flemingfield Road, a five-lane section is recommended. This includes two (2) travel lanes, a center two-way-left-turn lane (TWLTL), curb and gutter, and sidewalk on each side. The recommended typical sections are shown below.



##### Commercial Accesses on Wendover Avenue

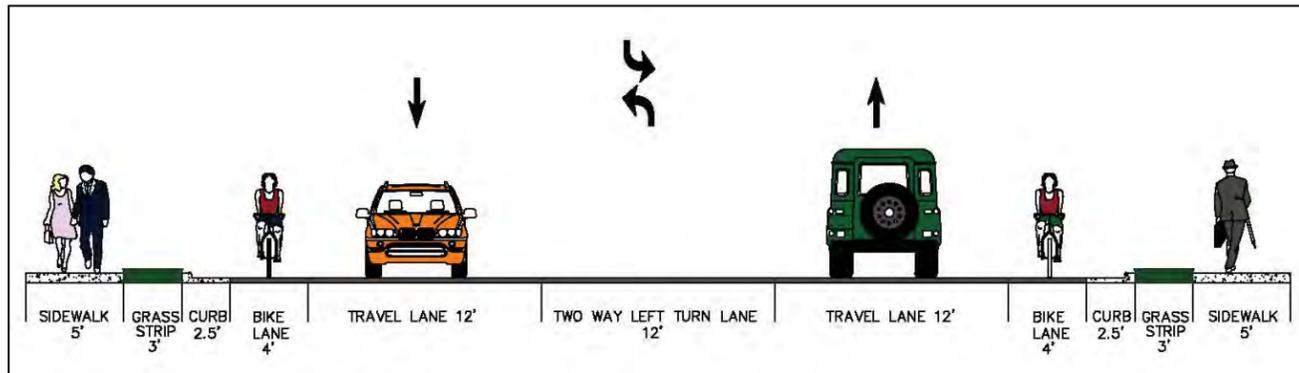
- The heavy traffic volumes on Wendover Avenue, heavy site trips to the development area, and the limited distance between intersections along Wendover Avenue create challenges to accommodating access on Wendover Avenue. We have prepared two (2) concepts for consideration: a signalized “power left” and a full access signalized intersection at Willowlake Road.
- **Concept 1** consists of a signalized “power left” at Willowlake Road. This scenario allows Willowlake Road to be maintained at its current location by installing a simple 2-phase traffic signal at Willowlake Road and restricting left turns from Wendover Avenue. The proposed traffic signal at Greensboro Urban Loop Southbound Ramps is located approximately 700 feet from Willowlake Road. A traffic signal is also envisioned at the site access on Wendover Avenue between Willowlake Road and Flemingfield Road.
- **Concept 2** consists of a **full access** signalized intersection at Willowlake Road. In order to allow full access, Willowlake Road will need to be relocated to the west to provide 1000 feet of separation between Willowlake Road and the future traffic signal at the Greensboro Urban Loop Southbound Ramps. A directional crossover (left out prohibited) is also envisioned at the site access on Wendover Avenue between Willowlake Road and Flemingfield Road. This scenario will involve costs including, but not limited to, right of way and construction costs to relocate Willowlake Road at Wendover Avenue.



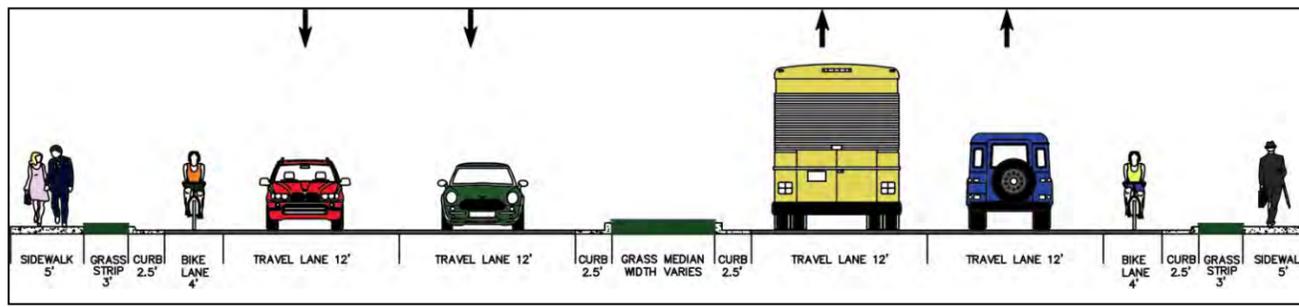
- ◆ We are aware of a potential retail development at the northeast quadrant of the intersection of Wendover Avenue and Willowlake Road. We have presented these two (2) concepts for intersection improvements based on a planning level of information. However, there will be the need for a detailed traffic analysis to determine the type of access that can be allowed at this potential retail development.

### Huffine Mill Road

To the west of Nealtown Road, a three-lane section is recommended. This includes one (1) travel lane in each direction, a center TWLTL, curb and gutter in each direction, bike lane in each direction, and a grass strip and sidewalk on each side. To the east of Nealtown Road, a four-lane divided section is recommended. This includes two (2) travel lanes and curb and gutter in each direction, a bike lane on each side, a grass strip and sidewalk on each side, and a landscaped median. The landscaped median will improve aesthetics and help to create an 'academic' style along Huffine Mill Road. The recommended typical sections are shown below.



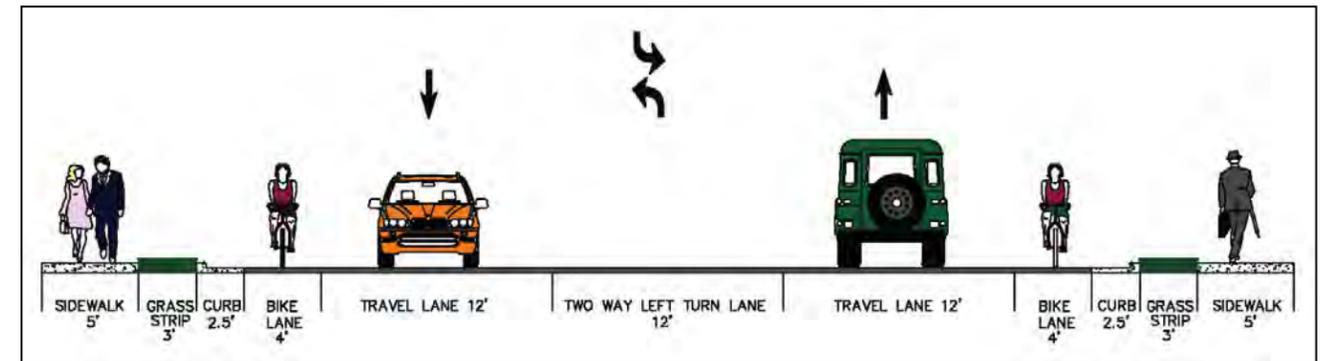
Recommended typical section for Huffine Mill Road (three-lane with TWLTL)



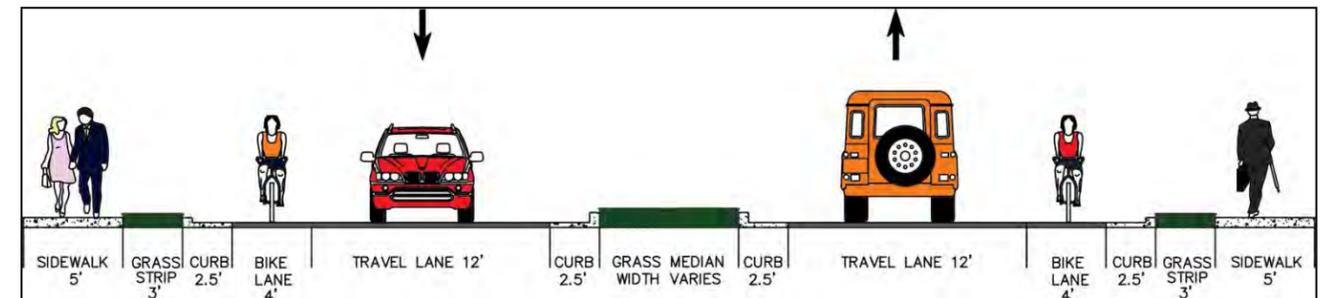
Recommended typical section for Huffine Mill Road (four-lane divided)

### Flemingfield Road

On the southern portion of Flemingfield Road, which is primarily commercial, we recommend a 3 lane section, including one (1) travel lane in each direction, a center TWLTL, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction. On the northern portion of Flemingfield Road, which is primarily residential, we recommend a 2 lane divided section. This includes one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median.



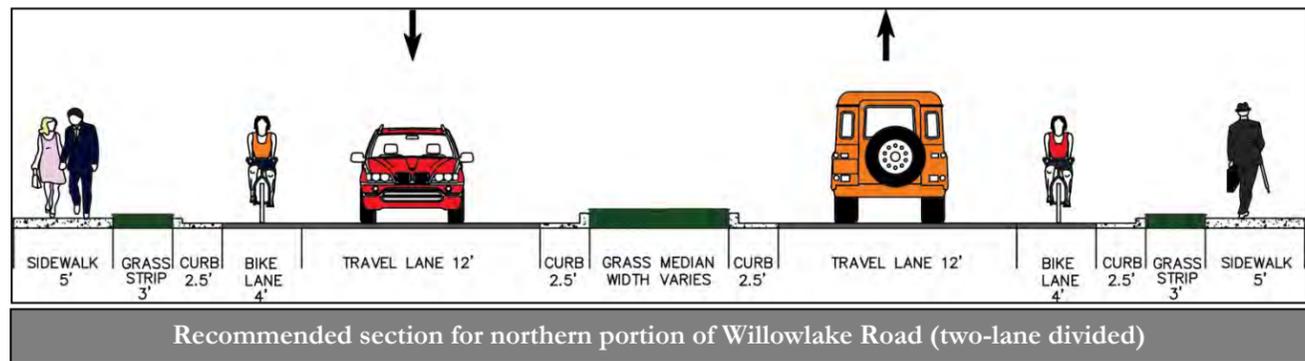
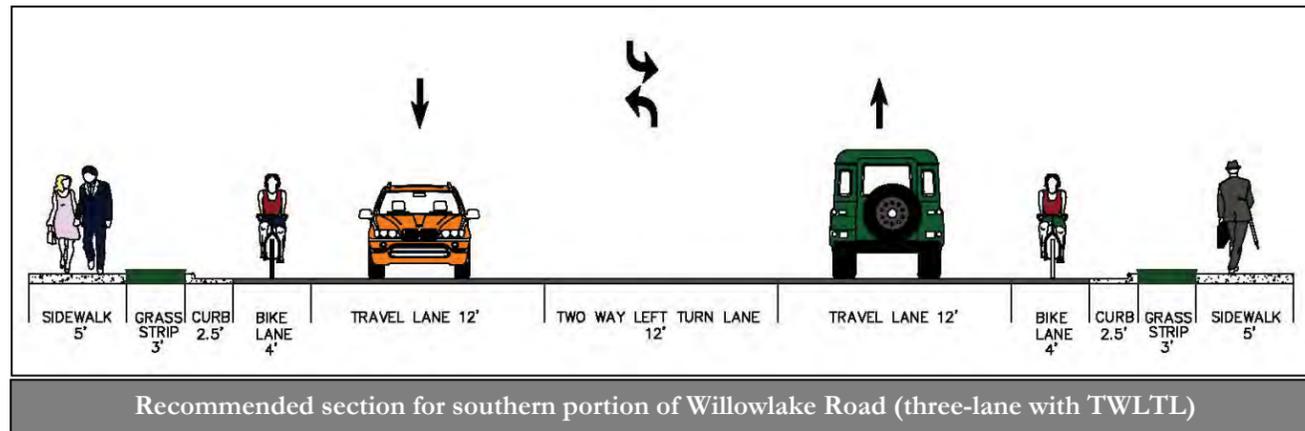
Recommended section for southern portion of Flemingfield Road (three-lane with TWLTL)



Recommended section for northern portion of Flemingfield Road (two-lane divided)

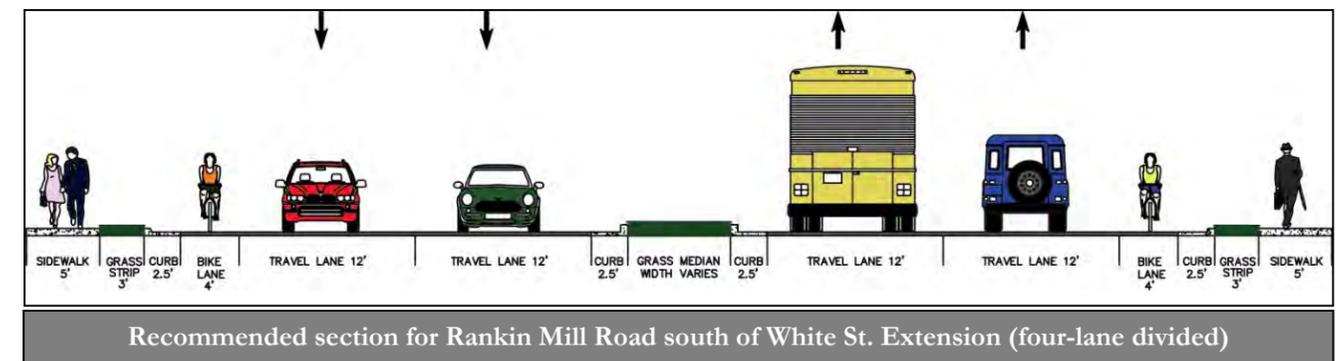
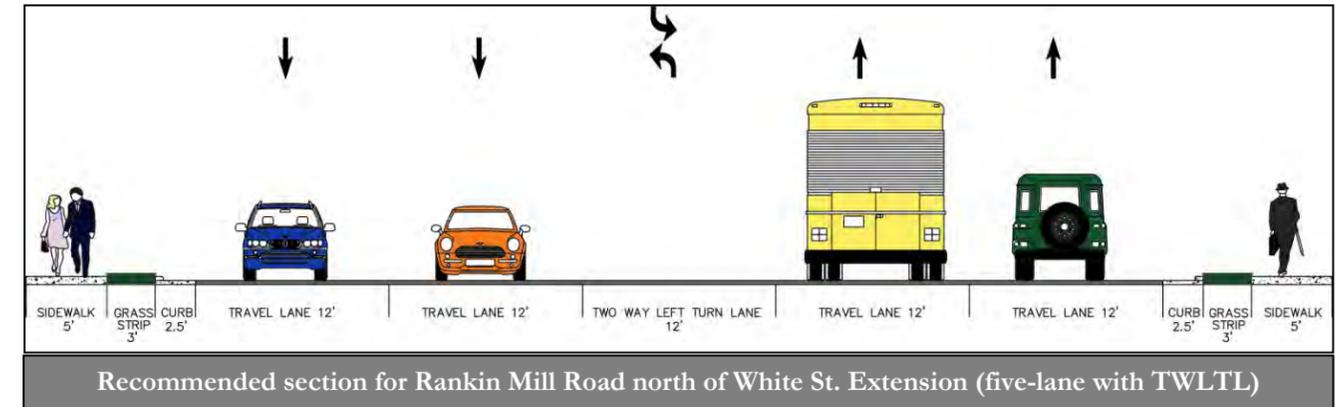
**Willowlake Road**

To the south of the South Buffalo Creek, which passes under Willowlake Road approximately 2,000 feet north of Wendover Avenue, we recommend a 3 lane section, including one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, as well as a TWLTL. On Willowlake Road from north of the South Buffalo Creek to Rankin Mill Road, we recommend a 2 lane divided section. This includes one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median.



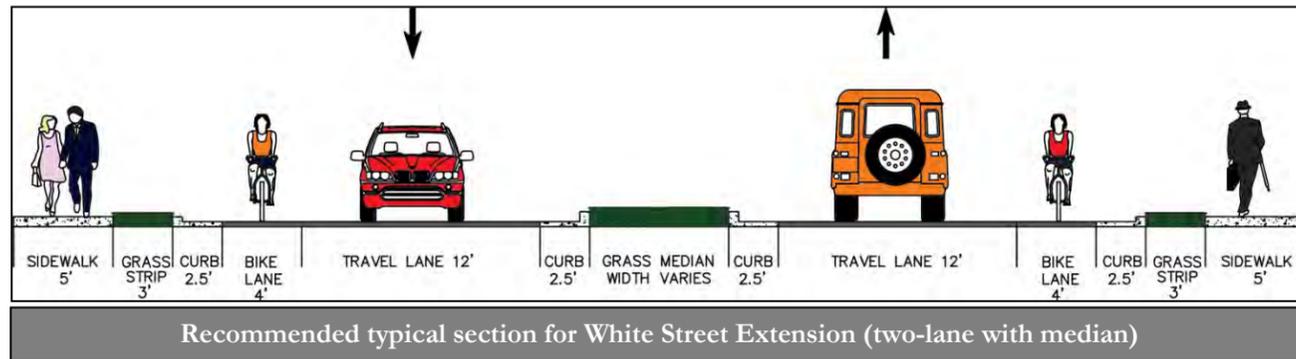
**Rankin Mill Road**

On Rankin Mill Road to the north of White Street Extension, we recommend a five-lane section, including two (2) travel lanes in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, as well as a TWLTL. To the south of White Street Extension, we recommend a four-lane divided section. This includes two (2) travel lanes in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median.



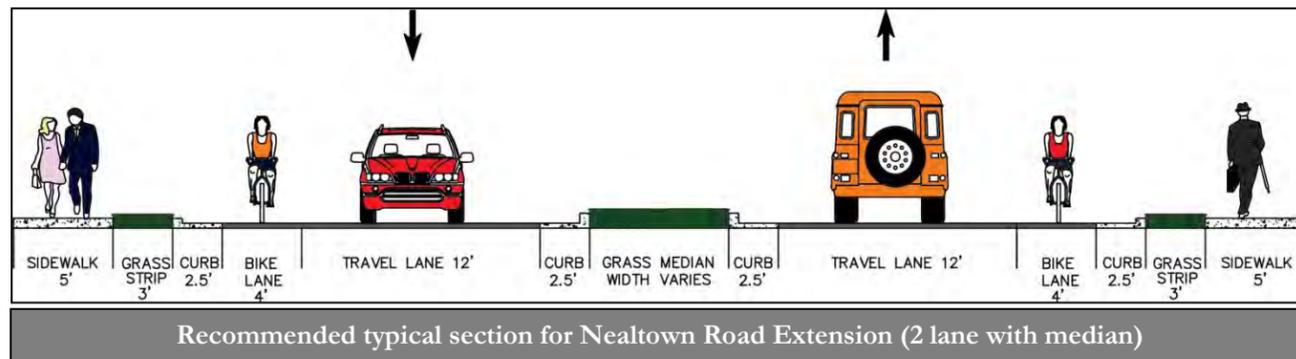
### White Street / White Street Extension

It is recommended that White Street Extension be constructed as a two-lane section with a divided median. The typical section should include one (1) travel lane, a bike lane, new curb and gutter, new sidewalk and grass strip in each direction, and a grass median.



### Nealtown Road / Nealtown Road Extension

On Nealtown Road between Huffine Mill Road and White Street, we recommend a two (2) lane section with a divided median. The typical section should include one (1) travel lane, a bike lane, new curb and gutter, new sidewalk and grass strip in each direction, and a grass median.



### Intersection of White Street Extension at Rankin Mill Road

It was considered that a roundabout would be an ideal configuration for this intersection, due to the lower long-term maintenance costs as compared to a traffic signal. Analysis results show that this intersection may be constructed as a single lane roundabout in the short term. However, the capacity should be reserved to expand the intersection to a two (2) lane roundabout at full build out of the study area. Further design of this intersection will be needed. Also, the East Greensboro Economic Development Plan calls for a roundabout at the intersection of Huffine Mill Road and Willowlake Road. Further analysis will be needed for this intersection.

### Potential Pedestrian Route under Greensboro Urban Loop Bridge

The NCDOT plans for TIP U-2525B show a bridge on the Greensboro Urban Loop traversing Camp Burton Road and the future White Street Extension. This overpass will provide the opportunity for a pedestrian path running east and west, under the bridge on the Greensboro Urban Loop. This area is expected to feature a sports park and other recreation areas. A pedestrian connection in this area could provide economic, recreational, and other benefits for pedestrians and cyclists traveling in this area. Further study will be needed to determine the feasibility and appropriate location and design of this pedestrian path.

## Recommendations

### 1. Additional Conceptual Development Plans

Additional Conceptual Development Plans should be prepared for the five potential Industrial/Corporate Park areas adjacent to the planned interchange at Huffine Mill road and I-840. These areas appear to have the most immediate development potential due to the proposed transportation improvements as well as existing and proposed utility infrastructure.

### 2. Sports Park Study

Our study identified approximately 120 acres adjacent to Keeley Park which includes land from the now closed prison property. This additional property as a softball or lacrosse destination may act as an economic driver to the area in addition to the Bryan Park Sports Park located further north on Highway 29. Impacts of small commercial, hotels and other tourist related industry could provide a game changing attitude in the area.

### 3. Landfill Energy and Technology Center

The Landfill Energy and Technology Center would be situated on the area adjacent to Phase III where borrow dirt was used for the landfill. Because the Solid Waste Commission is newly formed and has not met on this subject, it is felt that this area should be revisited. It is recommended that the Solid Waste Commission begin discussions regarding the future use of land at the Landfill for economic development. The area under consideration is shown below.



#### 4. Transportation Planning

In addition to the general recommendations provided in this report, the following potential next steps are recommended:

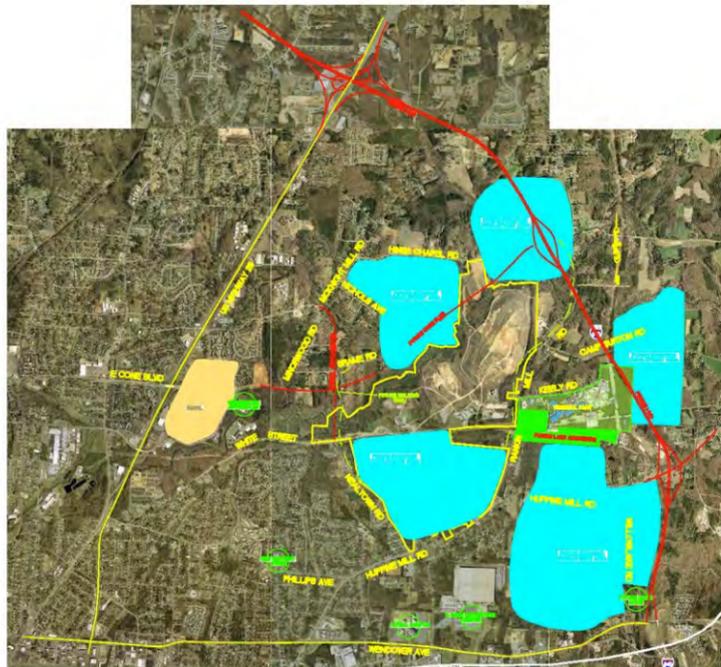
1. Develop cost estimates and a prioritization of the proposed transportation improvements.
2. A detailed analysis of the Huffine Mill Road, Willow Lake Road and Wendover Avenue transportation network due to the potential retail development currently under consideration in this area.
3. Further analysis of the extension of White Street and its intersection with Rankin Mill Road.

#### 5. Evaluation of Future Transportation Infrastructure Projects

The pilot evaluation model prepared by TTP appears to be a good first step in helping elected officials make better transportation decisions regarding transportation infrastructure investments which promote sustained economic development.

#### 6. Incorporation into East Greensboro "High-Impact Zone"

At the request of the Greensboro Economic Development Staff, the Evans Team provided the map shown below for discussion of a "High-Impact Zone" in this area. Future discussion regarding a Prosperity Zone as an incentive for business development in East Greensboro should incorporate the data developed in this Study.



#### 7. Sharing of Staff's East Greensboro Infrastructure Readiness Data

Greensboro Staff is currently developing an East Greensboro Infrastructure Readiness Study that includes data for both public and private utilities. It is recommended that as this information becomes available, this data will be shared with the Evans Team so that we may more completely evaluate the feasibility of our future recommendations.

#### 8. Next Steps for Two Conceptual Development Plans

##### ◆ Reedy Fork West Conceptual Development Plan

This property is currently zoned to allow development as generally depicted on the Conceptual Plan. Next steps to determine the near term development potential of this site should include:

1. The feasibility of extending public water and sewer to the interior of the property.
2. The evaluation of private utilities for the site to include power, fiber optic and gas.
3. The evaluation of possible widening and/or turn lanes for Summit Avenue and/or Brown Summit Road.
4. The evaluation of Chickasha Drive in terms of suitability for industrial traffic loads.
5. Prepare an opinion of probable cost to get the most economical building site "pad ready" for future development.

##### ◆ Hines Chapel Road Conceptual Development Plan

This property would need to be rezoned to allow development as generally depicted on the Conceptual Plan. Next steps to determine the near term development potential of this site should include:

1. The feasibility of extending public water and sewer to the interior of the property.
2. The evaluation of private utilities for the site to include power, fiber optic and gas.
3. The preparation of an opinion of probable cost for the extension of Cone Boulevard through this property.
4. Prepare an opinion of probable cost to get the most economical building site "pad ready" for future development.

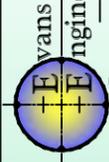
# HUFFINE MILL ROAD FUTURE LAND USE AND TRANSPORTATION PLANNING CONCEPT

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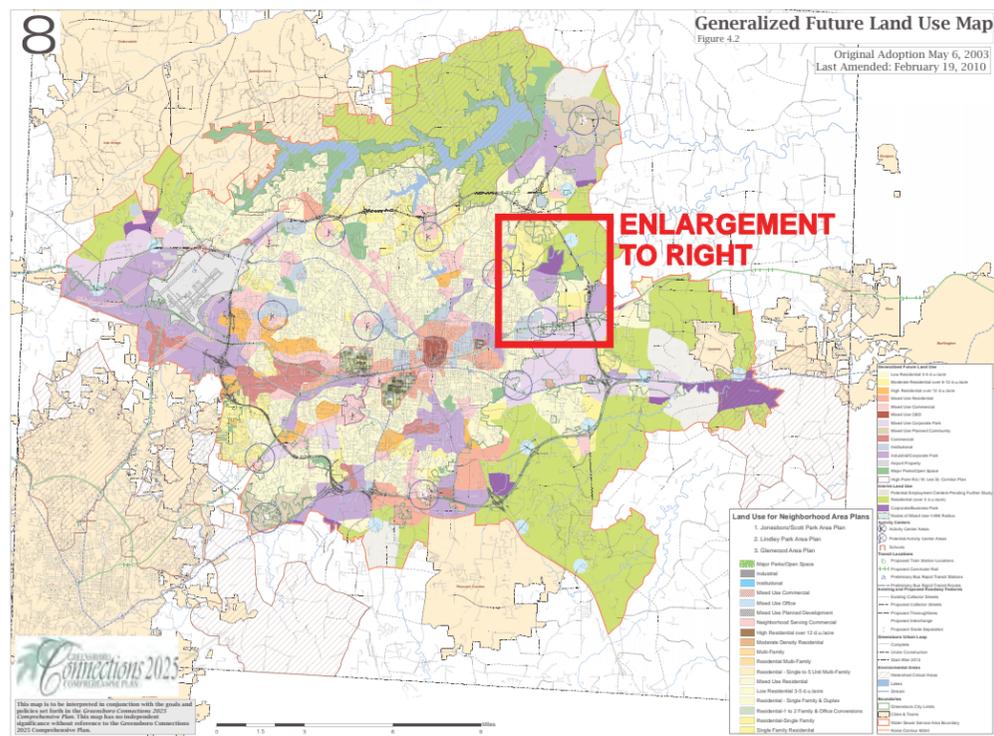


HUFFINE MILL ROAD FUTURE LAND USE AND TRANSPORTATION PLANNING CONCEPT

THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



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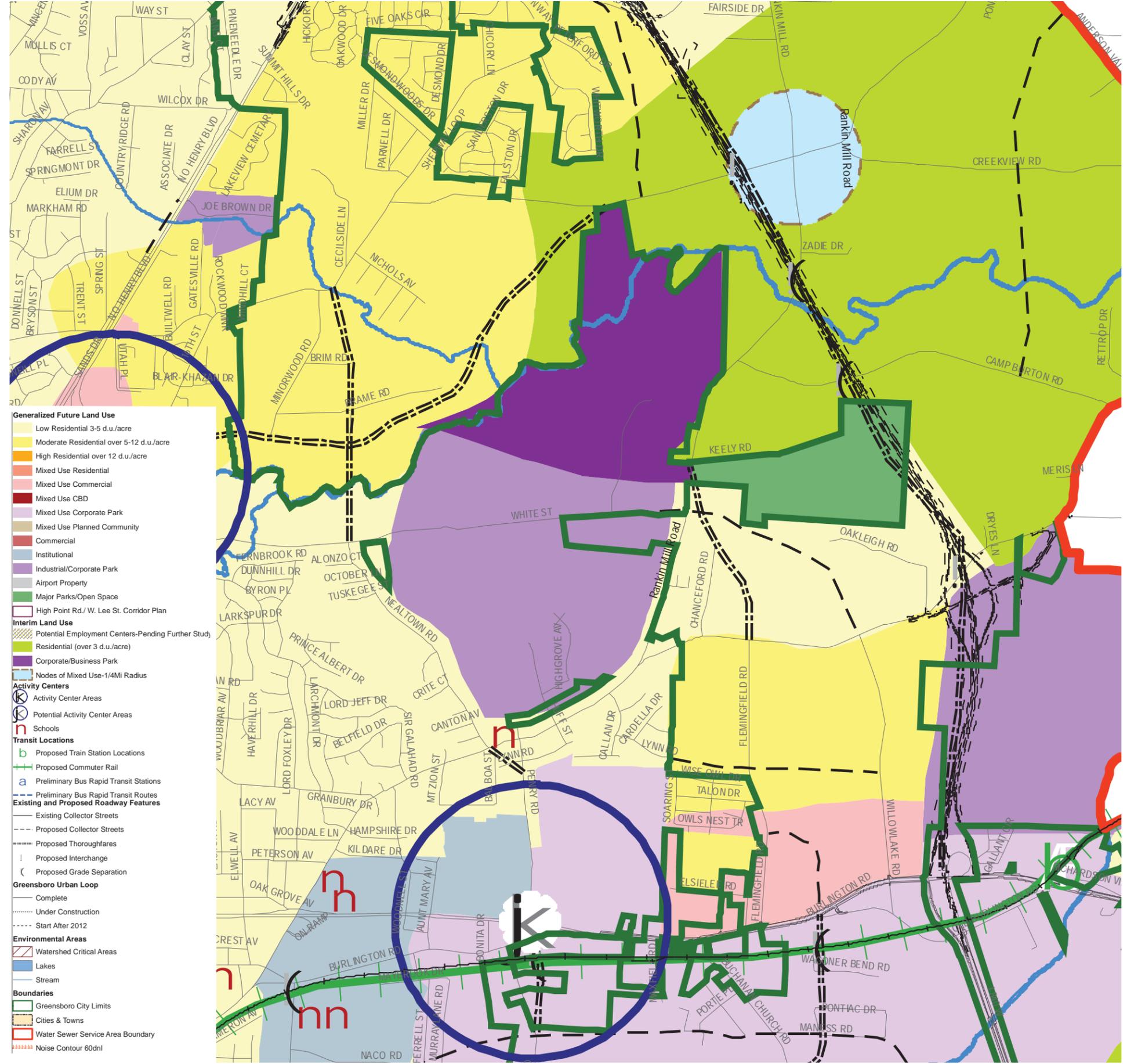
### City of Greensboro Generalized Future Land Use Map

**Narrative of Existing Conditions:**

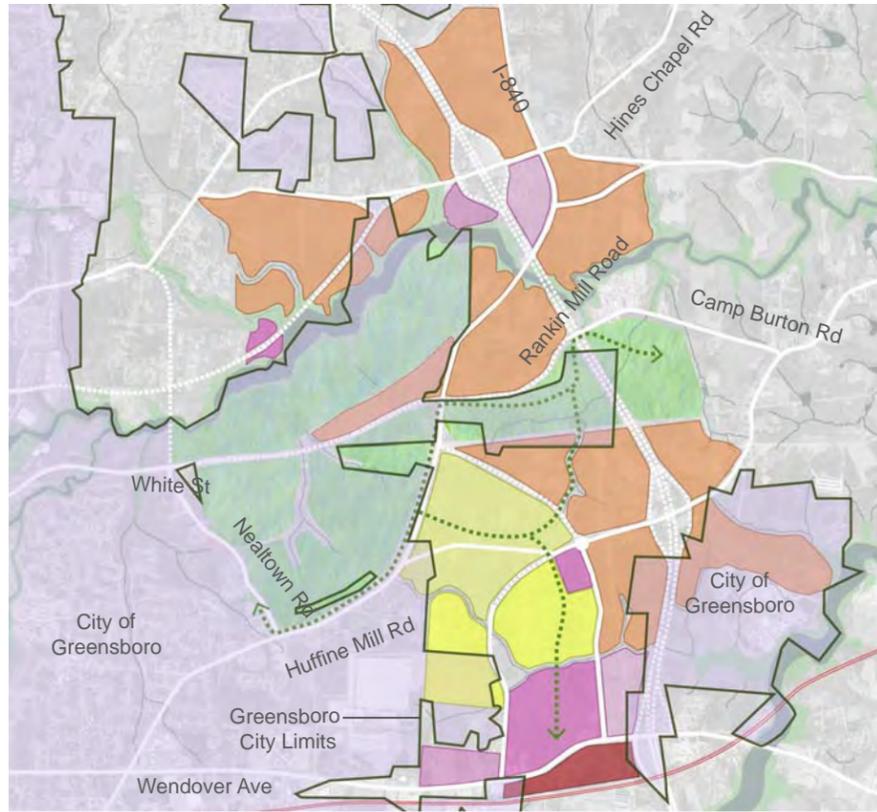
The area examined in the following land use and transportation planning concept is located 4 miles northeast of downtown Greensboro and is centered along the existing route of Huffine Mill Road. The area is bounded to the south by Wendover Avenue, Burlington Road, and Highway 70; to the west by Nealtown Road; to the north by McKnight Mill Road, Hines Chapel Road, and Link Road; and to the east by Rankin Mill Road, Creekview Road, Camp Burton Road, Huffine Mill Road, and the south branch of Buffalo Creek.

The concept area has several major thoroughfares; including Wendover Avenue/Burlington Road/and Highway 70, and I-840 and the I-840 future extension. The connection created by the Wendover Avenue/Burlington Road/and Highway 70 corridor connects Greensboro and Burlington. The existing route of I-840 travels south to I-85/I-40 and the future I-840 extension connects to North Cherry Boulevard/Highway 29. A section of the North Carolina railroad Company line runs east-west along the southern edge of the concept area and could potentially connect the site to the center of Greensboro and the rest of the "Carolina Crescent." The concept area is also contained between two branches (north and south) of Buffalo Creek and has several smaller tributaries that flow into Buffalo Creek. Buffalo Creek is a headwater stream of the Cape Fear River Basin.

Currently, the approximately 3,000 of acres that fall within the study area consist mainly of the following zoning districts; low and moderate residential, mixed used commercial, mixed use corporate park, industrial/corporate park, corporate/business park, institutional, and major parks/open space. Generally, the western, north eastern, and center sections of the concept area is low to moderate residential. The southern and northern sections are zoned institutional, mixed use corporate park, mixed use commercial, industrial/corporate park, and corporate/business park. These areas (institutional, corporate, industrial) tend to be located around Highway 70/ Burlington Road, White Street, and I-840.



Existing City of Greensboro Generalized Future Land Use Map  
2013-08-30



**Huffine Mill Road Future Land Use and Transportation Planning Concept**

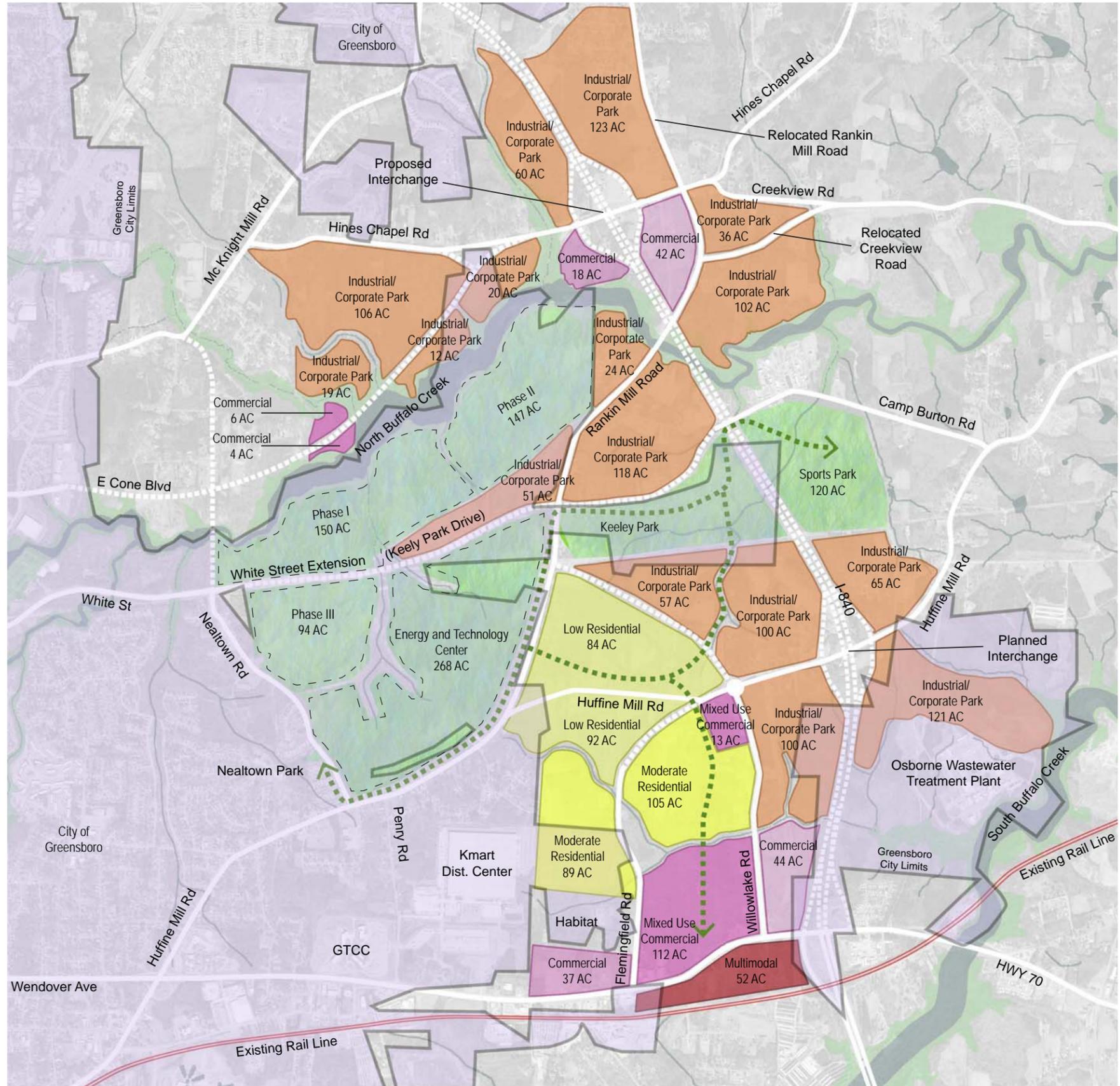
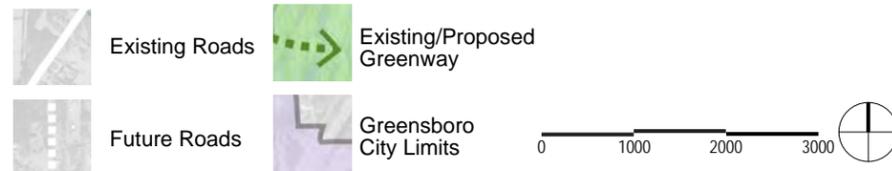
**Proposed Concept Narrative:**

The area adjacent to the existing and proposed I-840 interchange with Hwy 70 should be viewed as a gateway to east Greensboro. Therefore, the densest development and the highest land values should be located in this section of the study area, with lower density and values radiating from this node. This approach to the city would consist of moderately spaced residential neighborhoods, mixed use communities, and a multimodal hub that takes advantage of the existing road and rail infrastructure locations.

Adjacent to these residential and commercial neighborhoods are areas consisting of light industrial land uses, the existing Keeley Park, a large sports park, and an energy and technology center. The northern half of the study area consists of heavy industrial and small parcels of commercial areas which take advantage of the planned I-840 interchange.

The main differences between this concept and the Greensboro Generalized Future Land Use Map are as follows: 1.) the Energy and Technology Center replaces the Industrial/Corporate Park zoning in the center of the concept area; 2.) the existing commercial, residential, and mixed use shifts and becomes more dense at the Highway 70 and I-840 intersection; 3.) a multimodal zone has been created between Highway 70, I-840, and the North Carolina railroad Company rail line; 4.) Keeley Park has been expanded to include a proposed sports park and greenway system; 5.) proposed Industrial/Corporate Park zoning has replaced residential zones along the future extension of I-840.

**Legend:**

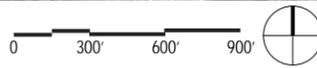


**Huffine Mill Road Future Land Use and Transportation Planning Concept**

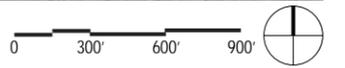
2013-08-30



**Mixed Use Commercial -**  
Biltmore Town Square Park, Asheville, NC  
64 Acres



**Mixed Use Commercial -**  
Southern Village, Chapel Hill, NC  
165 Acres



Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Mixed Use Commercial Case Studies  
2013-08-30



**Industrial / Corporate Park-**  
Hendersonville, NC  
41 Acres

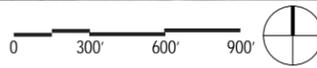


**Industrial / Corporate Park-**  
Hendersonville, NC  
45 Acres

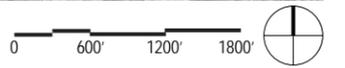
Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Industrial / Corporate Park Case Studies  
2013-08-30



**Industrial / Corporate Park-**  
Globe Center, Morrisville, NC  
96 Acres



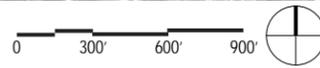
**Industrial / Corporate Park-**  
Westgate Road, Raleigh, NC  
675 Acres



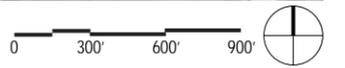
Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Industrial / Corporate Park Case Studies  
2013-08-30



**Low Density Residential -**  
Durham, NC  
107 Acres



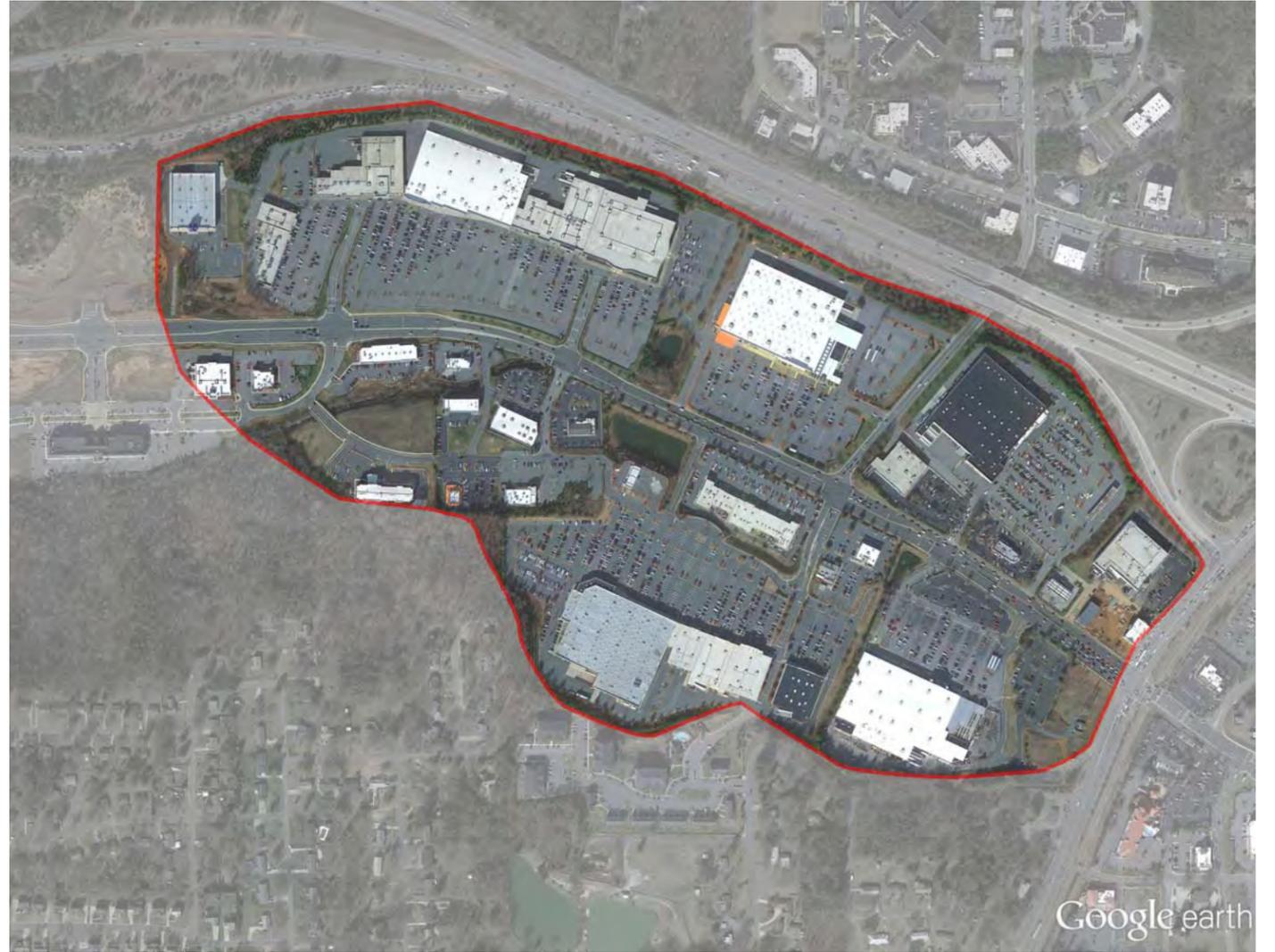
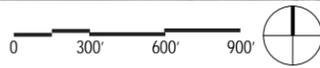
**Medium Density Residential -**  
Davidson, NC  
108 Acres



Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Residential Case Studies  
2013-08-30



**Commercial -**  
Briar Creek, Raleigh, NC  
113 Acres



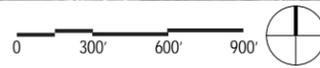
**Commercial -**  
Hanes Mall Blvd, Winston-Salem, NC  
174 Acres



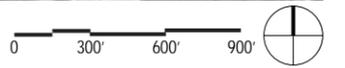
Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Commercial Case Studies  
2013-08-30



**Sports Park -**  
WRAL Soccer Complex, Raleigh, NC  
86 Acres



**Sports park -**  
USA Baseball, Cary, NC  
101 Acres



Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Case Studies  
2013-08-30



**Multimodal -**  
Reston, VA  
123 Acres



**Multimodal -**  
Atlanta, GA  
170 Acres

Huffine Mill Road Future Land Use  
and Transportation Planning Concept  
Multimodal Case Studies  
2013-08-30

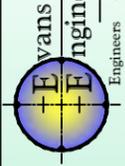
# CONCEPTUAL DEVELOPMENT PLAN STUDIES

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CONCEPTUAL DEVELOPMENT PLAN STUDIES

THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



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# REEDY FORK WEST CONCEPTUAL DEVELOPMENT PLAN

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**LEGEND**

**100-YR FLOOD**



**FLOODWAY**

GRAPHIC SCALE

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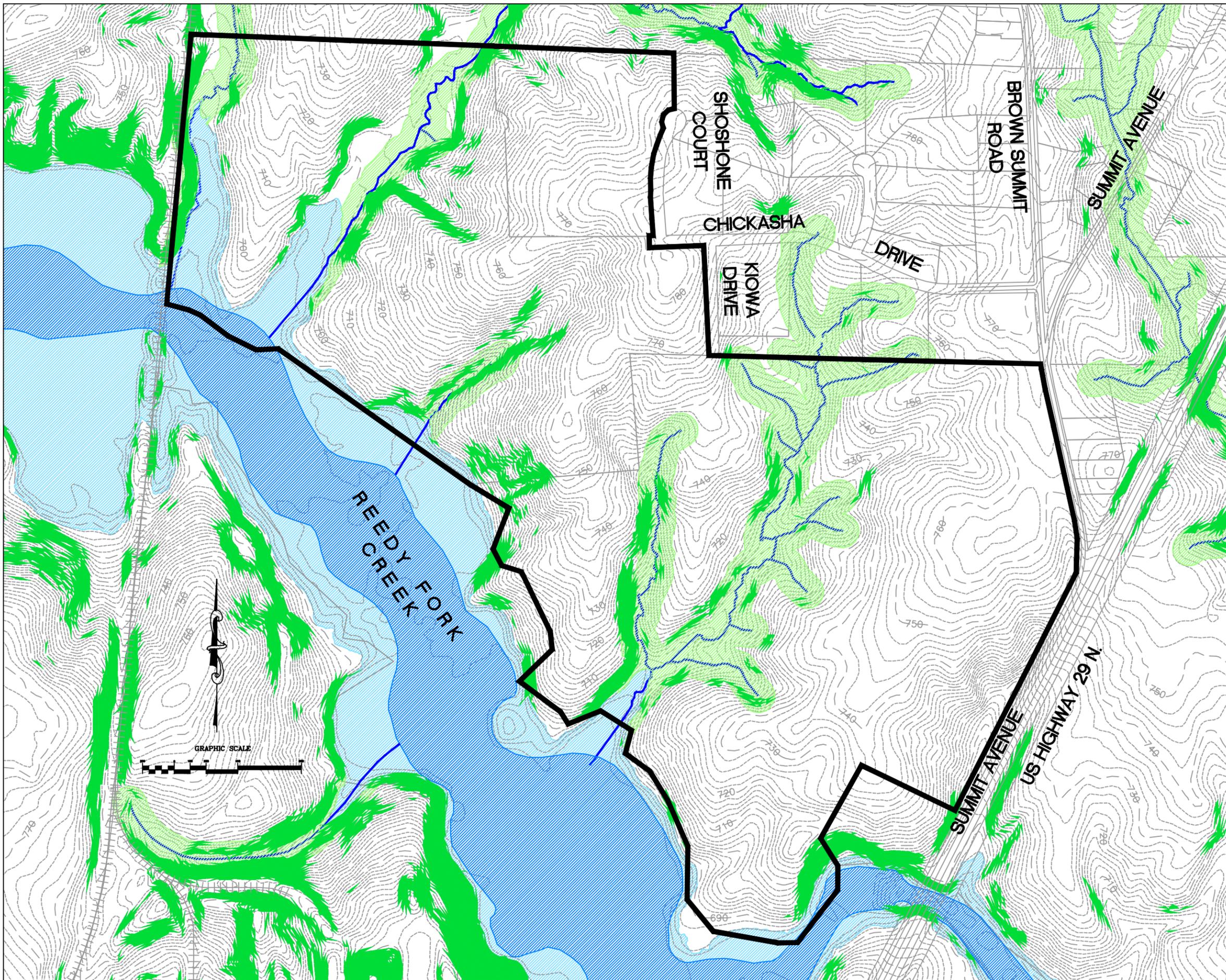
SEPTEMBER 17, 2013

REEDY FORK WEST CONCEPTUAL DEVELOPMENT STUDY - AERIAL MAP

**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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- LEGEND**
- 100-YR FLOOD 
  - FLOODWAY 
  - STREAM BUFFERS 
  - SLOPES GREATER THAN 15% 

**SITE DATA:**  
 TOTAL AREA: ±400 ACRES  
 DEVELOPABLE AREA: ±291 ACRES

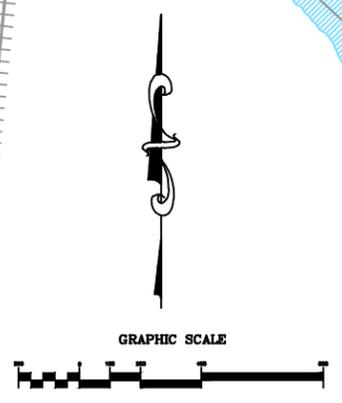


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SEPTEMBER 17, 2013

REEDY FORK WEST CONCEPTUAL DEVELOPMENT STUDY - CONSTRAINTS MAP  
 THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY  
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**LEGEND**  
 100-YR FLOOD   
 FLOODWAY 

**SITE DATA:**  
 TOTAL AREA: ±400 ACRES  
 DEVELOPABLE AREA: ±291 ACRES  
 BUILDING SQUARE FOOTAGE SHOWN: 3,305,000 SF

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 SEPTEMBER 17, 2013

REEDY FORK WEST CONCEPTUAL DEVELOPMENT PLAN - CONCEPTUAL LAYOUT  
**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**  



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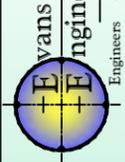
# HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT PLAN

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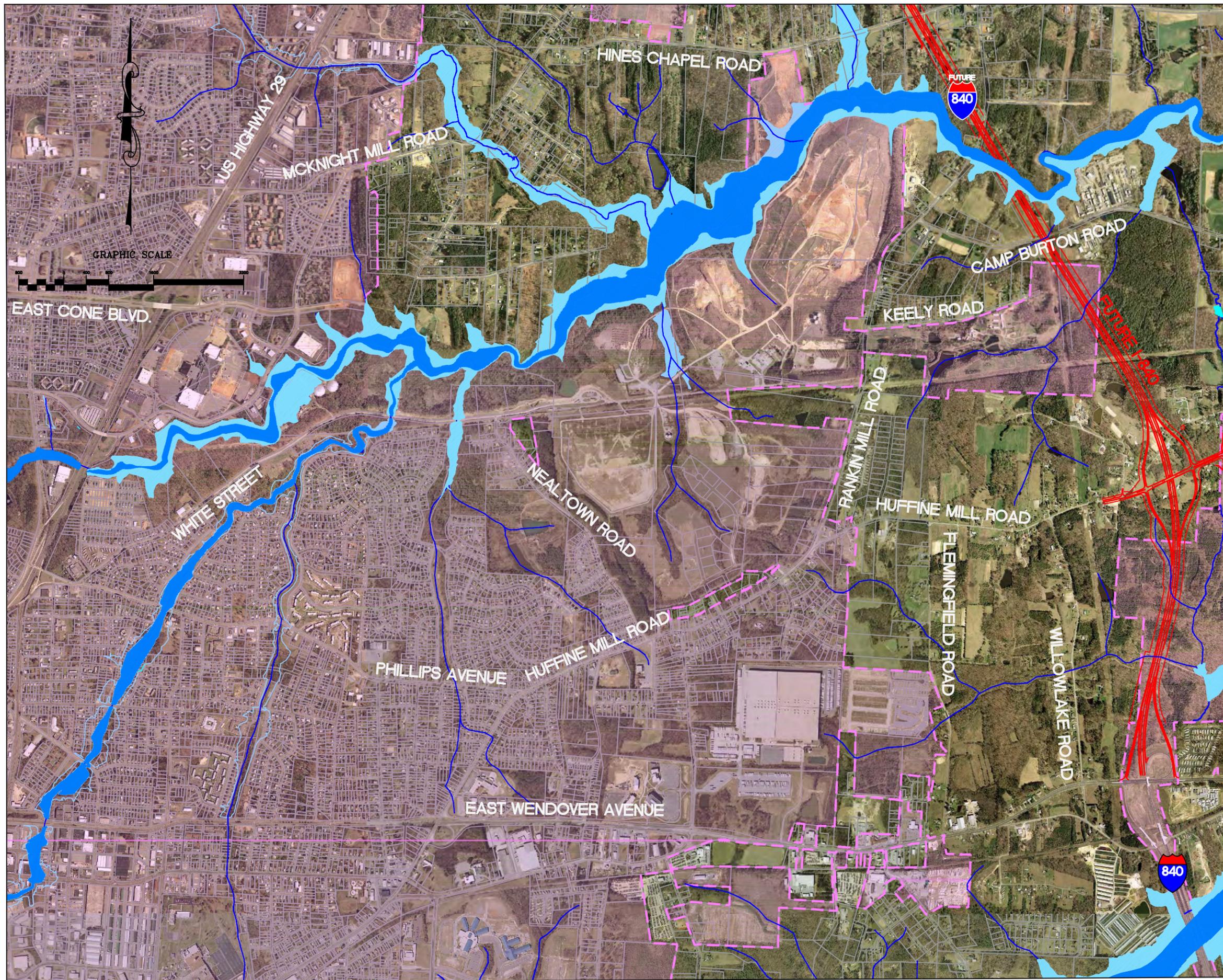


HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT PLAN

THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY

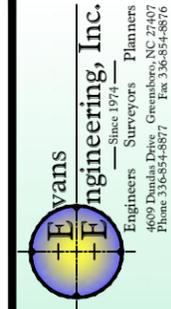


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**LEGEND:**

- 100-YR FLOOD
- FLOODWAY
- AREA IN THE CITY LIMITS



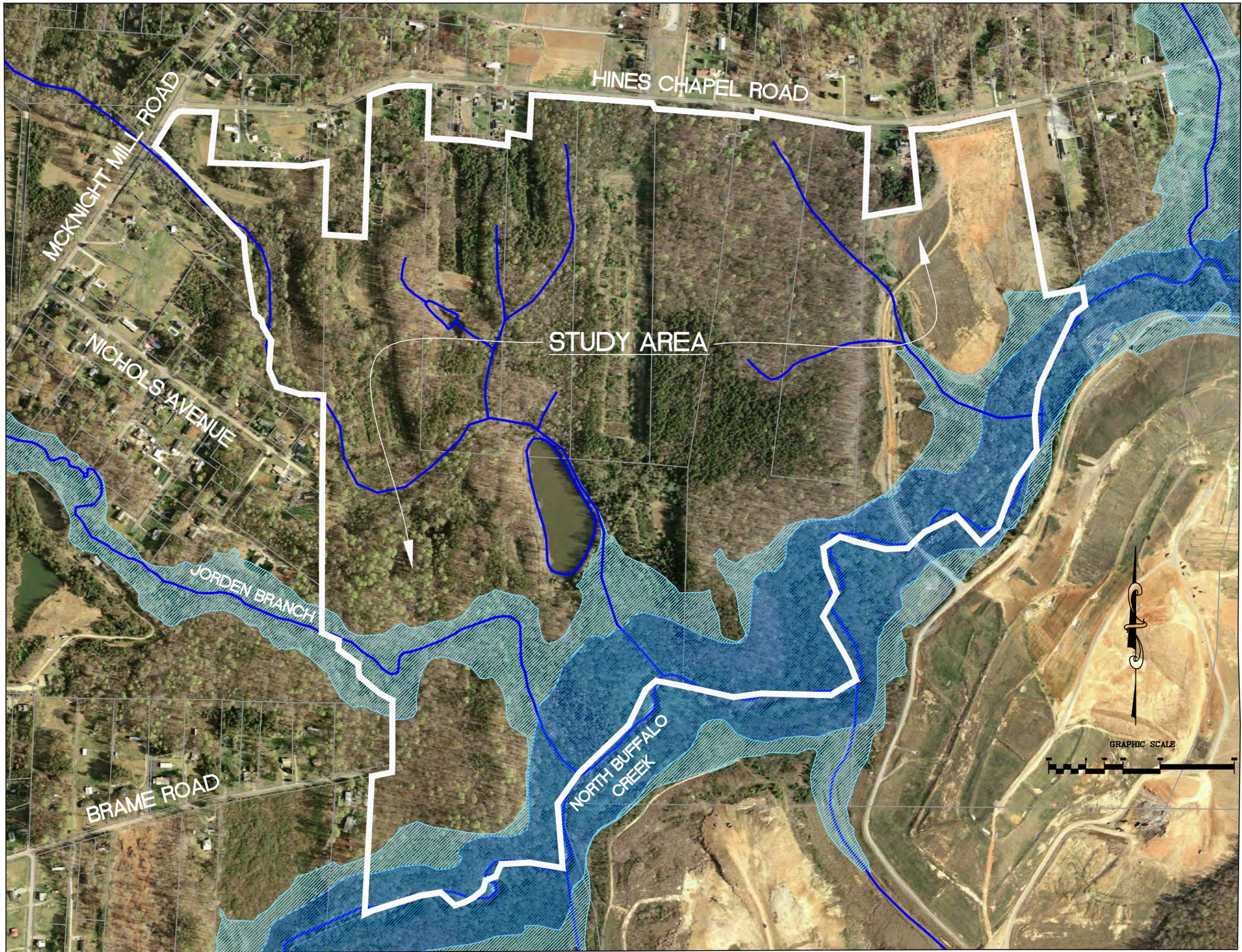
**HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT PLAN - OVERALL MAP**  
**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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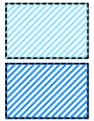
SEPTEMBER 17, 2013

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**LEGEND**

**100-YR FLOOD**



**FLOODWAY**

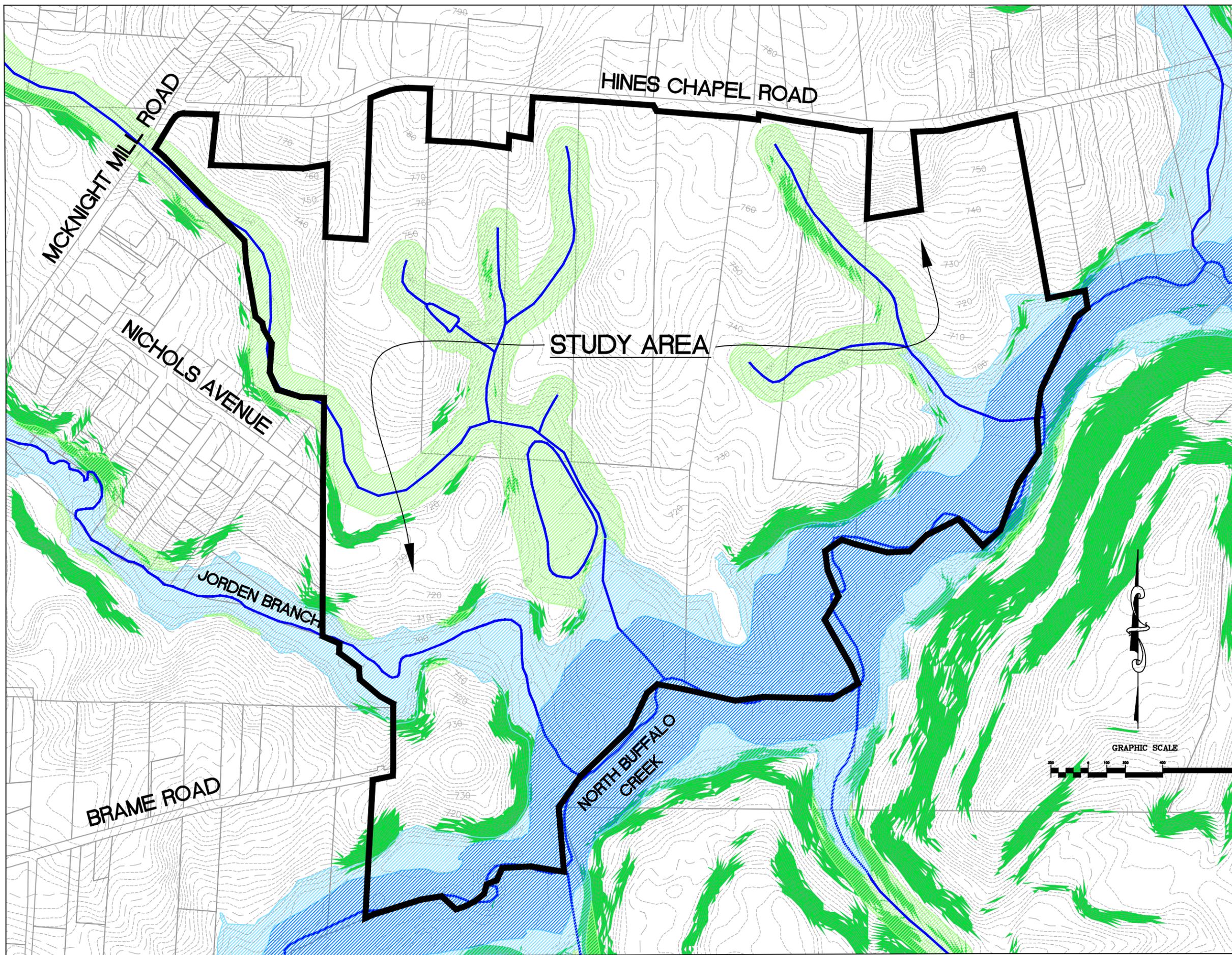


**HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT PLAN - AERIAL MAP**  
**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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SEPTEMBER 17, 2013



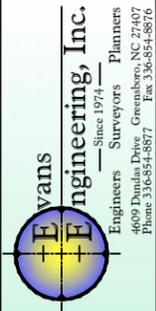
**LEGEND**

- 100-YR FLOOD 
- FLOODWAY 
- STREAM BUFFERS 
- SLOPES GREATER THAN 15% 

**SITE DATA:**

TOTAL AREA: ±288 ACRES

DEVELOPABLE AREA: ±171 ACRES



HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT STUDY - CONSTRAINTS MAP  
 THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
 AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



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SEPTEMBER 17, 2013



PROPOSED SANDERSON DR.  
PER APPROVED PRELIMINARY  
FOR THORTON SUBDIVISION

**LEGEND:**



**SITE DATA:**

- TOTAL AREA: ±288 ACRES
- DEVELOPABLE AREA: ±171 ACRES
- BUILDING SQUARE FOOTAGE SHOWN: 1,765,000 SF
- MULTI-FAMILY AREA: ±6.5 ACRES
- RETAIL AREA: ±2 ACRES

GRAPHIC SCALE



HINES CHAPEL ROAD CONCEPTUAL DEVELOPMENT STUDY - CONCEPTUAL LAYOUT  
**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
 AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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 SEPTEMBER 17, 2013

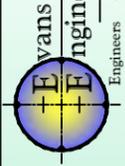
# LANDFILL ENERGY AND TECHNOLOGY CENTER

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LANDFILL ENERGY AND TECHNOLOGY CENTER

THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



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**LEGEND**

100-YR FLOOD



FLOODWAY



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**LANDFILL ENERGY AND TECHNOLOGY CENTER - DEVELOPMENT MAP**  
**THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE, AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY**



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SEPTEMBER 17, 2013

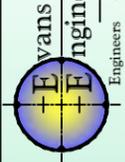
# PILOT EVALUATION OF TRANSPORTATION INFRASTRUCTURE PROJECT

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PILOT EVALUATION OF TRANSPORTATION INFRASTRUCTURE PROJECT

THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



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### Introduction

Transportation planning is undergoing a paradigm shift in the way problems are defined and solutions evaluated. The old paradigm assumed that a community's transportation investment priorities were primarily driven by the projected road user benefits using indicators such as the projected level of service, traffic speeds, and / or projected decreases in congestion delays. The new planning paradigm places a much greater emphasis on access to service and activities, multi-modal options, environmental quality, economic competitiveness, and public fitness and health. This shift appears to be driven by a combination of the state of the economy, declining trends in the availability of funding, and desires of people for an enhanced quality of life.

The primary intent of this process is to provide the City and MPO a consistent and flexible framework within which to assess community needs on a more holistic basis by evaluating multiple desired project outcomes. The pilot evaluation process contained in this study can be used to guide City, State, and private transportation infrastructure investments under multiple scenarios. This process should lead to a more balanced decision making process while acknowledging existing transportation deficiencies and potential economic development opportunities.

### New Evaluation Process Needed

During the Spring of 2013, Governor McCrory shared insights for an Associated Press published newspaper article that indicated that transportation infrastructure enhancements would be viewed more as a tool to improve the economy rather than merely improving mobility and safety in the future. In June 2013 the Legislature adopted a Strategic Mobility Formula as a new way to fund and prioritize transportation projects to ensure they provide the maximum benefit to the state. As a result of this legislation, it was determined that future transportation funding will be allocated on the following basis:

- ◆ 40% on a statewide basis
- ◆ 30% on a regional basis
- ◆ 30% on a local basis

### Proposed Benefits of a Different Evaluation Process

A multi-disciplined team of transportation and economic development professionals developed and pilot tested a new evaluation process that was patterned after key concepts in the governor's initiative and ideas from a study conducted in 2010 by the Victoria Transport Policy Institute. This study was referenced on the International Institute of Transportation Engineers All Member Forum dialogue in conjunction with the discussion topic of evaluating transportation economic development impacts.

A list of benefits for having a different process is listed below:

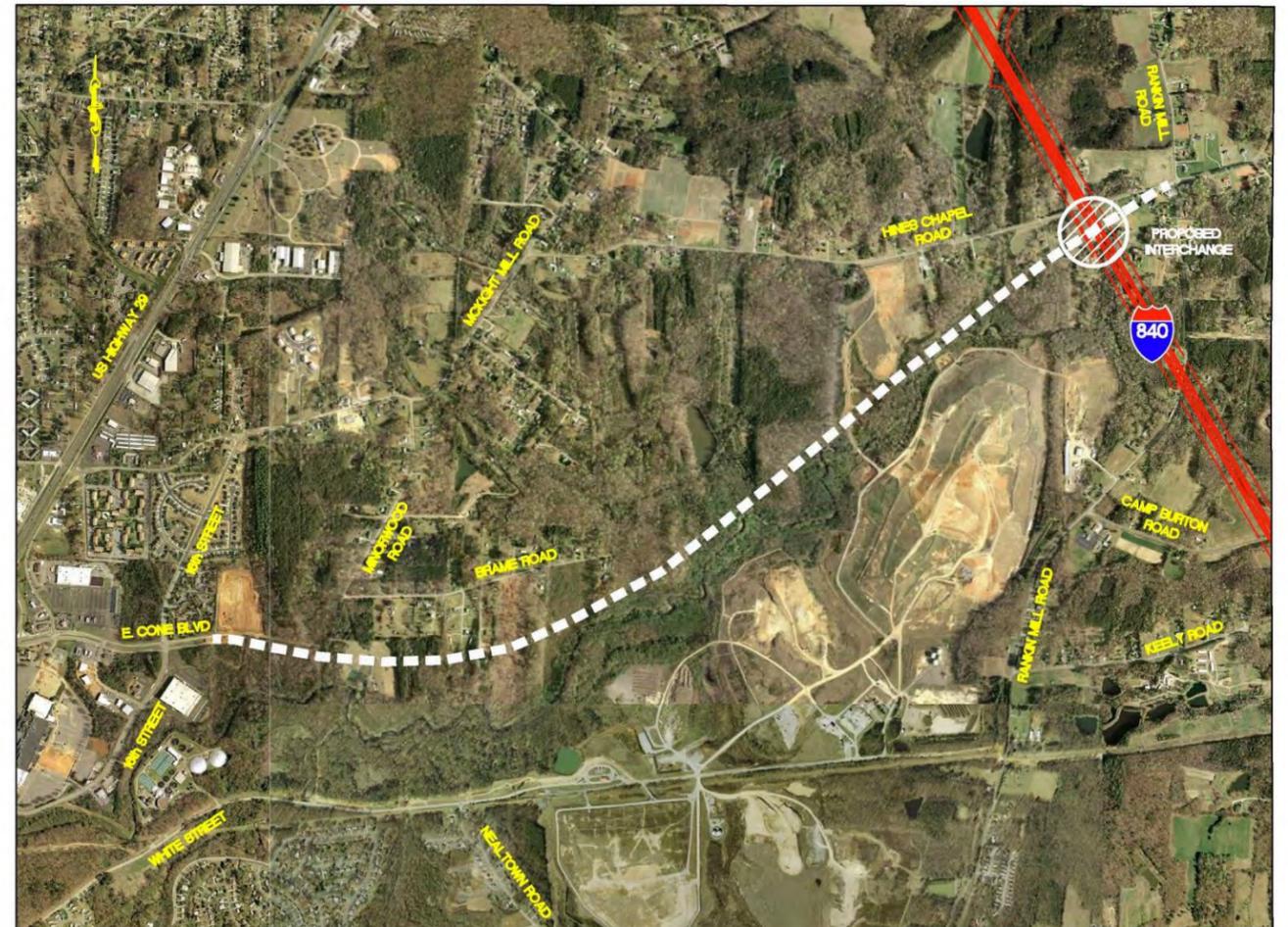
- ◆ Gain understanding, ownership, and support by elected officials and key stakeholders
- ◆ Invest transportation resources to maximize multiple project outcomes
- ◆ Have a documented simple, practical, and relevant process for establishing priorities
- ◆ Develop projects that are more competitive for future NCDOT funding support
- ◆ A tool for reevaluating planned transportation infrastructure projects
- ◆ Evaluate economic development incentive requests for transportation infrastructure support

### Pilot Transportation Infrastructure Project

The Evaluation Team performed a pilot evaluation of the following two construction alternatives:

- ◆ Alternative 1—Extend East Cone Boulevard generally from 850 feet east of Sixteenth Street to Rankin Mill Road
- ◆ Alternative 2—Extend East Cone Boulevard generally from 850 feet east of Sixteenth Street to Rankin Mill Road plus construct an interchange at the proposed Eastern Urban Loop.

A map of these two alternatives is shown below:



## Pilot Evaluation of the East Cone Boulevard Extension Alternatives

### Step One: Provide Project Background Information

Background information has been developed to allow elected officials and key project stakeholders to gain a proper transportation and economic development perspective as this project impacts sustainable economic development in the East Greensboro Economic Development Study.

### I—Background Transportation Infrastructure Information

The following information represents highlights in information provided in public meeting handouts for the Greensboro Eastern Loop and the Cone Boulevard Extension / Eastern Urban Loop Feasibility Study:

- ◆ In 1995, the State of North Carolina approved the Environmental Impact Study for the construction of the Eastern Loop. The design of the Eastern Loop between Wendover Avenue and US 29 only included an interchange at Huffine Mill Road.
- ◆ In 2003, the City adopted the Connections 2025 Comprehensive Plan. This plan recommended the City to target specific roadway improvements in this area.
- ◆ In 2004, a feasibility study was completed by Wilbur Smith Associates which recommended that East Cone Boulevard be extended to Rankin Mill Road and that an interchange be constructed at the Eastern Loop.
  - The feasibility study recommended that this project be considered for funding by the North Carolina Department of Transportation
  - The North Carolina Department of Transportation was not willing to incorporate the proposed interchange into the project.

The following information represents an overview of the City's additional efforts and project construction possibilities regarding the extension of East Cone Boulevard and the proposed construction of an interchange at the proposed Eastern Loop:

- ◆ In 2004 Greensboro MPO officials discussed the possibility of adding the interchange with NCDOT
- ◆ The City of Greensboro has developed plans for the initial extension of Cone Boulevard to the proposed extension of Nealtown Road. This project is currently scheduled to begin construction in 2014.
- ◆ The MPO has twice requested the portion of East Cone Boulevard Extension from Nealtown Road to the Eastern Loop for consideration to be added to the NCDOT Transportation Improvement Program. NCDOT determined that the interchange could not be added to the initial loop construction because it was not in the environmental document. Therefore, short of revising the environmental document which would have caused delays and potential problems, the interchange construction has to follow an independent project.
- ◆ The Greensboro Eastern Loop from US 70 to US 29 (NCDOT Project U-2525 B) is in right of way acquisition phase at this time and the project is scheduled for construction in May 2014. Additionally, the current design is a grade separation with Hines Chapel Road being of adequate width to accommodate a multi-lane section when East Cone Boulevard is extended.

### II—Background Economic Development Information

The following is a brief overview of the more significant efforts to promote economic development:

- ◆ In the late 40's and early 50's the Overseas Redeployment (ORD) project was constructed. Additionally, the construction of Lorillard Tobacco and expansions of A&T State University represented significant economic projects.
- ◆ Two economic development studies impacting East Greensboro have been completed in the past few months as follows:
  - The Timmons study identified four potential shovel ready economic development sites in East Greensboro
  - The Balanced Economic Development Study was conducted by Red Rock Global. This has been described as an economic development parity study driven by concerns regarding the economic development decline in Eastern Greensboro as evidenced by high poverty rates, low median household income, declining home ownership levels and prices, and below average performance of public schools. This study identified four potential economic opportunities in East Greensboro.
  - The construction of the first section of the Greensboro Eastern Urban Loop (Interstate 40 to Wendover Avenue) was completed in 2002 at a project cost of approximately 19 million dollars. This project was accelerated by NCDOT because there was a firm commitment to locate the K-Mart distribution center at Wendover Avenue and Penry Road. The City also made improvements to Wendover Avenue from Penry Road to the Eastern Urban Loop in association with the new K-Mart distribution center and the new interchange with the Eastern Urban Loop and US 70 / Wendover Avenue. Also, several years ago there was a rather large scale development proposed close to the Eastern Urban Loop / US 70 interchange that featured retail, dining, and a movie theatre.

**Step Two—Select Key Criteria and Develop Key Information**

The following is a summary of the key information by criteria selected to facilitate future decisions regarding the two transportation alternatives evaluated in conjunction with this economic development planning study. Data that was based on information provided by the land use sub-consultant is shown with an asterisk.

**Outcome 1—Sustainable Economic Impact**

**Criteria One: Potential for job creation**

- ◆ Study identified development pods for a targeted development area of approximately 1500 acres
- ◆ Potential job creation of approximately 8-10,000 jobs\*

**Criteria Two: Tax revenue enhancement**

- ◆ Approximately **1,760,000 square feet** of developable property\*
- ◆ Enhances the tax value of land and improvements by approximately **\$80,000,000\***
- ◆ This represents approximately **\$5,000,000** in additional revenues\*
- ◆ Potential additional revenues to City from the methane developed in the Technology and Energy Center

**Criteria Three: Opportunities for establishing funding partnerships**

- ◆ Potential partnership with A&T State University regarding proposed Technology and Energy Center
- ◆ Potential partnership with Guilford County Technical Community College (GTCC) for providing vocational training
- ◆ Potential partnership with the Greensboro Convention and Visitors Bureau and the Greensboro Sports Community for sports related development at Keely Park
- ◆ Potential partnership with the State on North Carolina for the Camp Burton Prison property

**Criteria Four: Provides a vital connection between proposed development projects**

- ◆ Proposed extension of East Cone Boulevard provides a major trunk line for connecting a number of economic development projects in the East Greensboro Economic Development Study area

**Outcome 2: Mobility and Safety Impact**

**Criteria One: Provides a missing link**

- ◆ Provides a major east-west corridor between US 29 and the Eastern Loop
- ◆ Projected 2030 traffic volume of approximately 20,000 vehicles per day\*
- ◆ Would divert traffic off a number of local and collector streets

**Criteria Two: Supports multi-modal choices**

- ◆ The East Cone Boulevard Feasibility Study recommended the provision of sidewalks and either bike lanes or a separate bike path along Buffalo Creek
- ◆ A future transit route is possible

**Outcome 3—Quality of Life Impact**

**Criteria One: Potential for per capita income enhancement**

- ◆ Latest US Census survey indicates the median income of residents (approximately \$22,000) in the study area is approximately 50% of the median income of residents of the entire City.\*
- ◆ Income of residents in the study area is projected to increase substantially in the future should the proposed development take place

**Criteria Two: Provides opportunity for providing a gateway entrance**

- ◆ Proposed East Cone Boulevard project includes provisions for sidewalks, a median, and bike lanes or separate bike path.

- ◆ Specialty signage plus decorative street lighting is a possibility

**Outcome 4—Intangible Project Impact**

**Criteria One: A game changer for economic development in East Greensboro**

- ◆ Anticipated that a City Prosperity Zone can be developed for this area
- ◆ Opportunity for changing the name of White Street to Keely Park Road
- ◆ Actions listed above will contribute towards a changing of the image plus the provision of economic hope for residents in the study area

**Criteria Two: Project timing**

- ◆ Proposed construction of the Eastern Loop will provide the momentum to move forward with the proposed construction of East Cone Boulevard and the provision of an interchange at the Eastern Loop

**Step Three: Assign Weights to the Desired Outcomes and Key Criteria Selected**

After reviewing the key information from project narratives supporting the four desired outcomes, please assign a weight for the four desired project outcomes and place in the table below and on the project scoring sheets in Step Six. The sum of the weights must add up to 100.

Description of Outcomes	Weight
◆ Sustainable Economic Impact	
◆ Mobility and Safety Impact	
◆ Quality of Life Impact	
◆ Intangible Impact	
<b>Totals</b>	<b>100</b>

**Step Four: Assign a Projected Magnitude of Impact**

A relative magnitude of impact for each of the four outcomes should be established by the evaluation team based on the scale shown below and placed on the project scoring sheets in Step Six.

- 0—A negative project impact
- 1—No project impact
- 2—A slight project impact
- 3—An average project impact
- 4—An above average project impact
- 5—A highly significant project impact

**Step Five: Assign a Probability of Success Factor**

The evaluation team should project a probability of success for each alternative based on feedback from seasoned development professionals based on the guidelines listed below and placed on the project scoring sheets in Step Six.

<b>Poor:</b>	<b>10%</b>
<b>Below Average:</b>	<b>25%</b>
<b>Average:</b>	<b>50%</b>
<b>Above Average:</b>	<b>75%</b>
<b>Excellent:</b>	<b>90%</b>

**Step Six: Use Evaluation Matrix to Develop Project Score**

A project score can be developed for each of the two alternatives evaluated in the East Greensboro Economic Development Study as follows:

**Relative Weight** x **Magnitude of Impact** x **Probability of Economic Enhancement** = **Project Score**

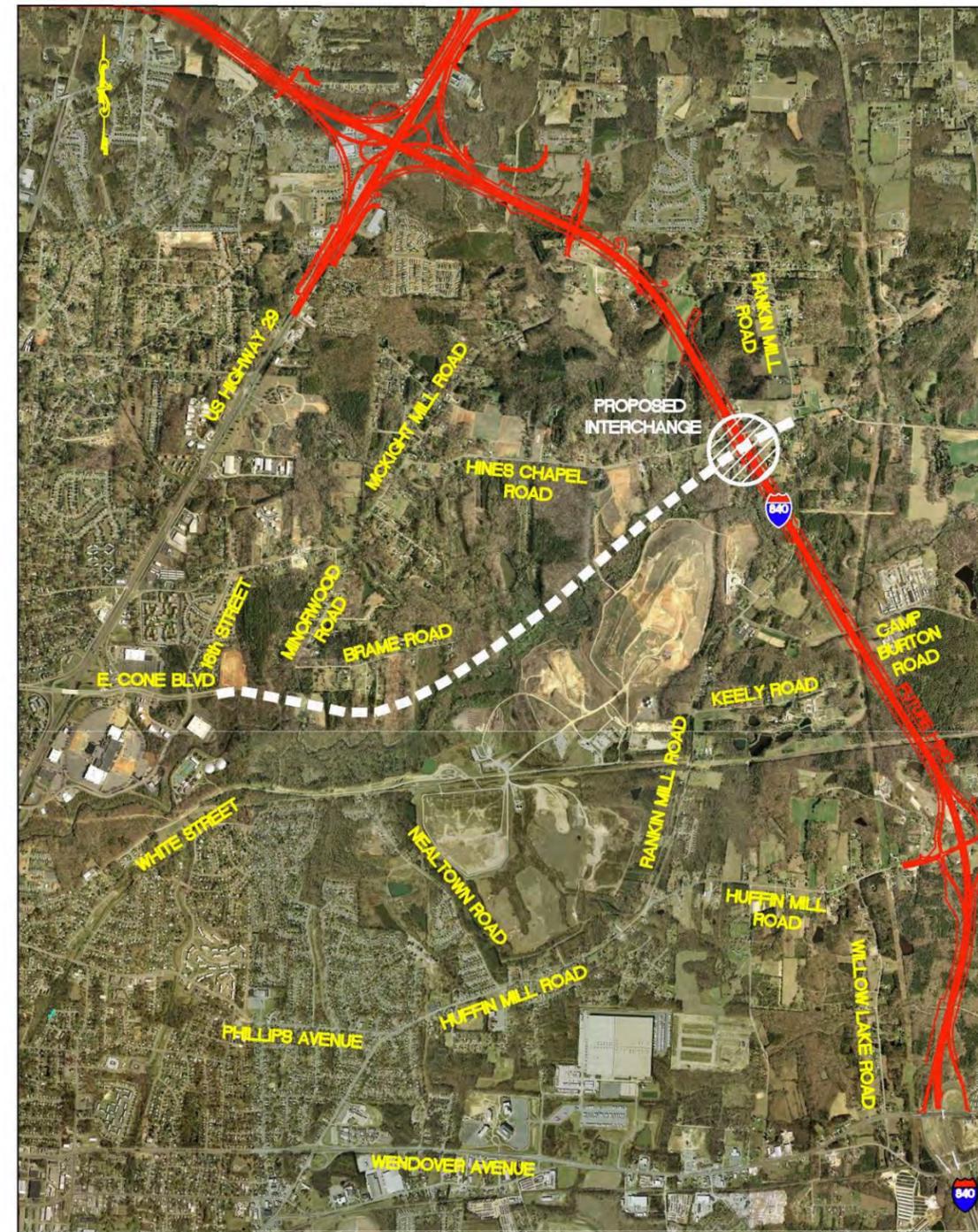
Project scoring for both alternatives are shown below in Table 1 and on Table 2.

Table 1—Project Scoring for Alternative 1 (Extension of East Cone Boulevard to Rankin Mill Road)				
Description of Outcome	Relative Weight	Magnitude Of Impact	Probability of Economic Enhancement	Project Score
Sustainable Economic Impact	45	5	.40	90
Mobility and Safety Impact	20	3	.50	30
Quality of Life Impact	20	4	.40	32
Intangibles Impact	15	5	.40	30
<b>Alternative 1 Project Score</b>				<b>182</b>

Table 2—Project Scoring for Alternative 2 (Extension of East Cone Boulevard to Rankin Mill Road plus Interchange)				
Description of Outcome	Relative Weight	Magnitude Of Impact	Probability of Economic Enhancement	Project Score
Sustainable Economic Impact	45	5	.60	135
Mobility and Safety Impact	20	3	.75	45
Quality of Life Impact	20	4	.60	48
Intangibles Impact	15	5	.60	45
<b>Total Project Score</b>				<b>273</b>

**Notes:**

- (1) The evaluations for both alternatives did not include consideration of the potential impact of a future Energy and Technology Center on the south side of the proposed East Cone Boulevard extension project.
- (2) The probability of economic enhancement factor should be viewed as an indicator of the likelihood that the projected job creation and tax revenue enhancement outcomes are achievable. A higher score would indicate there is a lesser economic risk in making a decision to invest in this transportation infrastructure project. The probability of sustainable economic enhancement of these alternatives would be significantly enhanced should a partnership involving the City, current property owners, the technology agency of choice, and a project development team be established.
- (3) These evaluations did not include consideration of potential development in the vicinity of the Proposed East Cone Boulevard / Eastern Urban Loop interchange. Preliminary land use plans included a mix of retail and industrial uses in this area. The probability of economic enhancement for both alternatives would increase should a development partnership be established in the future for promoting economic development in the general area of the future interchange.



### Step Seven: Review of Project Scoring

The evaluation team has reviewed the project scoring for the two alternatives and has concluded the 50% increase in project scoring for the second alternative can be rationally and objectively defended on a sound decision making basis.

### Step Eight: Develop Conclusions and Next Steps

#### I. Key Conclusions

The following are a list of key conclusions by the project evaluation team relative to the future construction of either alternative evaluated as follows:

- ◆ The proposed extension of East Cone Boulevard provides an opportunity for making a good transportation infrastructure investment in Eastern Greensboro should an economic development funding partnership be proposed for consideration by the City.
- ◆ It is likely the estimated project payback length of time calculated for the projected economic value of the additional tax revenue and jobs created would be less than the period based on the value of the road user benefits. To support NCDOT's data driven approach, a methodology for determining the projected project payback for the projected sustained economic impact should be considered for further study.
- ◆ The pilot evaluation model appears to be a good first step in helping elected officials makes better transportation decisions regarding transportation infrastructure investments which promote sustained economic development.

Additional conclusions regarding how the use of elements of this pilot evaluation model in the future by the City are as follows:

- ◆ The proposed pilot evaluation process supports the SPOT 3.0 Process as a documented means for distributing the number of local points to candidate projects in conjunction with the proposed NCDOT project prioritization process. Each MPO will be required to document their methodology for their project point allocations and this provides a framework for having a consistent, holistic, and practical process that is understood by key elected and appointed officials.
- ◆ While reviewing some e-mails to a number of Metropolitan Planning Organization officials from the High Point Area MPO, it was noted that a proposed interchange does not substantially recognize the contribution of an interchange towards a project's economic impact. One potential reason for this is that an interchange may not have a substantial impact on the projected roadway benefits as determined by time saved in NCDOT's formula.
- ◆ Since points are allocated on a local NCDOT Division basis for both local and regional projects, the City and / or MPO will need to work collaboratively with the Division 7 NCDOT Board Member, Division Engineer, and other regional partners to get future projects in the regional and division tiers funded.

#### II. Recommended Next Steps

In order for the City Council to establish a higher level of credibility regarding their commitment to support economic development in Eastern Greensboro, the project evaluation team recommends the following actions:

- ◆ Establish a Development Implementation Team to pursue the development of a partnership with the two property owners in order to significantly reduce the cost of extending East Cone Boulevard by getting commitments for future right of way donations. Preliminary thoughts regarding the composition of this team would include:
  - A representative of the City Manager's Office
  - A representative of the City of Greensboro's Economic Development Committee
  - Someone with proven experience in developing construction ready sites and working with property owners
  - A Civil Engineering firm to calculate the number of developable acres, identify potential development pods, and develop conceptual layouts for the proposed development

- A Land Use Planning firm to identify potential land uses and to identify which land uses might be considered better economic developments
- Someone with transportation planning expertise to help evaluate proposed transportation infrastructure investments

- ◆ Identify potential funding sources and develop a strategy for funding the proposed extension of East Cone Boulevard based on the progress from recommendation above.
- ◆ Schedule a briefing with the NCDOT Division 7 Board Member, Division Engineer, Division Planning Engineer, and a representative of the Department of Commerce to present the pilot evaluation process at the earliest convenient date. The purpose of this proposed meeting is to inform NCDOT regarding the methodology and findings of the independent transportation infrastructure evaluation team and to raise concerns regarding how interchanges are treated in SPOT 3.0. The meeting outcomes would be to get feedback regarding how to improve the pilot evaluation tool and gain NCDOT's commitment to investigate the concern regarding the impact of proposed interchanges in the project prioritization process.
- ◆ After making a decision to extend East Cone Boulevard to the Eastern Loop, fund an interchange justification study for the construction of an interchange at the Eastern Urban Loop. Since the U-2525 environmental document is a State of North Carolina environmental document, our team has determined that this study can begin as soon as there is a commitment to construct the Cone Boulevard Extension Project without jeopardizing the construction of the Eastern Urban Loop in this area. Based on past experiences, the evaluation team believes the funding of an interchange justification study based upon the City's commitment to construct the East Cone Boulevard project is a key strategy for accelerating the construction of this interchange in the future—this demonstrates project commitment as result of a willingness to become a funding partner.
- ◆ Further enhance the pilot evaluation process by establishing a definitive economic value for projected new jobs for proposed economic development projects. This supports the data driven concept of the SPOT 3.0 Process.

#### III. The City's Dilemma

With limited transportation infrastructure resources projected to be available in the future, the City of Greensboro and MPO will be faced with having to determine whether to invest in transportation infrastructure projects which are driven by proposed economic development projects or to select projects which are more likely to be favored by the current NCDOT formula which heavily emphasizes projected road user benefits. Since economic development policies are primarily driven by elected and appointed officials, the following observations are offered for reflection and future action:

- ◆ Elected and appointed officials must gain a greater understanding of how the SPOT 3.0 Process evaluates a transportation infrastructure project's potential economic impact for both regional and local tier projects.
- ◆ Elected and appointed officials must become more involved upfront in providing input needed to evaluate transportation infrastructure projects.
- ◆ Both NCDOT and local governments need to gain mutual understandings regarding how to evaluate the projected economic development impact of regional and state tier projects; otherwise, the City and MPO will be under pressure to rate projects the same as NCDOT in order to accumulate the number of project points needed to get future project requests funded. This does not appear to best serve the City's economic future.

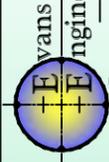
# EAST GREENSBORO TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY

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EAST GREENSBORO TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY

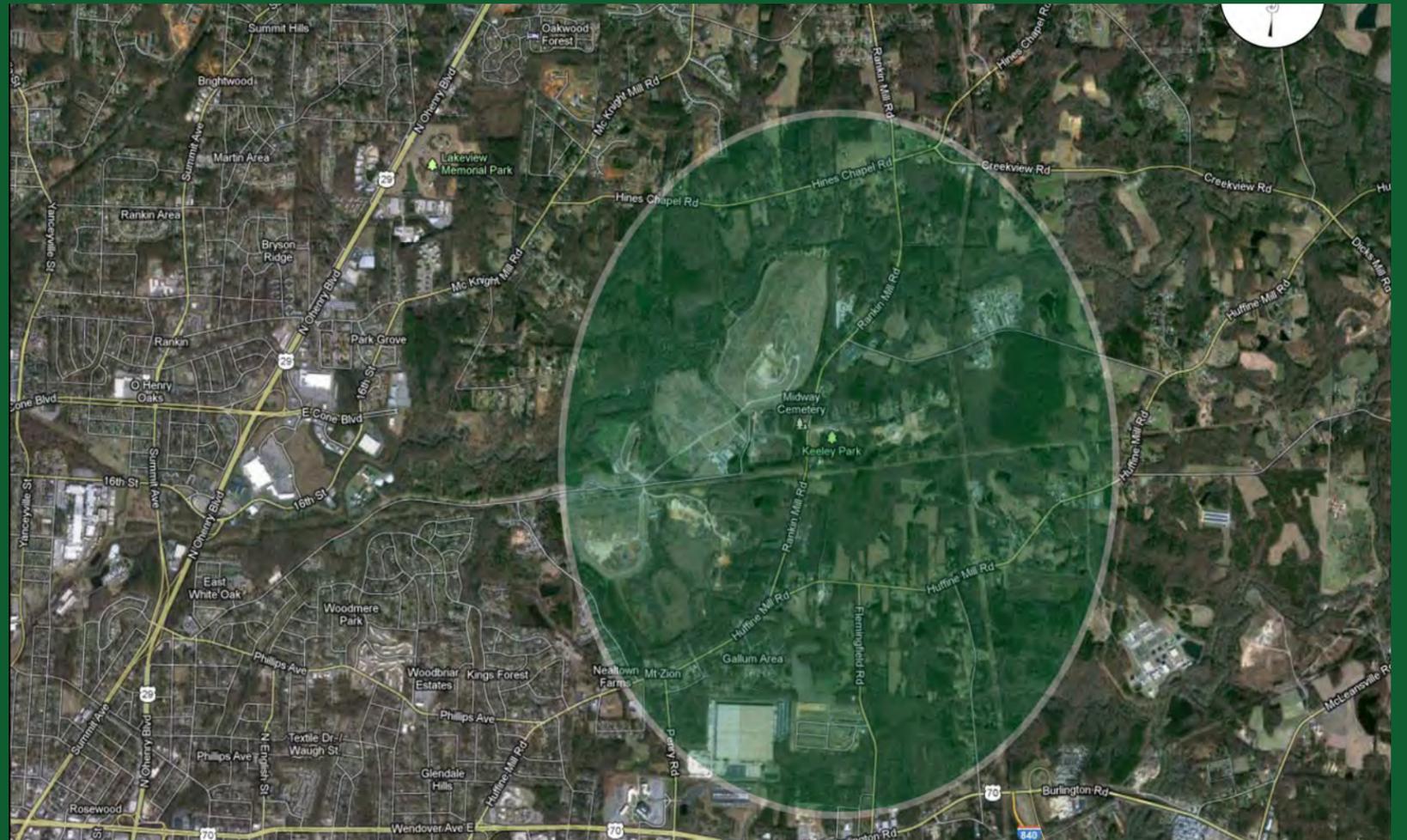
THE EAST GREENSBORO ECONOMIC DEVELOPMENT SITE, LAND USE,  
AND TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



Evans Engineering, Inc.  
Engineers — Since 1974 — Planners  
Surveyors  
4600 Panda Drive Greensboro, NC 27407  
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# EAST GREENSBORO TRANSPORTATION INFRASTRUCTURE IDENTIFICATION STUDY



PREPARED FOR THE CITY OF GREENSBORO

SEPTEMBER 2013





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# 1.0 introduction

The City of Greensboro is currently in the process of identifying future economic development areas in and around Huffine Mill Road in East Greensboro . As a part of this effort, the East Greensboro Transportation Infrastructure Identification Study is being carried out by Evans Engineering, Inc. to provide a guide for future economic development in the area. The study will serve as a springboard to other specific and detailed studies. DAVENPORT was retained to provide a general overview and assessment of the existing and proposed transportation infrastructure that will be needed to support the identified future economic development areas. The study area, shown in Figure 1, is located four miles northeast of downtown and is centered along Huffine Mill Road. The study area includes areas to the west and adjacent to the future Interstate 840 extension (referred to as the Eastern Outer Loop) from McKnight Mill Road to Hwy 70/Wendover Ave to the south, and areas extending out to the west of the Eastern Outer Loop bounded by McKnight Mill Road, Nealtown Road, and Huffine Mill Road.

## 1.1 Scope

As a part of the transportation assessment study, DAVENPORT’s scope of work included the following:

- Assessment of the proposed roadway connection between White Street and Keely Road (proposed White Street Extension), which is the southern portion of the landfill area bounded by White Street, Nealtown Road, Huffine Mill Road and Rankin Mill Road.
- Assessment of the proposed roadway infrastructure needed on Huffine Mill Road, Flemingfield Road and Willowlake Road.
- Assessment of roadway infrastructure needed on Wendover Avenue between the Eastern Outer Loop and Penry Road. DAVENPORT also developed a conceptual layout of two (2) alternatives.

Additionally, DAVENPORT will make general recommendations for the future roadway geometry and access management measures needed to support the Future Economic Development Area.

North Carolina Department of Transportation (NCDOT) and the City of Greensboro Department of Transportation (GDOT) access management standards were utilized, where applicable, as a part of this study and for recommendations provided in this report.

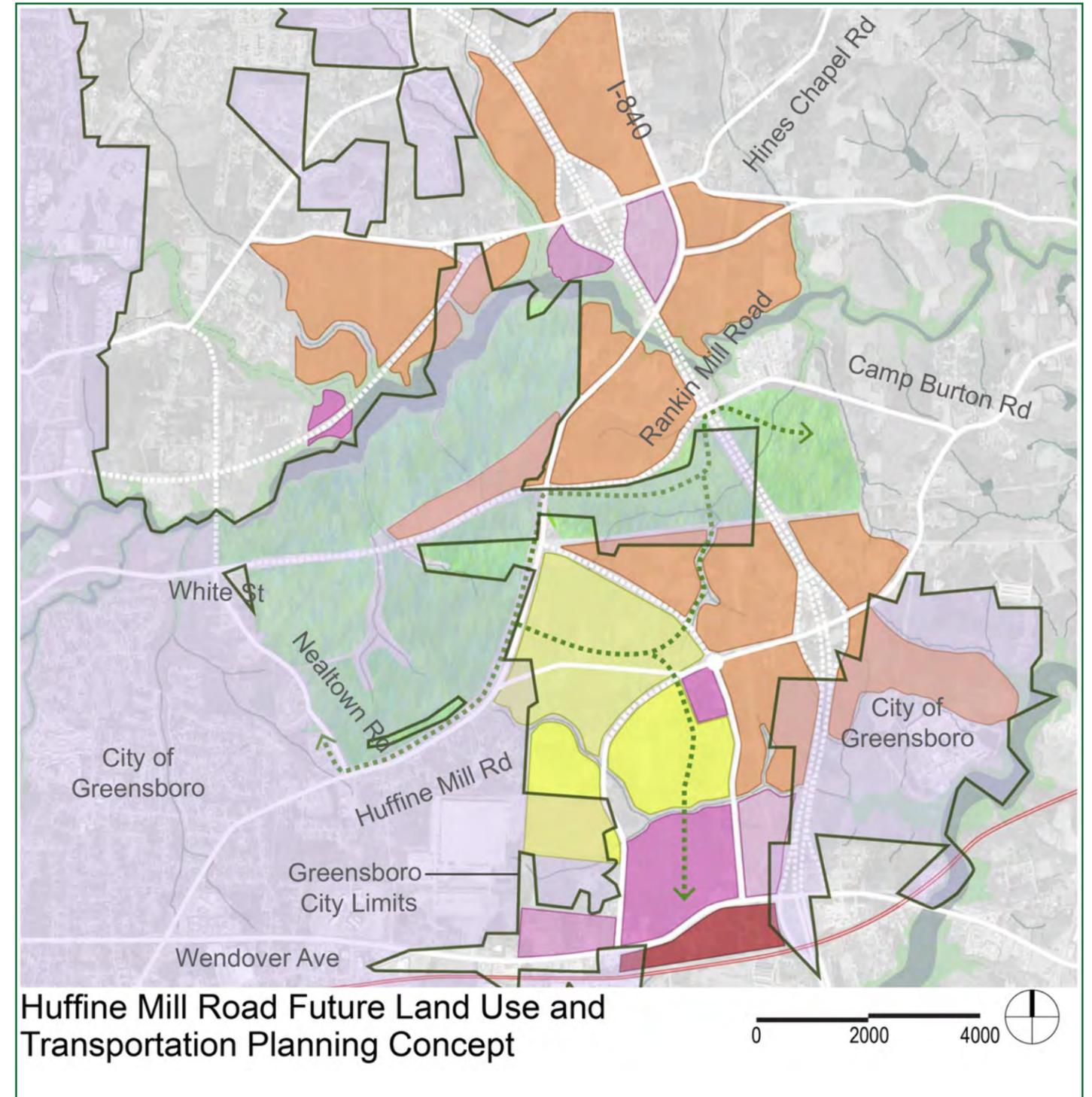
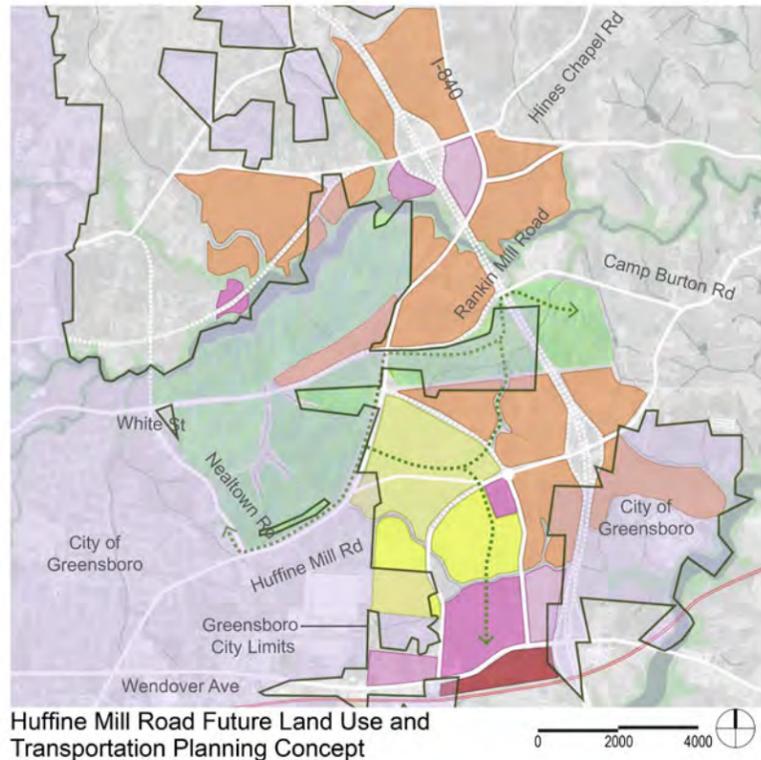


Figure 1 – East Greensboro Study Area



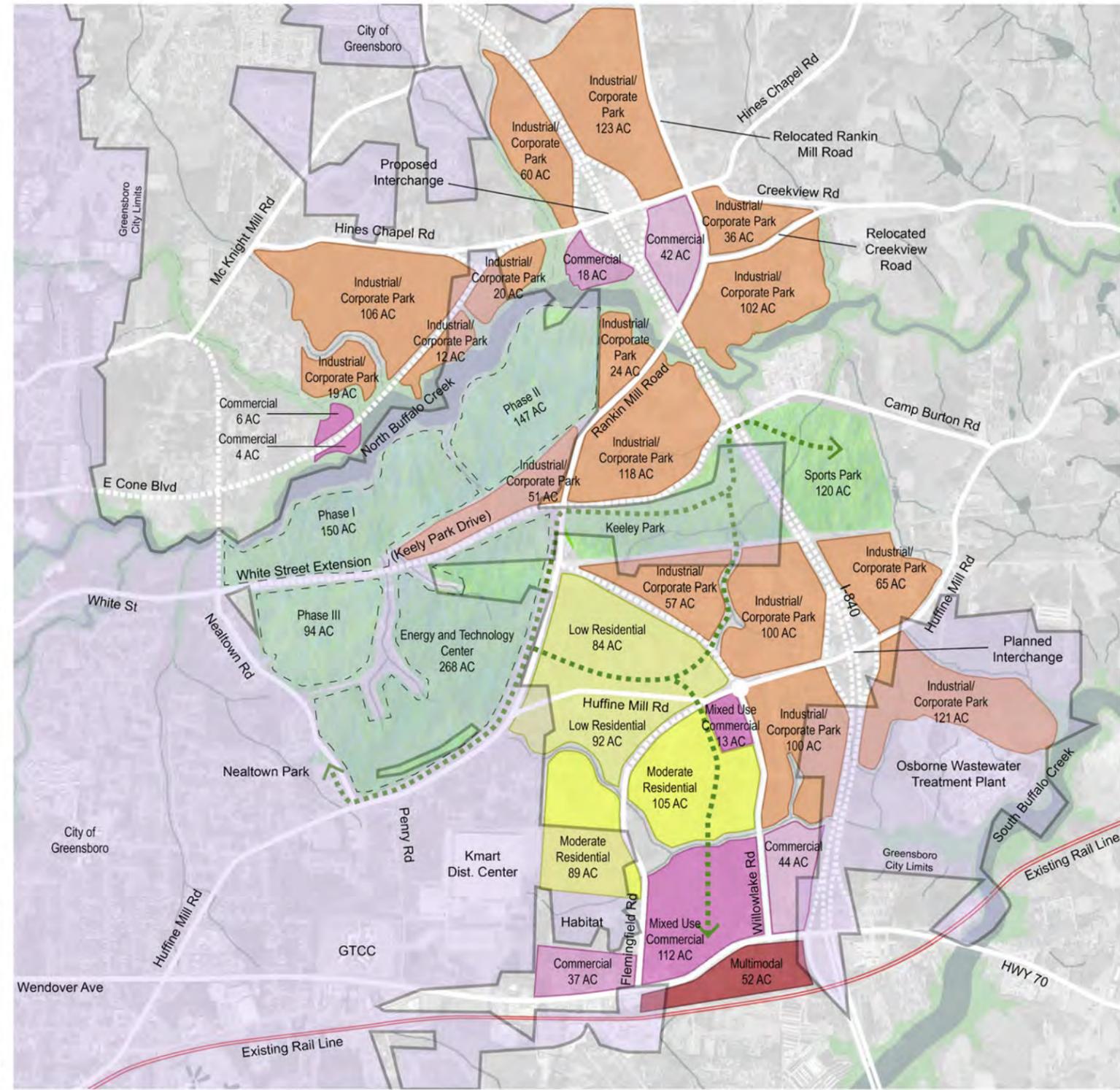
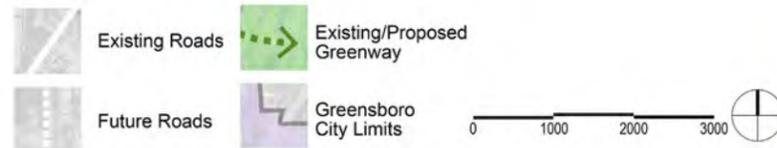
**Proposed Concept Narrative:**

The area adjacent to the existing and proposed I-840 interchange with Hwy 70 should be viewed as a gateway to east Greensboro. Therefore, the densest development and the highest land values should be located in this section of the study area, with lower density and values radiating from this node. This approach to the city would consist of moderately spaced residential neighborhoods, mixed use communities, and a multimodal hub that takes advantage of the existing road and rail infrastructure locations.

Adjacent to these residential and commercial neighborhoods are areas consisting of light industrial land uses, the existing Keeley Park, a large sports park, and an energy and technology center. The northern half of the study area consists of heavy industrial and small parcels of commercial areas which take advantage of the planned I-840 interchange.

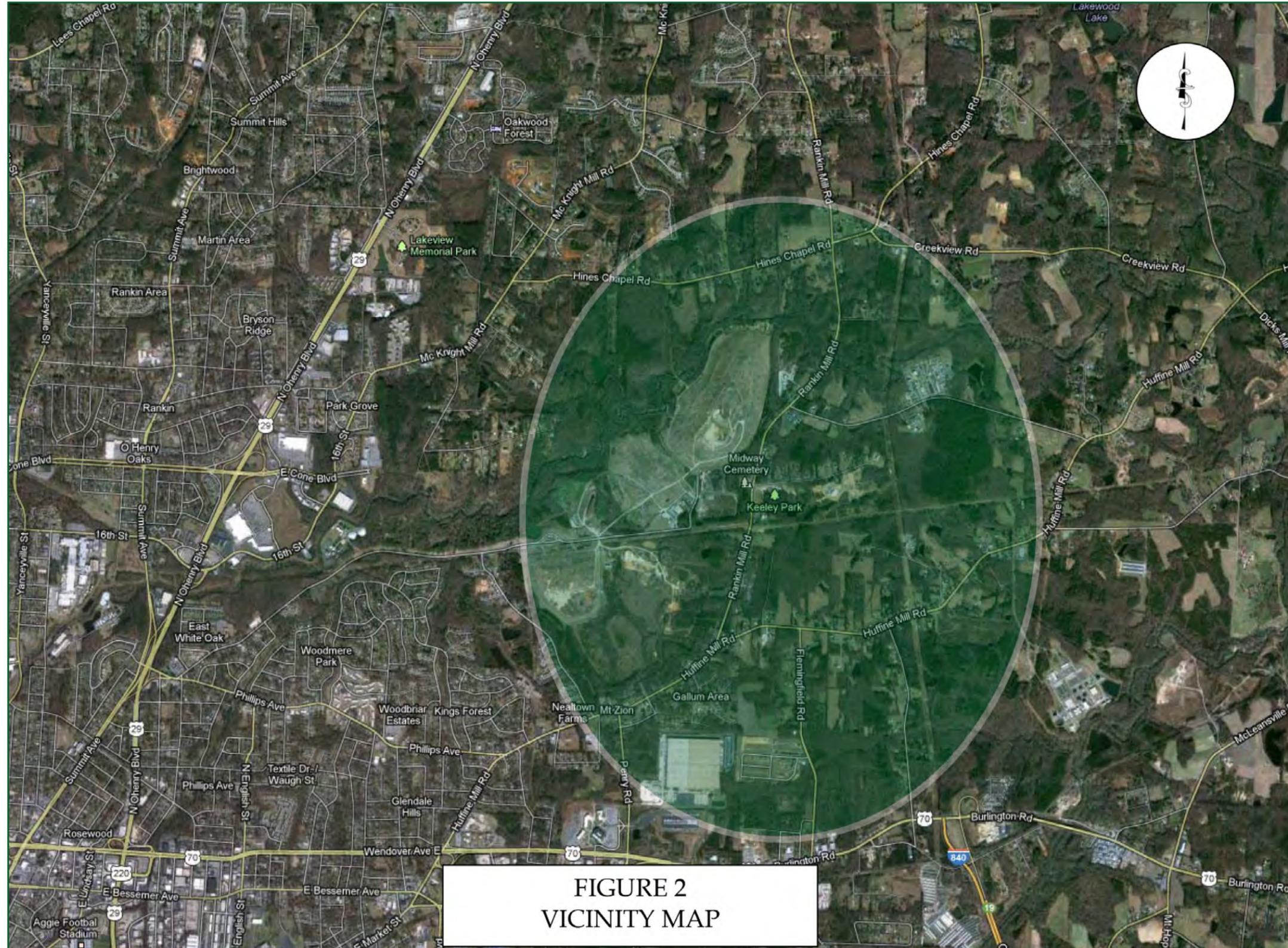
The main differences between this concept and the Greensboro Generalized Future Land Use Map are as follows: 1.) the Energy and Technology Center replaces the Industrial/Corporate Park zoning in the center of the concept area; 2.) the existing commercial, residential, and mixed use shifts and becomes more dense at the Highway 70 and I-840 intersection; 3.) a multimodal zone has been created between Highway 70, I-840, and the North Carolina railroad Company rail line; 4.) Keeley Park has been expanded to include a proposed sports park and greenway system; 5.) proposed Industrial/Corporate Park zoning has replaced residential zones along the future extension of I-840.

**Legend:**



Huffine Mill Road Future Land Use and Transportation Planning Concept  
2013-08-30

Figure 2 – Vicinity Map





# 2.0 background conditions

## 2.1 Existing Roadways

### US 70 (Wendover Avenue)

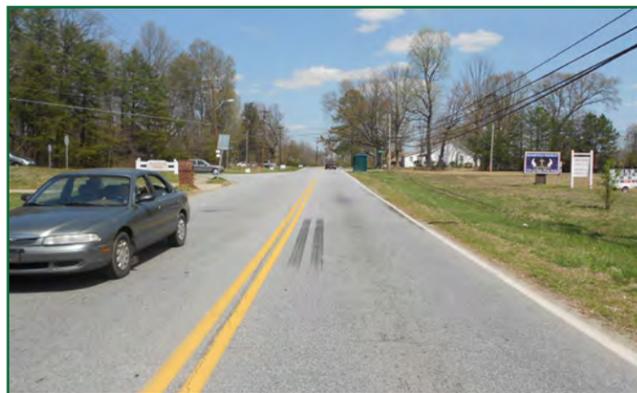
- Wendover Avenue is a 5-lane undivided roadway with a center left turn lane.
- The roadway width is approximately 60 feet.
- The posted speed limit is 45 mph.
- The land uses along Wendover Avenue are primarily commercial, with some residential and light industrial areas.
- Based on NCDOT traffic data, the 2011 average annual daily traffic (AADT) along Highway 70 was 25,000 vehicles per day (vpd).
- Based on City of Greensboro Thoroughfare Plan, Wendover Avenue is a major thoroughfare. It serves as one of the City's major east-west routes.



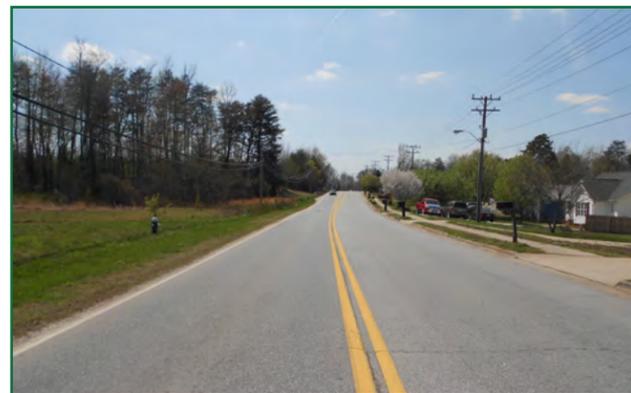
Highway 70 Looking West

### Huffine Mill Road

- Huffine Mill Road is a two to three lane undivided roadway. To the west of Nealtown Road, there is a two way left turn lane on Huffine Mill Road. To the east of Nealtown Road, it is a 2 lane undivided roadway.
- The pavement width varies from 22 feet to 40 feet.
- The posted speed limit is 35 mph.
- The land uses along Huffine Mill Road are primarily residential.
- Based on NCDOT traffic data, the 2011 AADT was 7,700 vehicles per day north of Wendover Avenue and 2,400 vehicles per day east of Willowlake Road.
- Based on the City of Greensboro Thoroughfare Plan, Huffine Mill Road is currently a major thoroughfare



Huffman Mill Road Looking East



Huffman Mill Road Looking West

### Flemingfield Road

- Flemingfield Road is a two-lane undivided roadway within the study area. The pavement width is approximately 20 feet.
- The posted speed limit is 45 mph.
- The land uses along Flemingfield Road are primarily ranch-style homes and undeveloped forested area.
- NCDOT traffic maps do not provide data on the daily traffic volume of Flemingfield Road
- Based on the City of Greensboro Thoroughfare Plan, this road is currently a minor thoroughfare. This road collects traffic from adjacent minor streets and residential collector roads, and provides connection with downtown Greensboro and the greater transportation network.



Fleming Road Looking South

### Willowlake Road

- Willowlake Road is a 2-lane undivided roadway. The pavement width is approximately 20 feet.
- The posted speed limit is 45 mph.
- The land uses along Willowlake Road are primarily ranch-style homes and undeveloped forested area.
- Based on NCDOT traffic data, the 2011 AADT was 1,500 vehicles per day.
- Based on the City of Greensboro Thoroughfare Plan, this road is currently a local collector.



Willowlake Road Looking North

## 2.1 Existing Roadways *(continued)*

### Rankin Mill Road

- Rankin Mill Road is a 2-lane undivided roadway. The pavement width is approximately 22 feet.
- The posted speed limit is 45 mph.
- The land uses along Rankin Mill Road are primarily low density residential and undeveloped area.
- Based on NCDOT traffic data, the 2011 AADT was 2,800 vehicles per day.
- Based on the City of Greensboro Thoroughfare Plan, this road is currently a minor thoroughfare.



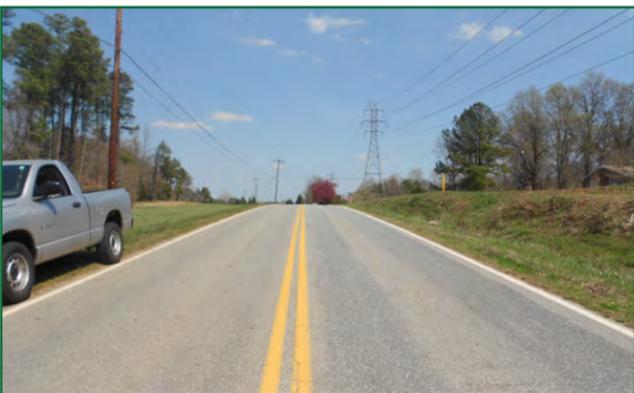
Rankin Mill Road Looking North



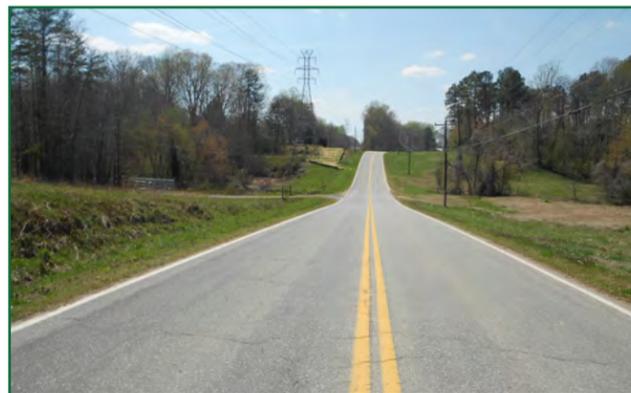
Rankin Mill Road Looking South

### White Street

- White Street is a 2-lane undivided roadway. The pavement width varies from 22 feet to 28 feet.
- The posted speed limit is 30 mph.
- The land uses along White Street include residential areas, the North Buffalo Wastewater Facility, and the Greensboro Landfill.
- Based on the City of Greensboro Thoroughfare Plan, this road is currently a local collector.



White Street Looking East



White Street Looking West

### Nealtown Road

- Nealtown Road is a 2-lane undivided roadway. The pavement width is approximately 20 feet
- The posted speed limit on this road is 35 mph
- The land uses are primarily residential on the west side of Nealtown Road, and the Greensboro Landfill is on the east of Nealtown Road
- Based on the City of Greensboro Thoroughfare Plan, this road is currently a local collector with an AADT of 1,200 vehicles per day



Nealtown Road Looking North



## 2.2 Committed Improvements

The following section provides a summary of committed improvements planned by NCDOT within the study area.

### TIP U-2525B (Greensboro Eastern Urban Loop)

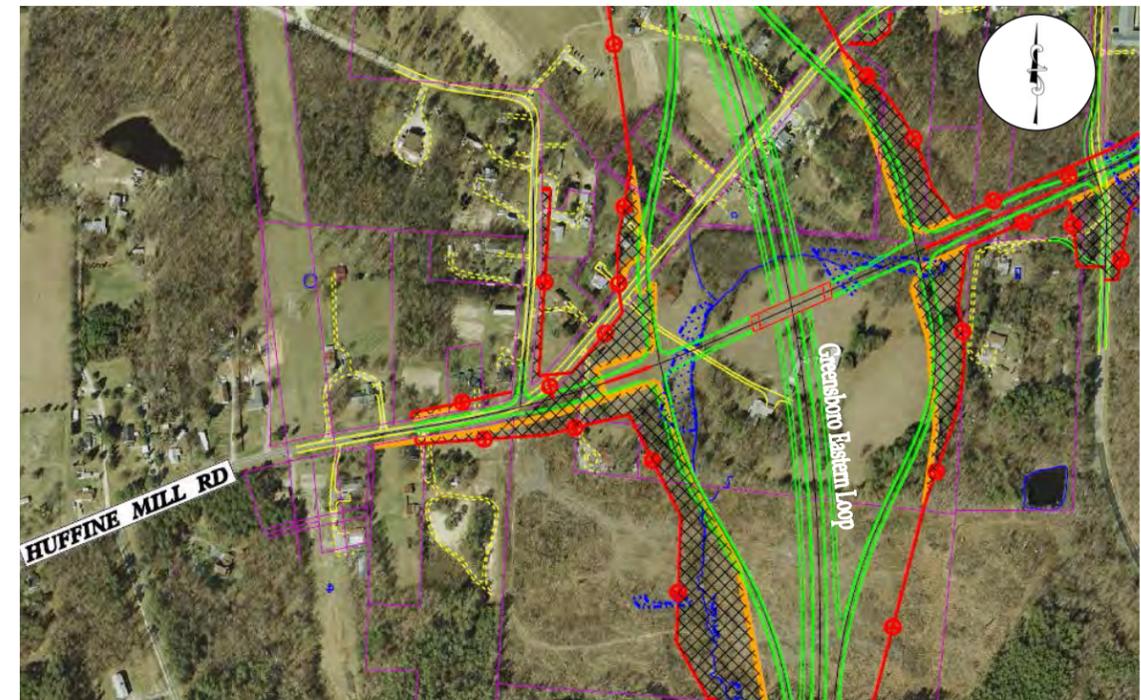
The Greensboro Urban Loop is part of NCDOT's plan to improve traffic flow within the City. Construction of the loop will allow traffic to bypass Greensboro, and will improve congestion on existing routes by providing a more direct route for traffic heading from south and east of Greensboro to destinations north and west of the city.



**Modified Interchange at Greensboro Eastern Loop and US 70 (Wendover Avenue)**

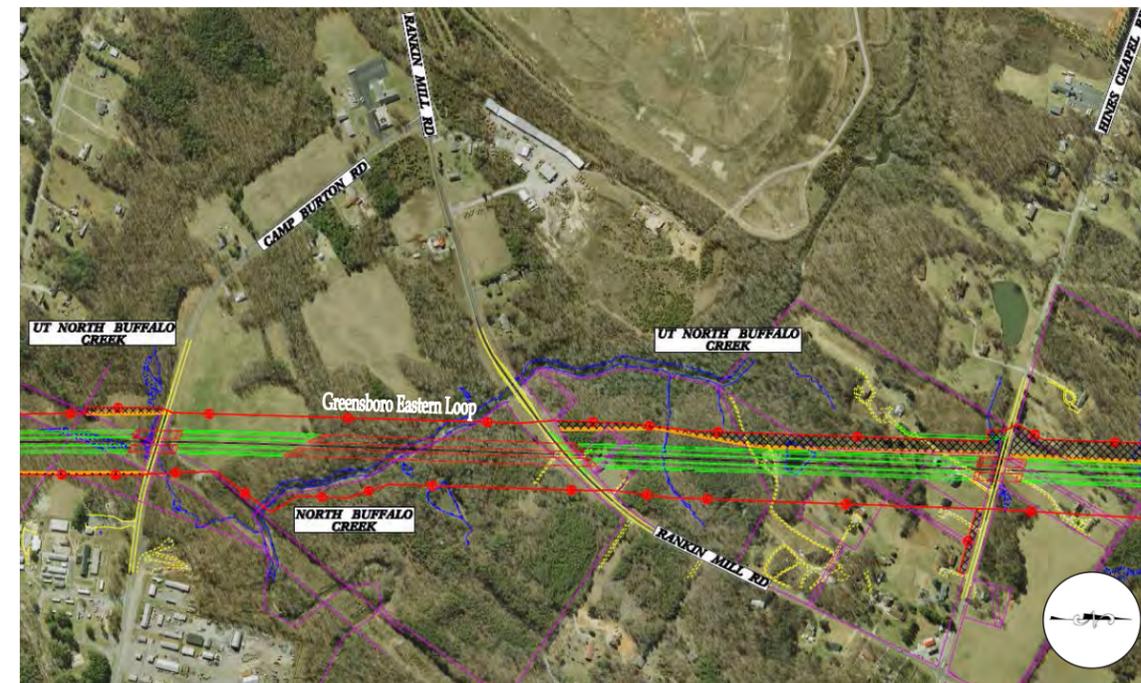
Source: NCDOT TIP U-2525B/C Public Hearing Map Sheet 1 of 5

TIP U-2525B is one of four (4) TIP projects to complete the remaining 15 miles of the 44-mile loop around the city. TIP U-2525B involves the construction of a new four-lane freeway from US 70 to US 29, which will serve as the eastern portion of the Greensboro Urban Loop. The total length of the new roadway in this project is 5.0 miles. This project will complete the Greensboro Loop / US 70 interchange, and will construct an interchange at the intersection of the Greensboro Loop and the realigned Huffine Mill Road. This project will also construct bridges on the Greensboro Loop over Camp Burton Road, Rankin Mill Road, and Hines Chapel Road. Construction is expected to begin in summer 2014. The expected completion date is summer 2017.



**Future Interchange at Greensboro Loop and Realigned Huffine Mill Road**

Source: NCDOT TIP U-2525B/C Public Hearing Map Sheet 1 of 5



**Greensboro Eastern Loop Overpasses**

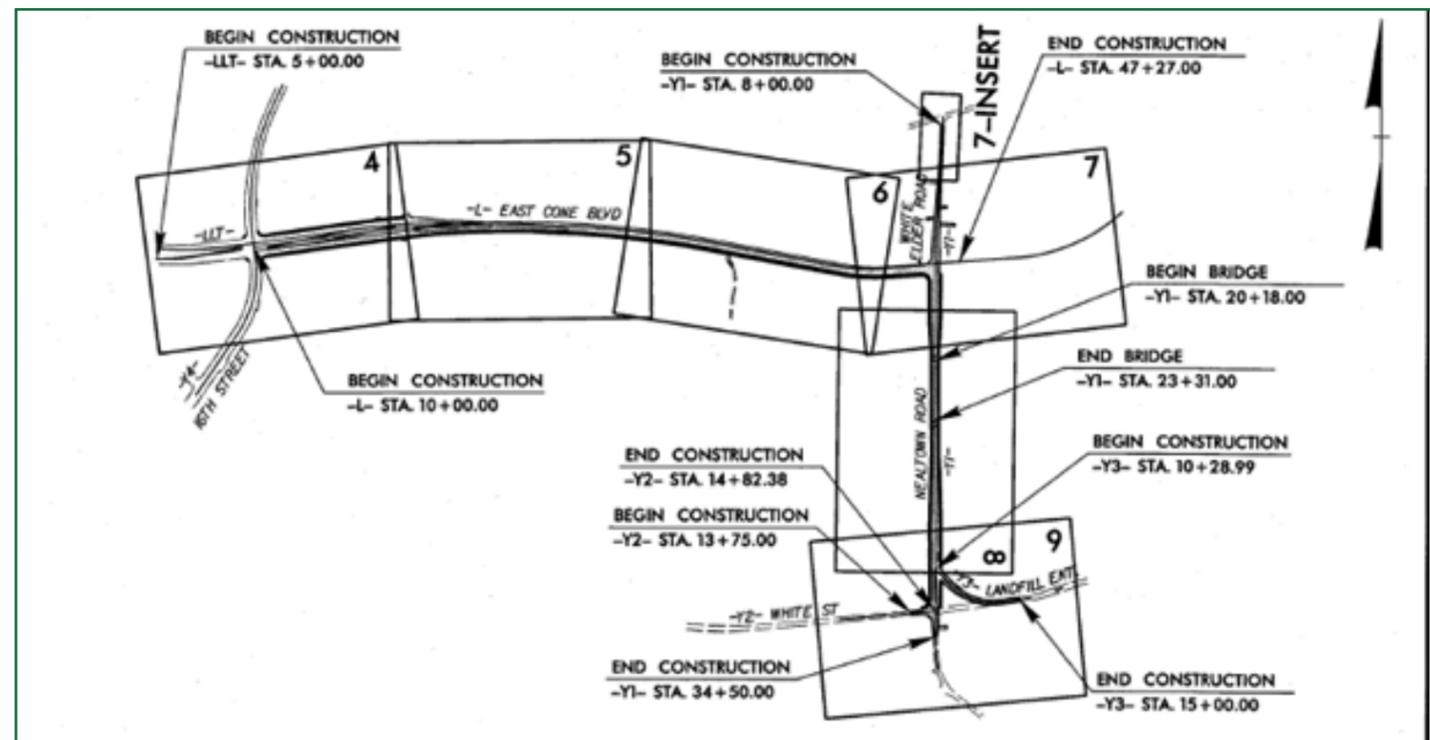
Source: NCDOT TIP U-2525B/C Public Hearing Map Sheet 1 of 5

## 2.2 Committed Improvements *(continued)*

### Nealtown Road / Cone Boulevard Extension

The City of Greensboro carried out a feasibility study in August, 2003 for the extension of both Nealtown Road and Cone Boulevard. The extension of these roadways will reduce truck traffic on the residential streets near the Greensboro Landfill, improve access to and from the Landfill, improve traffic operations and safety on residential streets, and provide the opportunity for a future gateway into Greensboro and improved aesthetics. The recommendations identified in the study include the following:

- Extend Cone Boulevard as a 4-lane divided roadway, approximately 0.7 miles from 16th Street to Nealtown Road
- Extend Nealtown Road as a 2-lane undivided roadway, approximately 0.4 miles from White Street to White Elder Road
- Configure intersection of Nealtown Road and White Street to only allow truck traffic to the landfill from the north on Nealtown Road
- Construction is scheduled to begin in summer 2014.



Cone Boulevard / Nealtown Road Extension

## 2.3 Planning Projects within the Study

The following section provides a summary of the planned projects in the study area that are currently unfunded.

### Cone Boulevard Extension

The City of Greensboro carried out a feasibility study in August 2004 for the extension of Cone Boulevard eastward to Hines Chapel Road near the future Greensboro Urban Loop. This extension of Cone Boulevard will provide an alternative route in the region which will relieve traffic congestion and improve access. The extension also provides opportunities for economic development in northeast Greensboro and improves pedestrian and bicycle travel. The recommendations identified in this study include the following:

- Extend Cone Boulevard eastward approximately 2.0 miles to Hines Chapel Road with a 4 lane divided cross section. This will include a landscaped center median, and sidewalk on each side of Cone Boulevard separated from the roadway by a grass strip
- Construct a diamond interchange at intersection of Greensboro Urban Loop and Hines Chapel Road

When complete, Cone Boulevard will serve as a major east-west route for the City, a key transportation investment in northeast Greensboro for the economic development of this area. This project is not currently funded, and the construction schedule is not known. The project was assumed to be in place by the 2035 analysis year.

### Bicycle & Greenway Plan, 2035 Long Range Transportation Plan, and Comprehensive Transportation Plan

The City of Greensboro has produced planning documents which give information on future transportation needs in order to accommodate expected growth. In particular, the [Bicycle, Pedestrian & Greenway Plan, 2035 Long Range Transportation Plan \(LRTP\)](#), and [Comprehensive Transportation Plan](#) were reviewed as part of this study. The LRTP provides the most up-to-date recommendations in terms of roadway, pedestrian, and bicycle facilities. Recommendations maps from the LRTP and Comprehensive Transportation Plan are presented in the following pages.



Figure 3 – LTRP Highway Projects Map

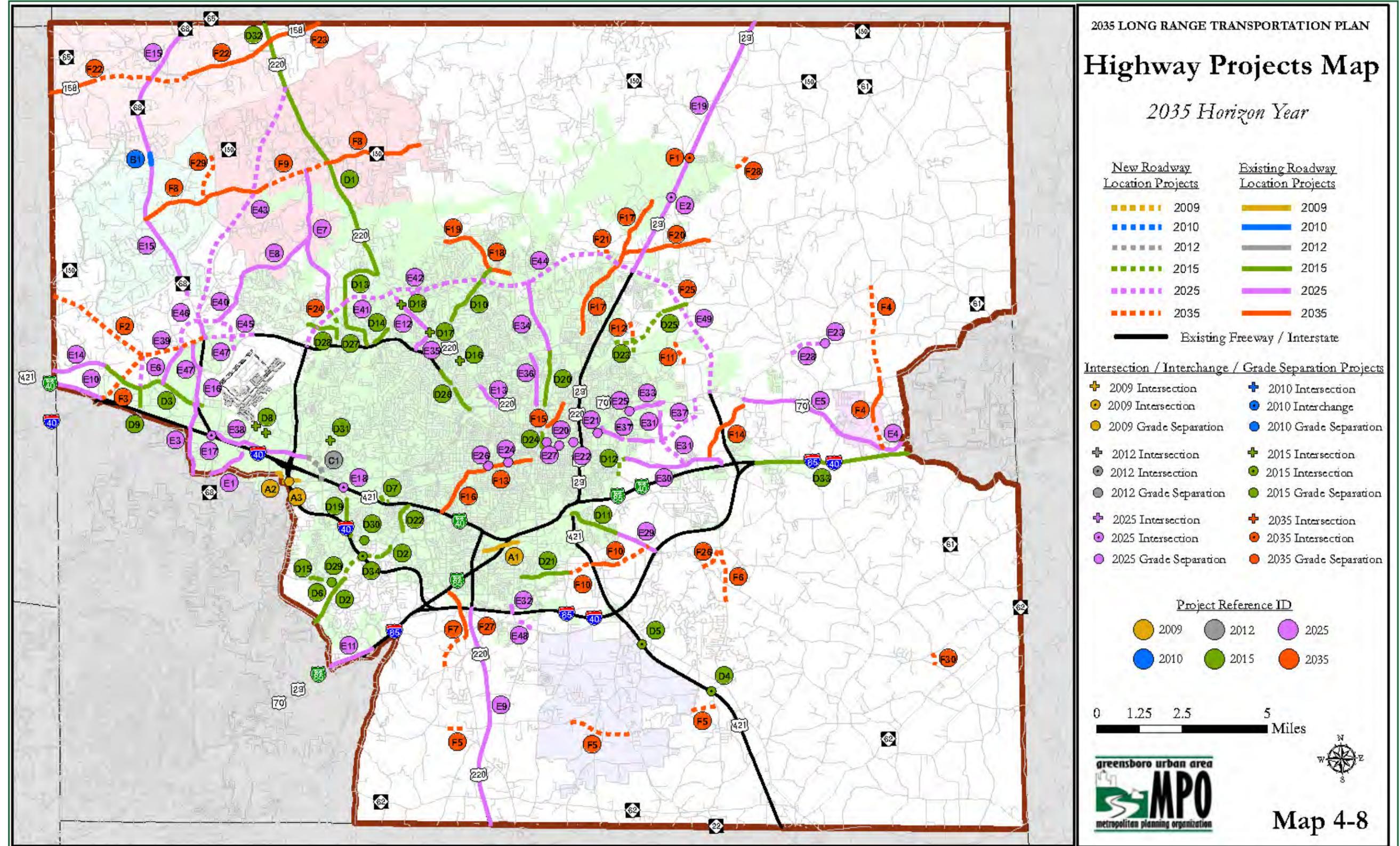




Figure 4 – LTRP Pedestrian Projects Map

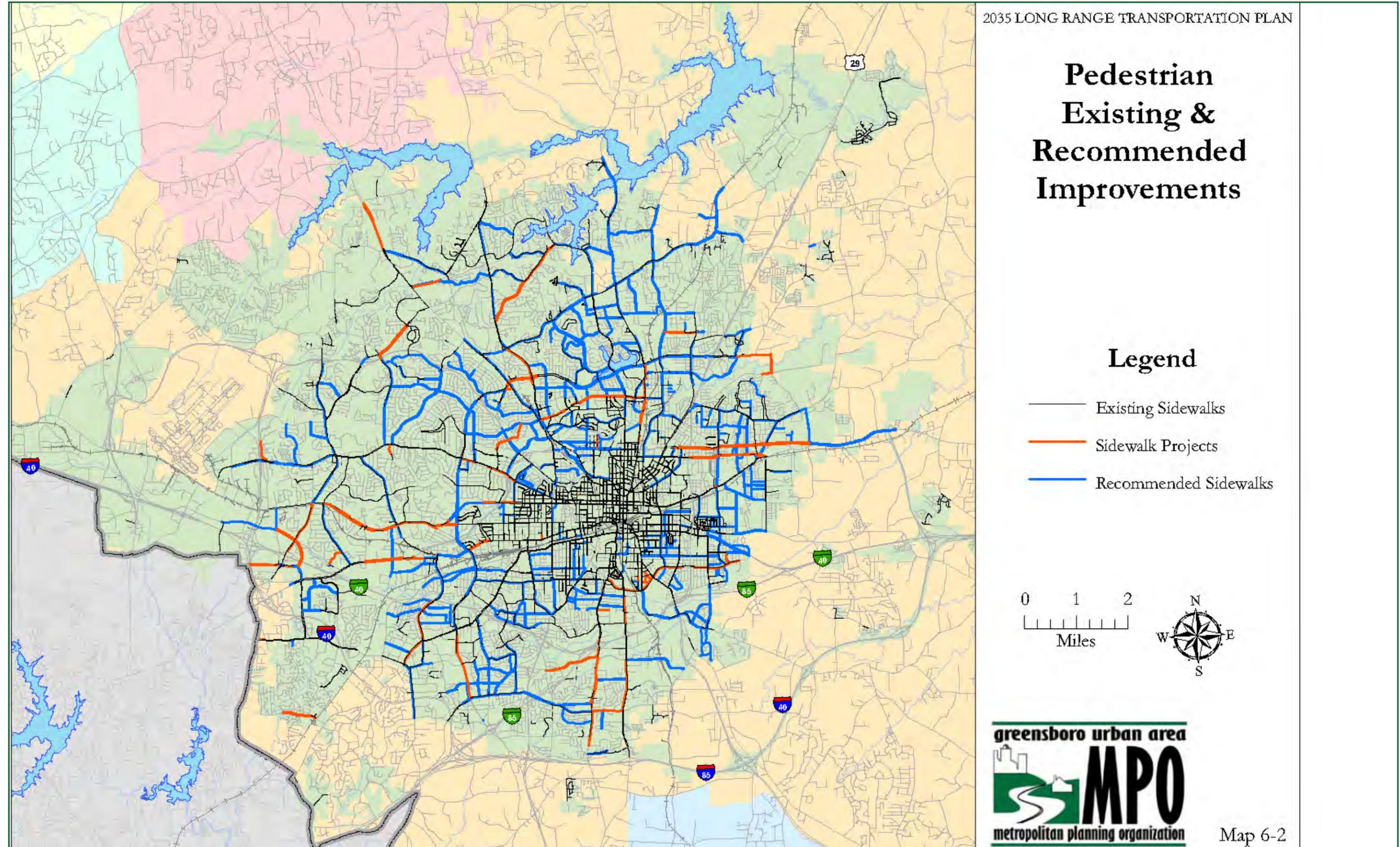




Figure 5 – LTRP Bicycle Projects Map

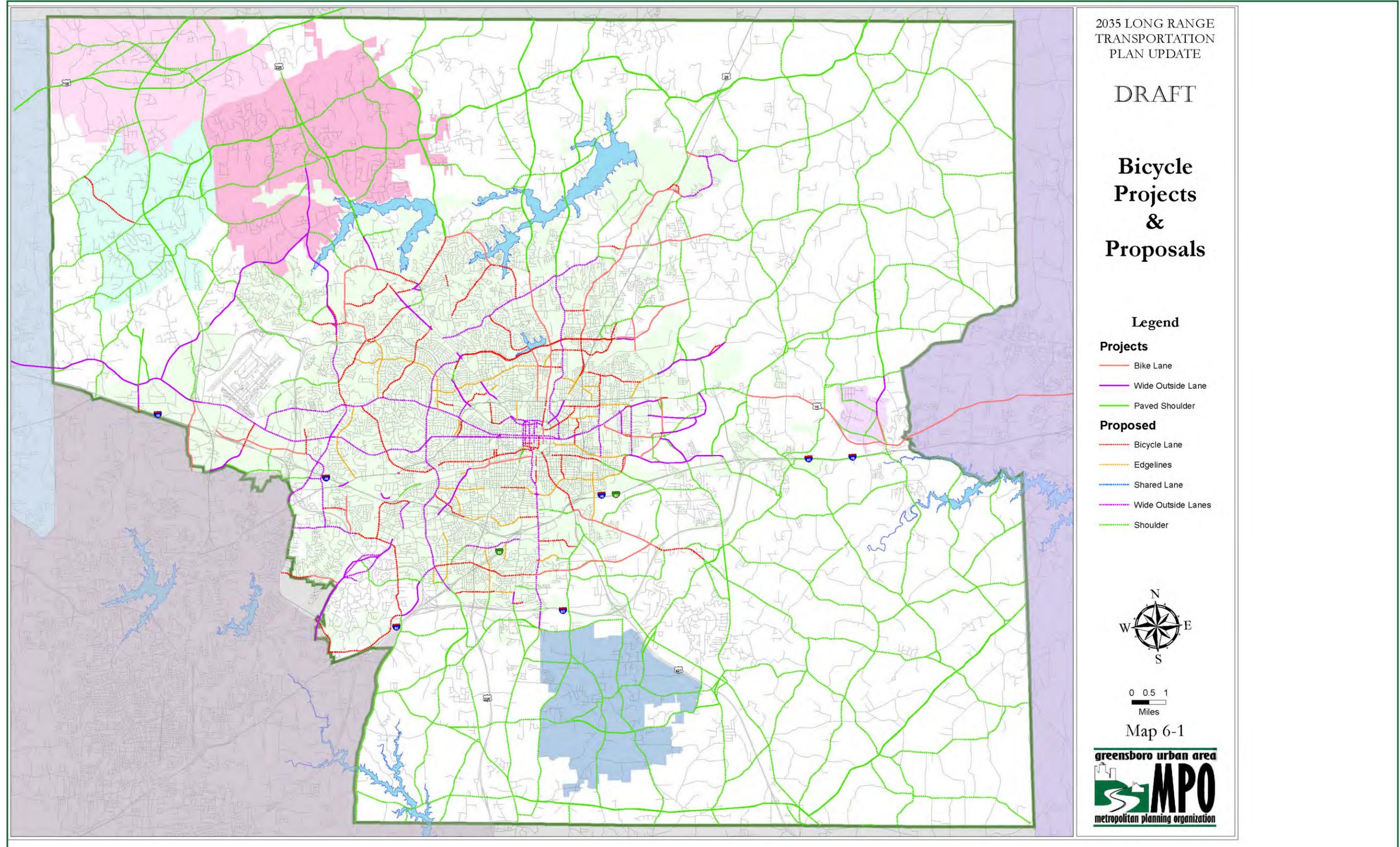
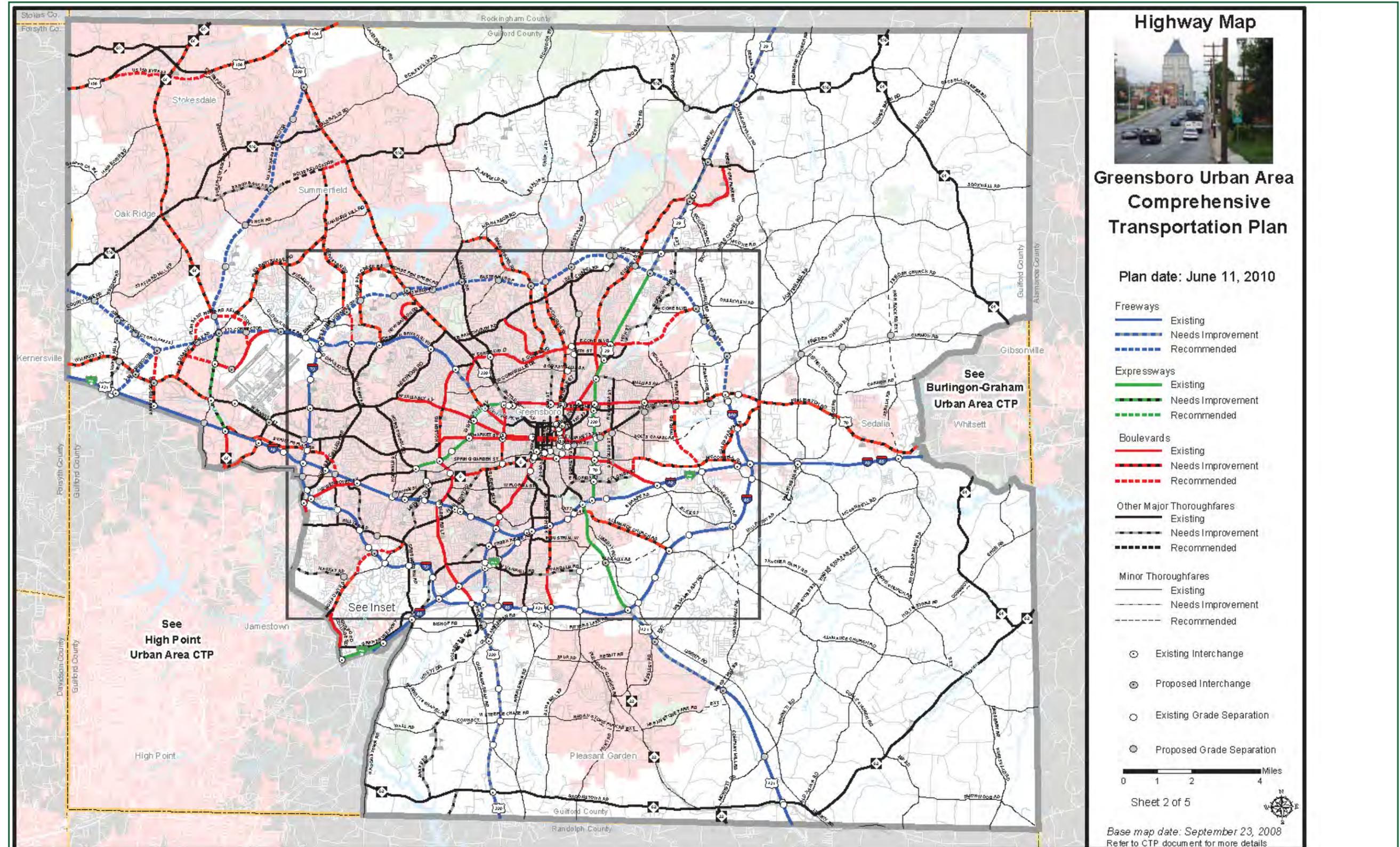


Figure 6 – Greensboro Thoroughfare Plan





# 3.0 methodology

## 3.0 Methodology

In order to provide an assessment of the existing and proposed transportation infrastructure that will be needed to support the identified future economic development areas, the future traffic volumes were estimated based on traffic forecast volumes for the study area. The forecast volumes for future year 2035 conditions were provided by GDOT.

Site-generated trips were estimated based on developable acreage of future land uses and ITE Trip Generation Version 6 software. These trips were distributed to onto the future roadway network. Highway Capacity Software (HCS) was utilized to determine the appropriate cross sections required on the study roadways to accommodate the future traffic demand. Level of Service D was considered as the threshold to be maintained on the study roadways. Table 3.1 below provides a summary of the traffic capacity for two, four, and six lane roadways:

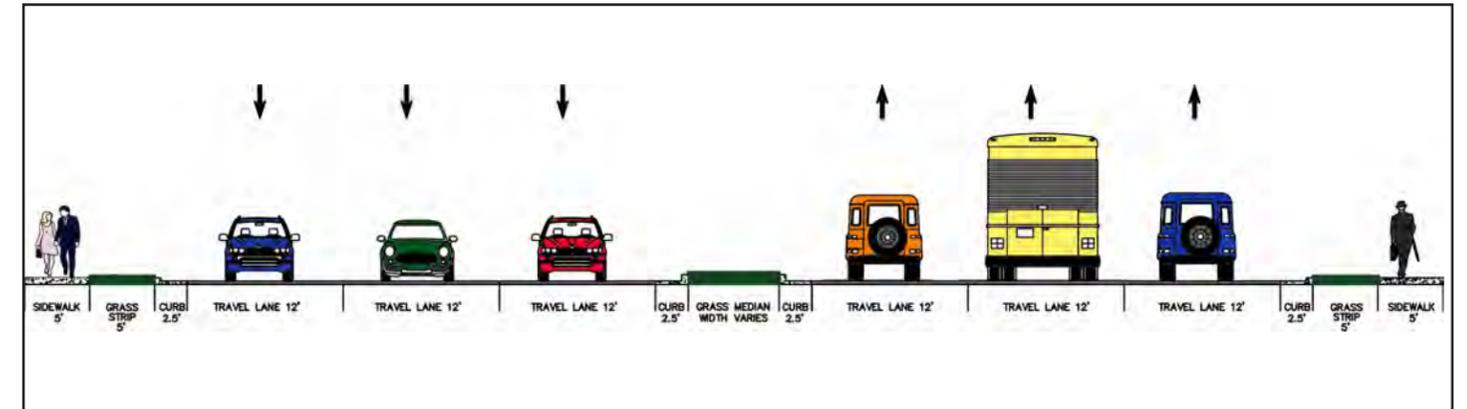
Table 3.1 Approximate Roadway Capacity for Various Roadway Widths			
Roadway Width	2 lane	4 lane	6 lane
Approximate Daily Traffic Capacity	15,000	50,000	75,000
Based on maintaining LOS D or better using HCS Two Lane and Multilane software. The following typical assumptions were used: Hourly factor 0.1, directional split 60%/40%, 2% trucks, shoulder width 6 ft, lane width 12 ft, and 8 access points per mile			

The GDOT Driveway Manual and NCDOT "Policy on Street and Driveway Access to North Carolina Highways" were consulted. The following section outlines our recommendations by roadway. Note that these recommendations are based on a planning level analysis by roadway. No detailed intersection analysis has been carried out at this stage of the project. The recommended cross sections may change based on what is ultimately built in the East Greensboro Development Area.

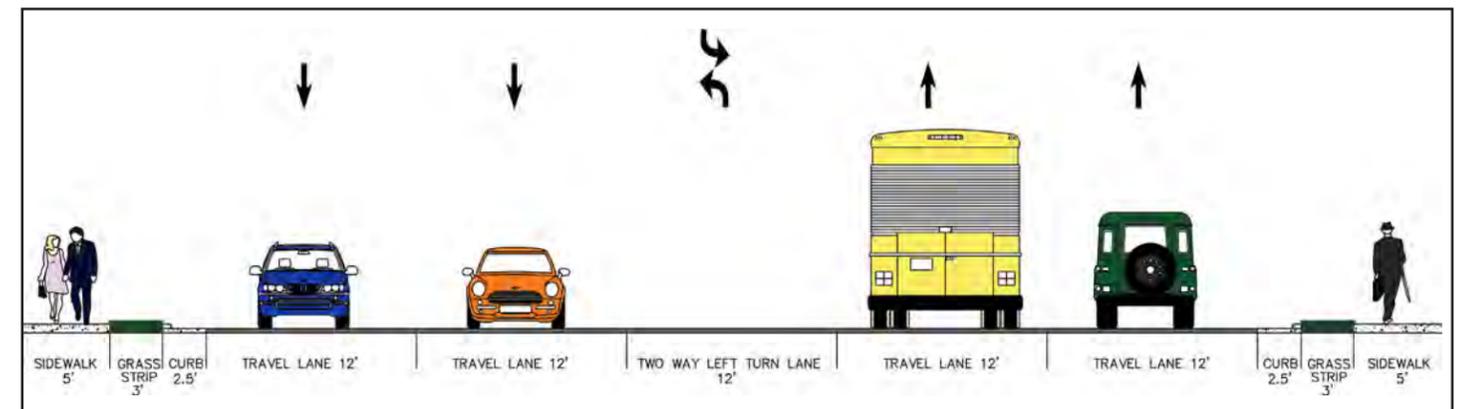
# 4.0 recommendations

## 4.1 US 70 (Wendover Avenue)

- Based on the Economic Development Plan, Wendover Avenue will serve commercial, light industrial, and residential uses.
- When TIP U-2525B (Greensboro Urban Loop) is in place, the interchange at US 70 / Greensboro Loop will be completed and a third westbound through lane will be added on Wendover Avenue in the vicinity of the interchange.
- Our analysis indicates that a six-lane divided section will be needed to the east of Flemingfield Road in order to facilitate 2035 future traffic volumes. This includes three (3) travel lanes and curb and gutter in each direction, and a grass strip and sidewalk on each side due to limited right of way. **It should be noted that adequate right of way (ROW) will be needed in order to provide the recommended typical sections.** The recommended typical section is shown below.



- To the west of Flemingfield Road, a five-lane section is recommended. This includes two (2) travel lanes, a center two-way-left-turn lane (TWLTL), curb and gutter, and sidewalk on each side. The recommended typical section is shown below.



#### 4.1 US 70 (Wendover Avenue) (continued)

- The heavy traffic volumes on Wendover Avenue, heavy site trips to the development area, and the limited distance between intersections along Wendover Avenue create challenges to accommodating traffic on Wendover Avenue. In order to provide adequate access management spacing, NCDOT would typically require 1000 feet between traffic signals. The distance along Wendover Avenue is approximately 700 feet between Willowlake Road and the Greensboro Urban Loop Southbound Ramp. We have prepared two (2) concepts for consideration: a signalized “power left” and a full access signalized intersection at Willowlake Road.
- Concept 1** consists of a signalized “power left” at Willowlake Road. This scenario allows Willowlake Road to be maintained at its current location by installing a simple 2-phase traffic signal at Willowlake Road and restricting left turns from Wendover Avenue. The proposed traffic signal at Greensboro Urban Loop Southbound Ramps is located approximately 700 feet from Willowlake Road. A 2-phase traffic signal at Willowlake Road will allow more green time for traffic on Wendover Avenue and thereby prevent queues from reaching back and blocking the Southbound Ramps. In this scenario, drivers seeking to make an eastbound left turns from Wendover Avenue onto Willowlake Road must make a u-turn at the traffic signal at the Southbound Ramps. A traffic signal is also envisioned at the site access on Wendover Avenue between Willowlake Road and Flemingfield Road.
- The “power left” option includes the following lanes at the intersection with Wendover Avenue: two (2) left turn lanes and a left/right combined lane in the southbound direction, and one (1) northbound lane



Power Left Concept

- Concept 2** consists of a full access signalized intersection at Willowlake Road. In order to allow full access, Willowlake Road will need to be relocated to the west to provide 1000 feet of separation between Willowlake Road and the future traffic signal at the Greensboro Urban Loop Southbound Ramps. A directional crossover (left out prohibited) is also envisioned at the site access on Wendover Avenue between Willowlake Road and Flemingfield Road. This scenario will involve costs including, but not limited to, right of way and construction costs to relocate Willowlake Road at Wendover Avenue.
- The full access option includes the following lanes at the intersection with Wendover Avenue: two (2) left turn lanes and one (1) right turn lane in the southbound direction, and one (1) northbound lane



Full Access Concept

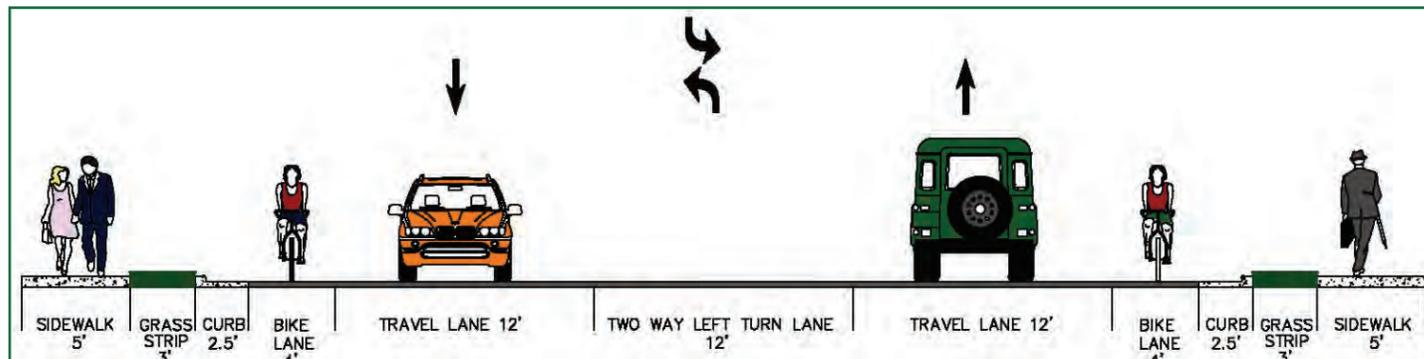
- Both of the above concepts will involve cutting off the southern leg of Willowlake Road from Wendover Avenue, and rerouting traffic to the Flemingfield Road traffic signal. The plans also shows a divided median on Wendover Avenue from east of Flemingfield Road to Greensboro Urban Loop Southbound Ramp.
- We are aware of a potential retail development at the northeast quadrant of the intersection of Wendover Avenue and Willowlake Road. We have presented these two (2) concepts for intersection improvements based on a planning level of information. However, there will be the need for a detailed traffic analysis to determine the type of access that can be allowed at this potential retail development.





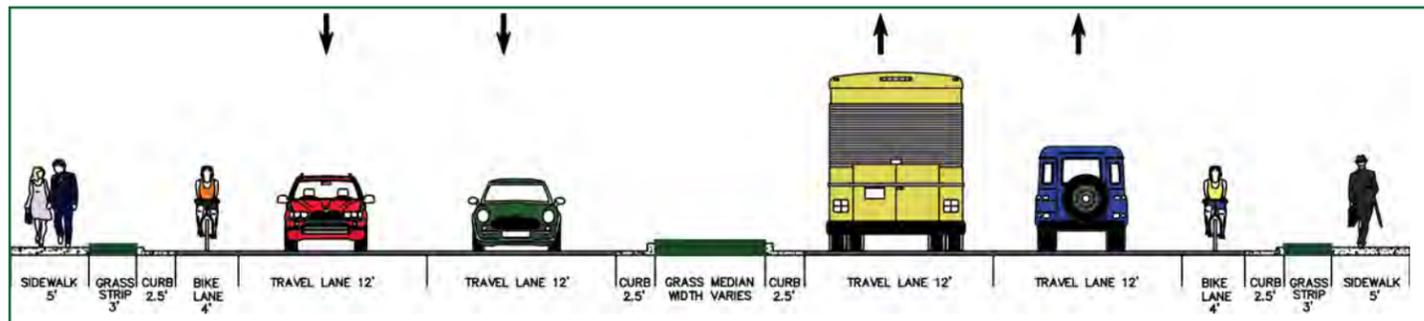
### 4.2 Huffine Mill Road

- Huffine Mill Road provides a connection between downtown Greensboro and the future development area in eastern Greensboro. In the long term, Huffine Mill Road will serve residential, mixed-use development and light industrial uses.
- Based on forecast volumes, the projected ADT in 2035 is 25,900 vehicles per day between Wendover Avenue and Rankin Mill Road. On the realigned section of Huffine Mill Road between Willowlake Road and future Greensboro Urban Loop, an ADT of 26,500 vehicles is expected
- To the west of Nealtown Road, a three-lane section is recommended. This includes one (1) travel lane in each direction, a center TWLTL, curb and gutter in each direction, bike lane in each direction, and a grass strip and sidewalk on each side. The recommended typical section is shown below.



**Recommended typical section for Huffine Mill Road (three-lane with TWLTL)**

- To the east of Nealtown Road, a four-lane divided section is recommended. This includes two (2) travel lanes and curb and gutter in each direction, a bike lane on each side, a grass strip and sidewalk on each side, and a landscaped median. The landscaped median will improve aesthetics and help to create an 'academic' style along Huffine Mill Road. The recommended typical section is shown below.

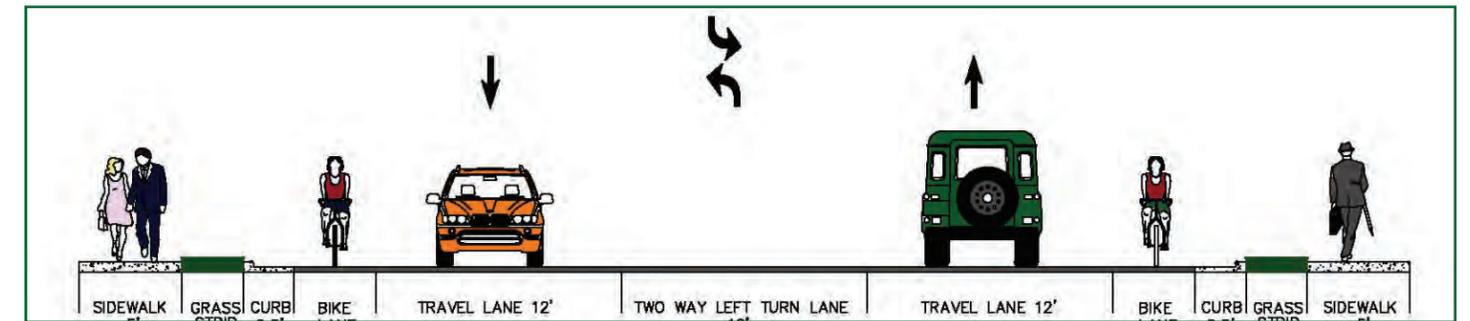


**Recommended typical section for Huffine Mill Road (four-lane divided)**

- As part of TIP U-2525B (Greensboro Urban Loop), an interchange will be constructed at the intersection of the realigned Huffine Mill Road and Greensboro Urban Loop

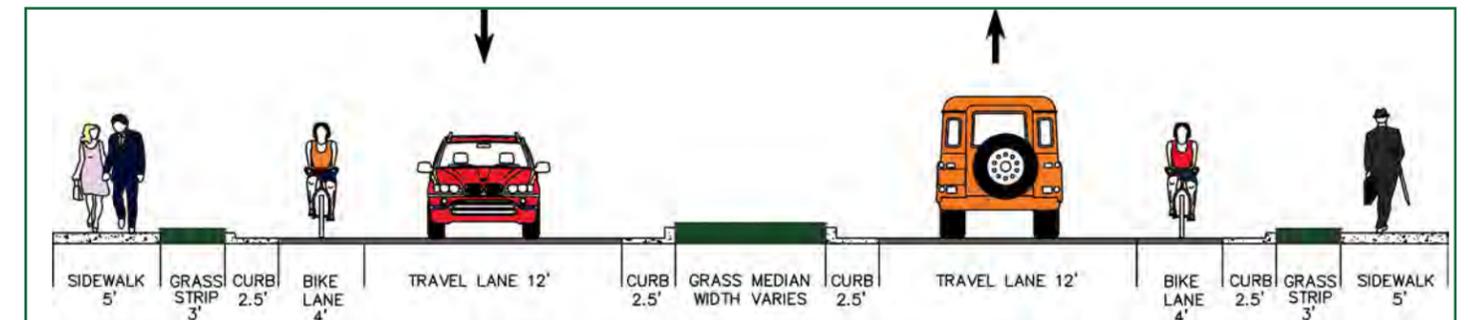
### 4.3 Flemingfield Road

- In the long term, Flemingfield Road will serve residential, mixed-use development and light industrial uses.
- Based on forecast volumes, the projected ADT in 2035 is 12,300 vehicles per day.
- On the southern portion of Flemingfield Road, which is primarily commercial, we recommend a 3 lane section, including one (1) travel lane in each direction, a center TWLTL, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction. The TWLTL will accommodate left turns into the commercial accesses on the southern section of Flemingfield Road. The typical section is illustrated below.



**Recommended section for southern portion of Flemingfield Road (three-lane with TWLTL)**

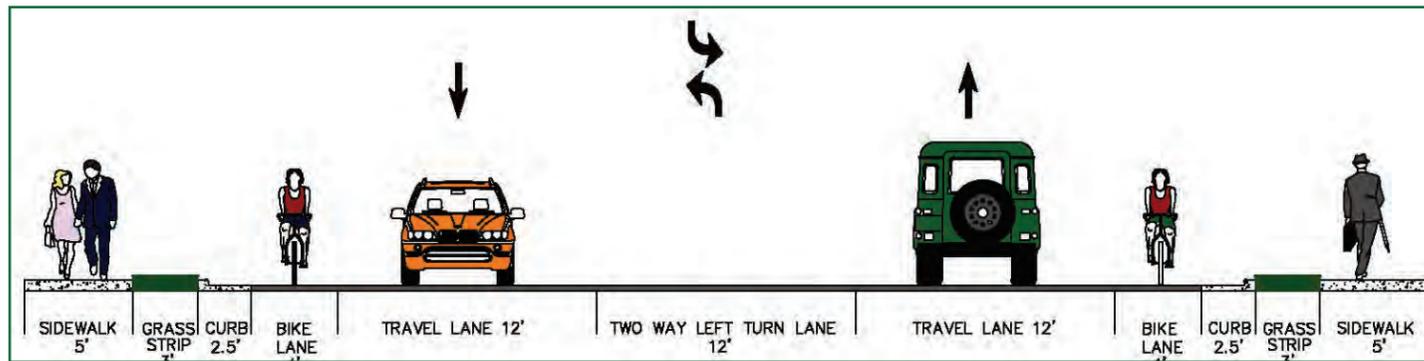
- On the northern portion of Flemingfield Road, which is primarily residential, we recommend a 2 lane divided section. This includes one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median. The typical section is illustrated below.



**Recommended section for northern portion of Flemingfield Road (two-lane divided)**

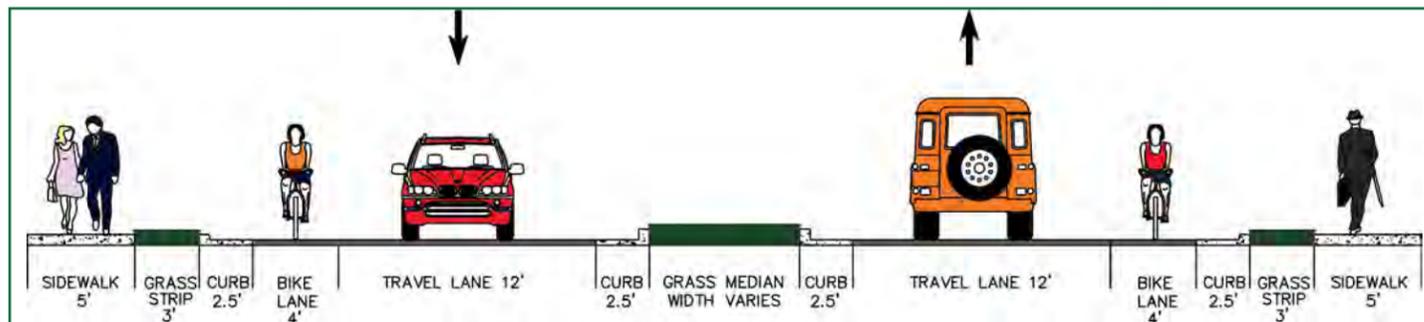
#### 4.4 Willow Lake Road

- In the long term, Willowlake Road will serve commercial, residential, and light industrial uses.
- Based on forecast volumes, the projected ADT in 2035 is 10,200 vehicles per day.
- To the south of the South Buffalo Creek, which passes under Willowlake Road approximately 2,000 feet north of Wendover Avenue, commercial land uses are planned along Willowlake Road. On this segment we recommend a 3 lane section, including one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, as well as a TWLTL. The TWLTL will accommodate left turns into the commercial accesses on Willowlake Road. The typical section is illustrated below.



**Recommended section for southern portion of Willowlake Road (three-lane with TWLTL)**

- On Willowlake Road from north of the South Buffalo Creek to Rankin Mill Road, residential and light industrial land uses are planned. We recommend a 2 lane divided section on this segment of Willowlake Road. This includes one (1) travel lane in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median. The typical section is illustrated below.

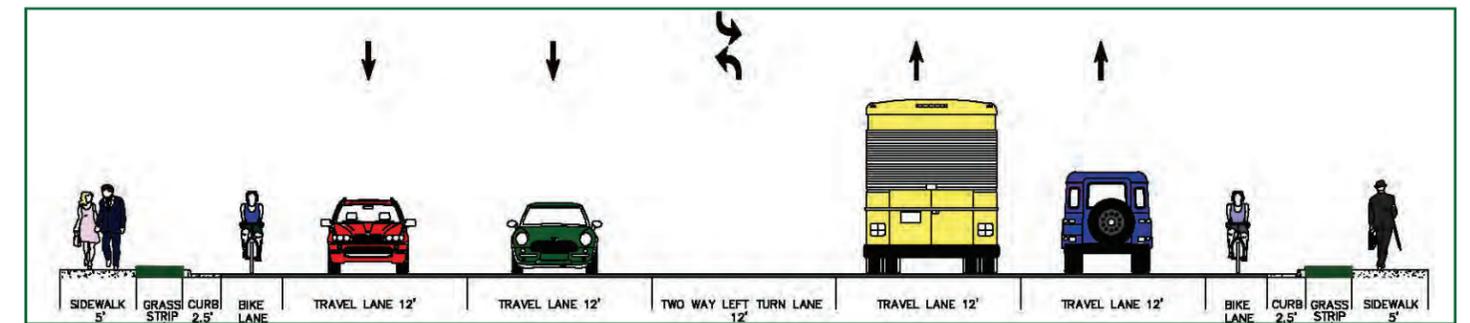


**Recommended section for northern portion of Willowlake Road (two-lane divided)**

- At the intersection with Wendover Avenue, a total of three (3) southbound turn lanes and one (1) northbound lane will be needed on Willowlake Road, as illustrated in the Concept 1 and Concept 2 plans.

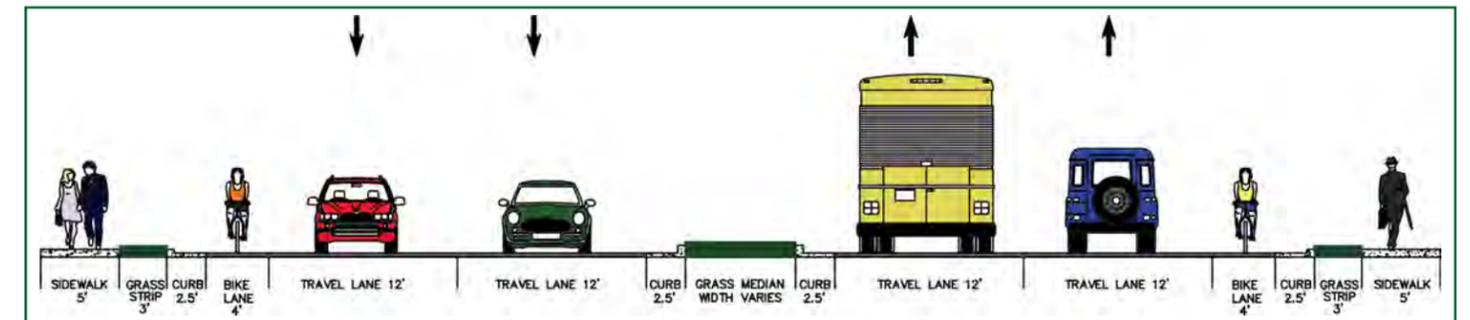
#### 4.5 Rankin Mill Road

- Rankin Mill Road is expected to serve primarily industrial land uses in the future.
- Based on forecast volumes, the projected ADT in 2035 is 20,700 vehicles per day.
- On Rankin Mill Road to the north of White Street Extension, which is primarily industrial, we recommend a five-lane section, including two (2) travel lanes in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, as well as a TWLTL. The TWLTL will accommodate left turns into the industrial accesses. The typical section is illustrated below.



**Recommended section for Rankin Mill Road north of White St. Extension (five-lane with TWLTL)**

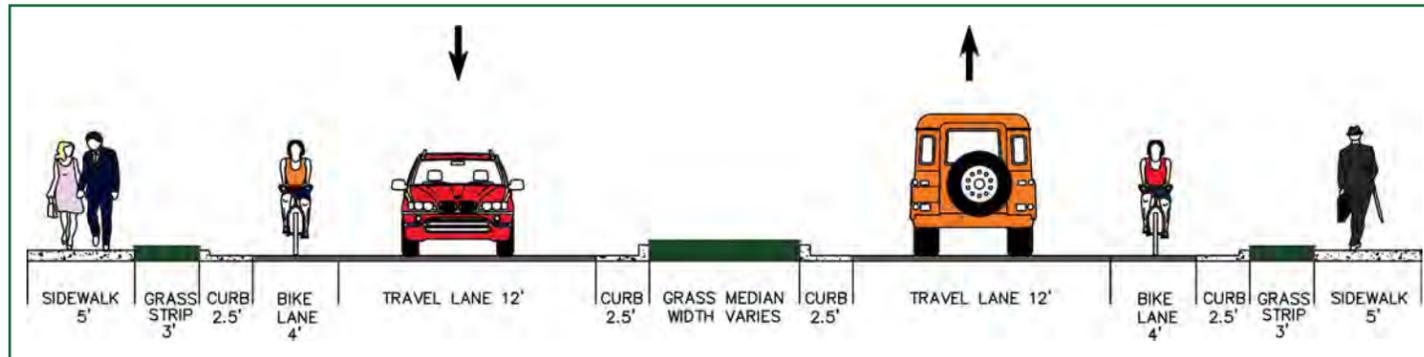
- On Rankin Mill Road to the south of White Street Extension, we recommend a four-lane divided section. This includes two (2) travel lanes in each direction, a bike lane, new curb and gutter, a grass strip, and new sidewalk in each direction, and a grass median. The typical section is illustrated below.



**Recommended section for Rankin Mill Road south of White St. Extension (four-lane divided)**

#### 4.6 White Street / White Street Extension

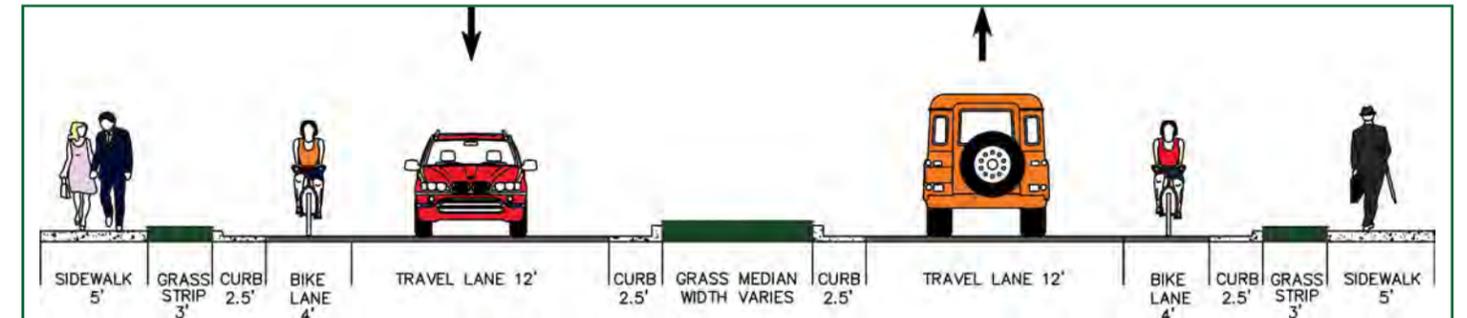
- White Street Extension will serve technology and industrial land uses in the future
- As currently planned, White Street will be extended eastward to tie into Keely Road, which in turn will tie into Camp Burton Road near the future Greensboro Urban Loop
- Based on forecast volumes, the projected ADT in 2035 is 3,600 vehicles per day
- It is recommended that White Street Extension be constructed as a two-lane section with a divided median. The typical section should include one (1) travel lane, a bike lane, new curb and gutter, new sidewalk and grass strip in each direction, and a grass median. The recommended typical section is illustrated below



Recommended typical section for White Street Extension (two-lane with median)

#### 4.7 Nealtown Road / Nealtown Road Extension

- Nealtown Road Extension will serve technology and industrial land uses in the future
- Nealtown Road will be extended by City of Greensboro as part of the Nealtown Road / Cone Boulevard Extension project. The City will extend Nealtown Road from its current terminus at White Street northward to White Elder Road, approximately 0.4 miles. This roadway will have a 2-lane undivided cross section. The East Greensboro Economic Development Plan calls for Nealtown Road to be extended northward to McKnight Mill Road.
- This study considered the segment of Nealtown Road between Huffine Mill Road and White Street
- Based on forecast volumes, the projected ADT on Nealtown Road in 2035 is 3,600 vehicles per day
- On Nealtown Road between Huffine Mill Road and White Street, we recommend a two (2) lane section with a divided median. The typical section should include one (1) travel lane, a bike lane, new curb and gutter, new sidewalk and grass strip in each direction, and a grass median. The recommended typical section is illustrated to the right



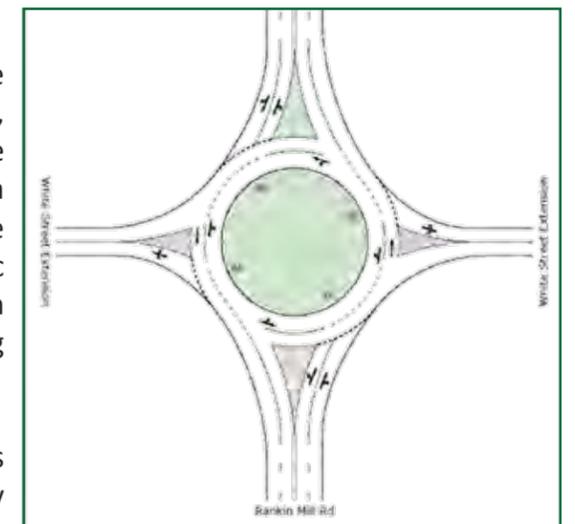
Recommended typical section for Nealtown Road Extension (2 lane with median)

#### 4.8 Intersection of White Street Extension at Rankin Mill Road

As mentioned earlier, White Street will be extended eastward and will provide connectivity between central Greensboro and the Urban Loop. White Street Extension will intersect with Rankin Mill Road in the center of the East Greensboro Economic Development area. In order to provide adequate traffic capacity, a traffic analysis was carried out for this intersection. Daily traffic volume forecasts were provided by City of Greensboro for Year 2035. These volumes were converted to peak hour volumes using peak hour factors and directional splits provided by the City. Site trips due to the Economic Development area were then added based on the ITE trip generation and expected trip distribution patterns. More information on the methodology can be found in the Technical Appendix.

This intersection was analyzed for the potential of a two-lane roundabout. Based on the results for 2035 future build conditions, this intersection is expected to operate at an overall level of service (LOS) A in both the AM and PM peak hours. It was considered that a roundabout would be an ideal configuration for this intersection, due to the lower long-term maintenance costs as compared to a traffic signal. The roundabout also adds visual appeal and is consistent with the East Greensboro Economic Development Plan's goal of providing a natural and academic style in this area.

Analysis results show that this intersection may be constructed as a single lane roundabout in the short term. However, the capacity should be reserved to expand the intersection to a two (2) lane roundabout at full build out of the study area. Further design of this intersection will be needed.

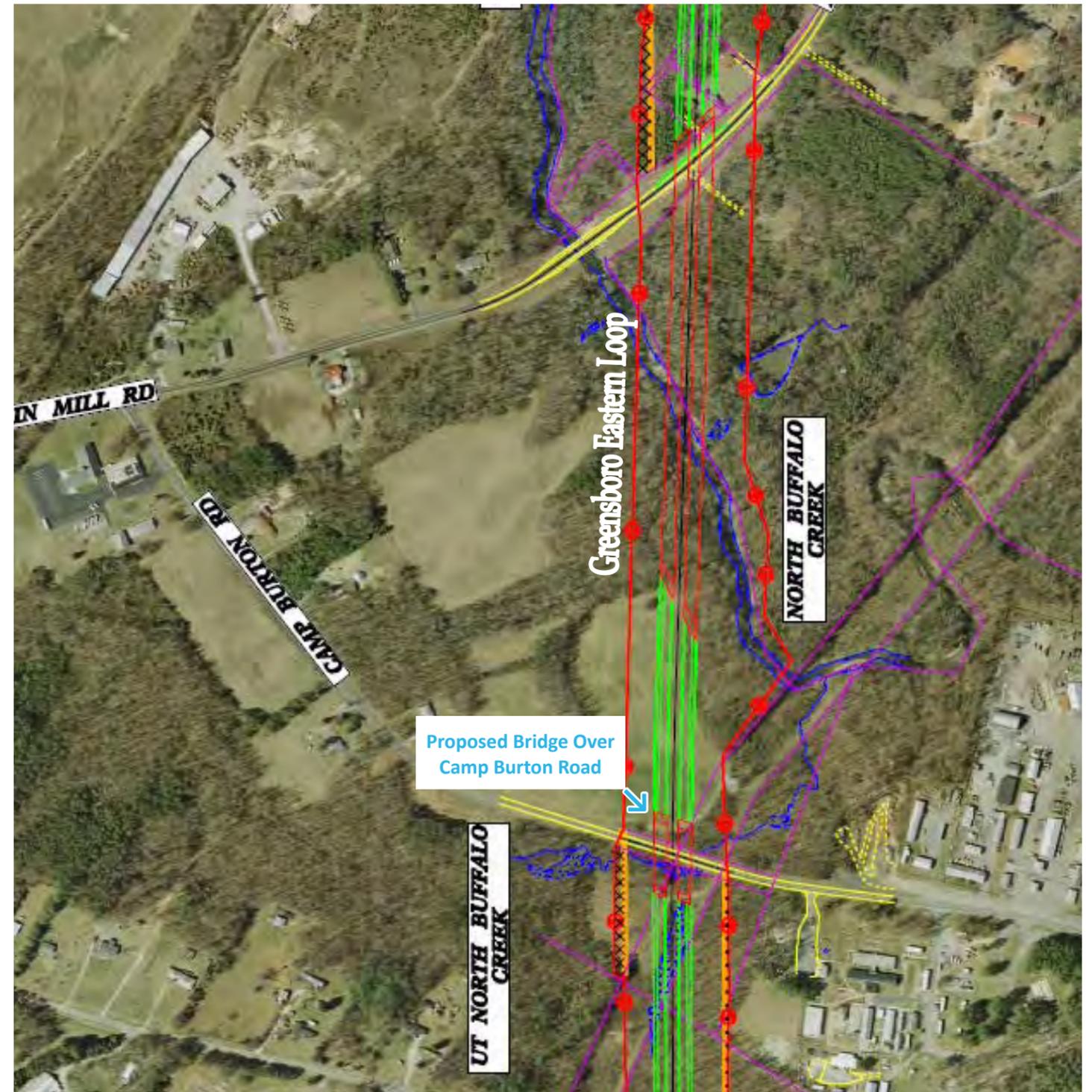
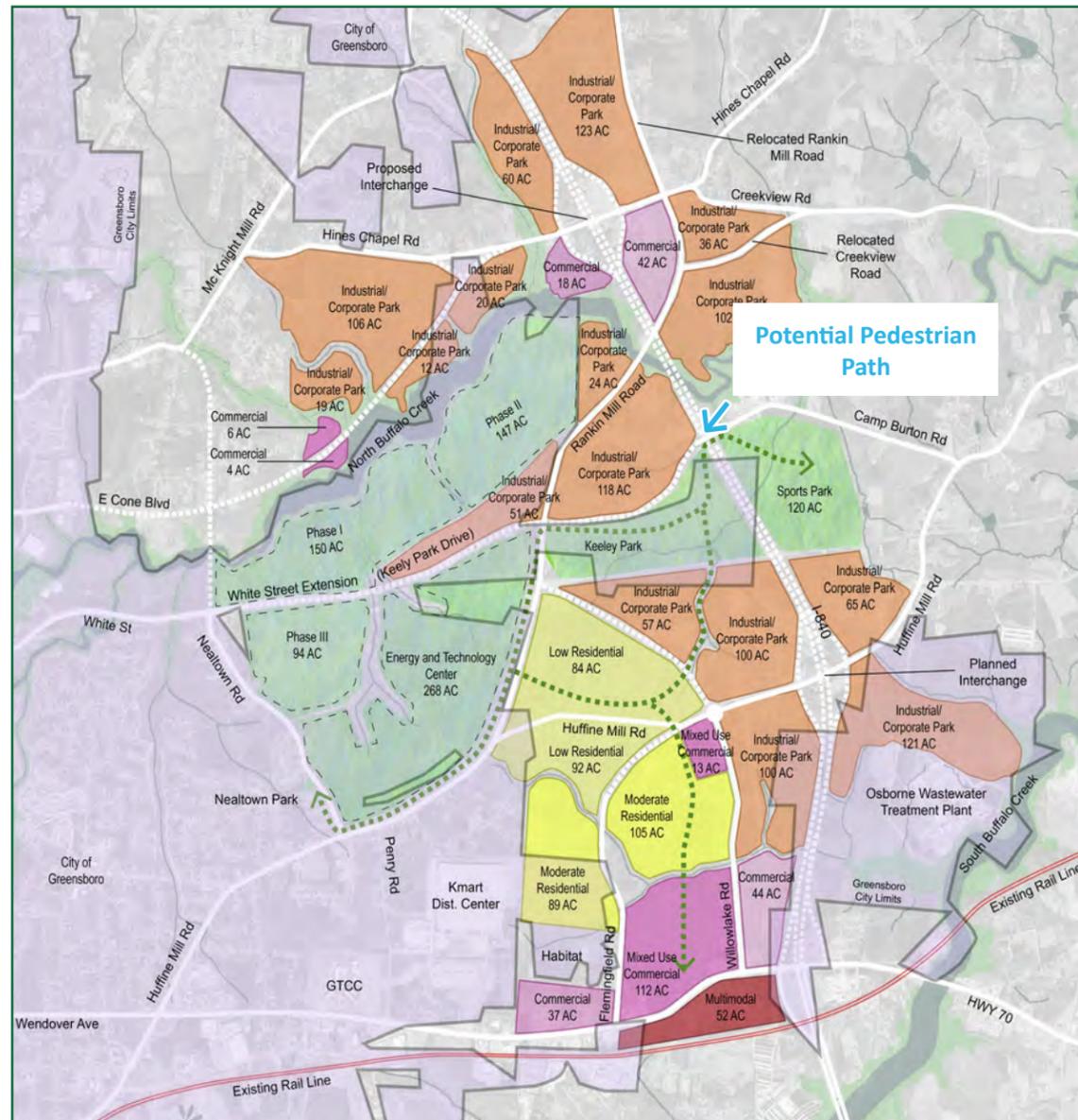


Recommended Roundabout Concept at White Street Extension/Rankin Mill Road

The East Greensboro Economic Development Plan calls for a roundabout also at the intersection of Huffine Mill Road and Willowlake Road. Further analysis will be needed for this intersection.

#### 4.9 Potential Pedestrian Route under Greensboro Urban Loop Bridge

The NCDOT plans for TIP U-2525B show a bridge on the Greensboro Urban Loop traversing Camp Burton Road and the future White Street Extension. This overpass will provide the opportunity for a pedestrian path running east and west, under the bridge on the Greensboro Urban Loop. This area is expected to feature a sports park and other recreation areas. A pedestrian connection in this area could provide economic, recreational, and other benefits for pedestrians and cyclists traveling in this area. Further study will be needed to determine the feasibility and appropriate location and design of this pedestrian path.



Greensboro Eastern Loop Overpasses  
Source: NCDOT TIP U-2525B/C Public Hearing Map Sheet 1 of 5



## 5.0 summary and conclusion

### 5.0 Summary and Conclusion

The City of Greensboro is currently in the process of identifying future economic development areas in and around Huffine Mill Road in East Greensboro. As a part of this effort, the East Greensboro Future Economic Development Area Study is being carried out by Evans Engineering, Inc. to provide a guide for future economic development in the area. The study will serve as a springboard to other specific and detailed studies. DAVENPORT was retained to provide a general overview and assessment of the existing and proposed transportation infrastructure that will be needed to support the identified future economic development areas.

The study area is located four miles northeast of downtown and is centered along Huffine Mill Road. The study area includes areas to the west and adjacent to the future Interstate 840 extension (referred to as the Eastern Outer Loop) from McKnight Mill Road to Hwy 70/Wendover Ave to the south, and areas extending out to the west of the Eastern Outer Loop bounded by McKnight Mill Road, Nealtown Road, and Huffine Mill Road.

As a part of the planned future economic development in the study area, the following objectives and goals were considered in developing recommendations:

- **Improve traffic flow and connectivity of the overall transportation network.** The completion of several roadway projects planned by the City and NCDOT will provide enhanced connectivity. These include the Greensboro Eastern Urban Loop, Cone Boulevard Extension, and Nealtown Road Extension. Additionally, the extension of White Street, Flemingfield Road, and Willowlake Road will enhance connectivity between residential, commercial, industrial and other portions of the East Greensboro Development Area.
- **Increase pedestrian activity through proper design of street sections and roadway network.** The recommended typical cross sections include 5-foot sidewalks on each side of the street, separated from the curb by a grass or landscaped strip. We recommend installing median refuge islands, pedestrian signals, and appropriate pavement markings and signage at designated pedestrian crossings.
- **Promote internal connectivity of developable area.** New development should have a well-connected system of local collector streets and access roads that efficiently conduct traffic between destinations. Sidewalks, bicycle lanes, and transit routes give motorists other options for travel between various destinations such as work, home, recreation, and shopping. Providing connections between developments gives motorists a variety of travel options so that they are not forced exclusively onto thoroughfares. This ultimately reduces congestion and travel distances.
- **Provide bike lanes and greenways in order to make cycling a safe, convenient, attractive form of transportation.** We have recommended providing bike lanes on new and existing roads in order to promote cycling within the study area as a viable mode of transportation.
- **Improve aesthetics.** We have recommended grass medians on the new and modified roadways where appropriate, as well as grass strips between curb and sidewalk. These areas will provide opportunities for landscaping and will improve the aesthetics of the corridors, and can be used to create an attractive, 'academic' style in the study area.

This study provided a general overview and assessment of the existing and proposed transportation infrastructure that will be needed to support the identified future economic development areas. It should be noted that these recommendations are based on a planning level analysis by roadway. No detailed intersection analysis has been carried out at this stage of the project. The recommended cross sections may change based on what is ultimately built in the East Greensboro Development Area.

In addition to the general recommendations provided in this report, the following items are recommended as potential next steps:

- Develop cost estimates and a prioritization of the proposed transportation improvements
- A detailed traffic capacity analysis will be needed for the East Greensboro Development study area, including the potential retail development at the northeast quadrant of intersection of Wendover Avenue and Willowlake Road. Analysis will be needed to determine the type of access that can be allowed at this potential retail development.
- Traffic analysis will be needed for the intersection of Huffine Mill Road and Willowlake Road. This intersection is currently envisioned as a roundabout. The feasibility and laneage of the proposed roundabout will need to be reviewed, including a conceptual design of the roundabout
- A conceptual design will be needed for the proposed roundabout at the intersection of the White Street Extension and Rankin Mill Road.
- Conceptual design of street sections will be needed, including Huffine Mill Road, Rankin Mill Road, Flemingfield Road, Willowlake Road, Nealtown Road, and White Street Extension.

Additional information on the methodology and results of the intersection capacity analysis are presented in the Technical Appendix in the pages that follow.



## APPENDIX



## APPENDIX A: Trip Generation



ITE Trip Generation												
Average Weekday Driveway Volumes							24 Hour	AM Peak		PM Peak		
Ref. #	Zoning Code	ITE Land Use	ITE Land Use Code	Acres	Rate	Size	Two-Way	Hour		Hour		
							Volume	Enter	Exit	Enter	Exit	
1	HI	General Heavy Industrial	120	60	0.15	392	Th.Sq.Ft. GFA	588	90	10	14	86
2	HI	General Heavy Industrial	120	123	0.15	804	Th.Sq.Ft. GFA	1206	369	41	21	132
3	HI	General Heavy Industrial	120	106	0.15	693	Th.Sq.Ft. GFA	1040	318	35	18	114
4	HI	General Heavy Industrial	120	20	0.15	131	Th.Sq.Ft. GFA	197	60	7	4	22
5	C-H	Shopping Center	820	18	0.15	118	Th.Sq.Ft. GFA	7562	104	66	348	362
6	C-M	Shopping Center	820	12	0.15	78	Th.Sq.Ft. GFA	5778	81	52	264	275
7	HI	General Heavy Industrial	120	167	0.15	1091	Th.Sq.Ft. GFA	1637	500	56	29	178
8	HI	General Heavy Industrial	120	19	0.15	124	Th.Sq.Ft. GFA	186	57	6	3	21
9	HI	General Heavy Industrial	120	12	0.15	78	Th.Sq.Ft. GFA	117	36	4	2	13
10	HI	General Heavy Industrial	120	24	0.15	157	Th.Sq.Ft. GFA	236	72	8	4	26
11	C-L	Shopping Center	820	6	0.15	39	Th.Sq.Ft. GFA	3682	54	34	166	173
12	C-L	Shopping Center	820	4	0.15	26	Th.Sq.Ft. GFA	2829	42	27	126	132
13	HI	General Heavy Industrial	120	51	0.15	333	Th.Sq.Ft. GFA	500	153	17	9	54
14	HI	General Heavy Industrial	120	118	0.15	771	Th.Sq.Ft. GFA	1157	354	39	20	126
15	Research	Research and Development Center	760	280	0.15	42	Acres	3344	592	113	78	571
16	Park	City Park	411	125	1	125	Acres	199	10	10	10	10
17	Park	City Park	411	125	1	125	Acres	199	10	10	10	10
18	R7	Single Family Detached Housing	210	220	0.15	1437	Dwelling Units	12073	254	762	729	428
19	LI	General Light Industrial	110	57	0.15	372	Th.Sq.Ft. GFA	2677	308	42	45	330
20	LI	General Light Industrial	110	100	0.15	653	Th.Sq.Ft. GFA	4776	600	82	93	683
21	LI	General Light Industrial	110	65	0.15	425	Th.Sq.Ft. GFA	3073	363	49	54	396
22	C-L	Shopping Center	820	13	0.1	57	Th.Sq.Ft. GFA	4713	67	43	214	223
23	LI	General Light Industrial	110	100	0.15	653	Th.Sq.Ft. GFA	4776	600	82	93	683
24	LI	General Light Industrial	110	121	0.15	791	Th.Sq.Ft. GFA	5807	743	101	117	857
25	RM-18	Single Family Detached Housing	210	89	0.15	582	Dwelling Units	5256	104	313	323	190
26	RM-26	Single Family Detached Housing	210	105	0.15	686	Dwelling Units	6114	122	367	375	220
27	C-H	Shopping Center	820	37	0.1	161	Th.Sq.Ft. GFA	9255	124	80	429	446
28	MU-M	Shopping Center	820	112	0.1	488	Th.Sq.Ft. GFA	19029	239	153	902	938
29	C-M	Shopping Center	820	44	0.1	192	Th.Sq.Ft. GFA	10377	138	88	483	502
<b>Total Unadjusted Trips</b>							<b>118,383</b>	<b>6,564</b>	<b>2,697</b>	<b>4,983</b>	<b>8,201</b>	
Pass-by Reduction (Commercial on Wendover Avenue)							-13145	0	0	-617	-641	
Pass-by Limited to 10% of Wendover Avenue Traffic (33,900 veh/day)							-3390	0	0	-339	-339	
<b>Total Adjusted Trips</b>							<b>114,993</b>	<b>6,564</b>	<b>2,697</b>	<b>4,644</b>	<b>7,862</b>	
<b>Residential Trips</b>							<b>23,443</b>	<b>480</b>	<b>1,442</b>	<b>1,427</b>	<b>838</b>	
<b>Commercial Trips</b>							<b>43,374</b>	<b>568</b>	<b>364</b>	<b>2,028</b>	<b>2,109</b>	
<b>Light Industrial Trips</b>							<b>21,109</b>	<b>2,614</b>	<b>356</b>	<b>402</b>	<b>2,949</b>	
<b>Heavy Industrial Trips</b>							<b>26,715</b>	<b>2,290</b>	<b>402</b>	<b>1,028</b>	<b>1,714</b>	
<b>Research and Recreation Trips</b>							<b>3,742</b>	<b>612</b>	<b>133</b>	<b>98</b>	<b>591</b>	



Summary of Multi-Use Trip Generation  
Average Weekday Driveway Volumes  
June 27, 2013

Land Use	Size	24 Hour Two-Way Volume	AM Pk Hour Enter	AM Pk Hour Exit	PM Pk Hour Enter	PM Pk Hour Exit
General Heavy Industrial	392 Th.Sq.Ft. GFA	588	0	0	0	0
General Heavy Industrial	804 Th.Sq.Ft. GFA	1206	0	0	0	0
General Heavy Industrial	693 Th.Sq.Ft. GFA	1040	0	0	0	0
General Heavy Industrial	131 Th.Sq.Ft. GFA	197	0	0	0	0
General Heavy Industrial	1091 Th.Sq.Ft. GFA	1637	0	0	0	0
General Heavy Industrial	124 Th.Sq.Ft. GFA	186	0	0	0	0
General Heavy Industrial	78 Th.Sq.Ft. GFA	117	0	0	0	0
General Heavy Industrial	157 Th.Sq.Ft. GFA	236	0	0	0	0
General Heavy Industrial	333 Th.Sq.Ft. GFA	500	0	0	0	0
General Heavy Industrial	771 Th.Sq.Ft. GFA	1157	0	0	0	0
General Light Industrial	372 Th.Sq.Ft. GFA	2677	308	42	45	330
General Light Industrial	653 Th.Sq.Ft. GFA	4776	600	82	93	683
General Light Industrial	425 Th.Sq.Ft. GFA	3073	363	49	54	396
General Light Industrial	653 Th.Sq.Ft. GFA	4776	600	82	93	683
General Light Industrial	791 Th.Sq.Ft. GFA	5807	743	101	117	857
Shopping Center	118 Th.Sq.Ft. GLA	7562	104	66	348	362
Shopping Center	78 Th.Sq.Ft. GLA	5778	81	52	264	275
Shopping Center	39 Th.Sq.Ft. GLA	3682	54	34	166	173
Shopping Center	26 Th.Sq.Ft. GLA	2829	42	27	126	132
Shopping Center	57 Th.Sq.Ft. GLA	4713	67	43	214	223
Shopping Center	161 Th.Sq.Ft. GLA	9255	124	80	429	446
Shopping Center	488 Th.Sq.Ft. GLA	19029	239	153	902	938
Shopping Center	192 Th.Sq.Ft. GLA	10377	138	88	483	502
Research and Development Center	42 Acres	3344	592	113	78	571
Single Family Detached Housing	1437 Dwelling Units	12073	254	762	729	428
Single Family Detached Housing	582 Dwelling Units	5256	104	313	323	190
Single Family Detached Housing	686 Dwelling Units	6114	122	367	375	220
City Park	125 Acres	199	0	0	0	0
City Park	125 Acres	199	0	0	0	0
Total Driveway Volume		118383	4535	2454	4839	7409
Total Peak Hour Pass-By Trips			0	0	1020	1062
Total Peak Hour Vol. Added to Adjacent Streets			4535	2454	3819	6347



**APPENDIX B: Level of Service Analysis**



6/27/2013

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst Agency or Company Date Performed Analysis Time Period	Nick Liguori, EI Davenport 4/16/2013 12-073 East Greensboro
<b>Site Information</b>	
Highway From/To Jurisdiction Analysis Year	Nealtown Rd Huffine Mill/White St 2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    640 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 2 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8 <input type="checkbox"/> Show North Arrow
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.2
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.996
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	714
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	428
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS    FFS=S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> -f <sub>np</sub>	47.5
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.998
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	713
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	428
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	46.6
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	46.6
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	C
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.22
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	160
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	576
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	3.4
<b>Notes</b>	
1. If V <sub>p</sub> >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split V <sub>p</sub> >= 1,700 pc/h, terminated anlysis-the LOS is F.	

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TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst	Nick Liguori, EI
Agency or Company	Davenport
Date Performed	4/16/2013
Analysis Time Period	
Project Description: 12-073 East Greensboro	
<b>Site Information</b>	
Highway	Willowlake Rd
From/To	Wendover/Huffine Mill
Jurisdiction	
Analysis Year	2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    1330 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 2 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.998
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1481
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	889
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS = S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> *f <sub>np</sub>	41.5
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	1.000
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1478
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	887
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	72.7
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	72.7
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	D
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.46
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	296
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	1064
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	7.1
<b>Notes</b>	
1. If V <sub>p</sub> >= 3,200 pc/h, terminate analysis-the LOS is F.	
2. If highest directional split V <sub>p</sub> >= 1,700 pc/h, terminated anlysis-the LOS is F.	

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TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst Agency or Company Date Performed Analysis Time Period	Nick Liguori, EI Davenport 4/16/2013 12-073 East Greensboro
<b>Site Information</b>	
Highway From/To Jurisdiction Analysis Year	Flemingfield Rd Wendover/Willowlake 2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    1240 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 2 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.998
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1381
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	829
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS FFS=S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> f <sub>np</sub>	42.3
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	1.000
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1378
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	827
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	70.2
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	70.2
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	D
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.43
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	448
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	1612
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	10.6
<b>Notes</b>	
1. If V <sub>p</sub> >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split V <sub>p</sub> >= 1,700 pc/h, terminated anlysis-the LOS is F.	

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TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst Agency or Company Date Performed Analysis Time Period	Nick Liguori, EI Davenport 4/16/2013 12-073 East Greensboro
<b>Site Information</b>	
Highway From/To Jurisdiction Analysis Year	White St Ext Nealtown/Rankine Mill 2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    360 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 10 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.935
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	428
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	257
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS = S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> *f <sub>np</sub>	49.7
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.990
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	404
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	242
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	29.9
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.5
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	30.4
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	C
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.13
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	130
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	468
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	2.6
<b>Notes</b>	
1. If V <sub>p</sub> >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split V <sub>p</sub> >= 1,700 pc/h, terminated anlysis-the LOS is F.	

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Phone: Fax:  
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PLANNING ANALYSIS

Analyst: Nick Liguori, EI  
Agency/Co: Davenport  
Date: 4/16/2013  
Analysis Period:  
Highway: Rankin Mill Rd  
From/To: White St Ext/Hines Chapel  
Jurisdiction:  
Analysis Year: 2035 Future Build  
Project ID: 12-073 East Greensboro

INPUT DATA

Total AADT volume, AADT 8500 vpd  
Proportion AADT during peak hour, K 0.10  
Percent peak-hour traffic in heaviest direction, D 60 %  
Trucks 10 %  
Terrain type Level  
Base free-flow speed, BFFS 55.0 mph

ANALYSIS

DDHV = AADT x D x K  
DDHV = 8500 x 0.60 x 0.10 = 510

Volume for : LOS  
4-lane highway = 510 vph/2 lanes = 255 vphpl A  
6-lane highway = 510 vph/3 lanes = 170 vphpl A

LEVEL OF SERVICE

	LOS	Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain		0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----  
 PLANNING ANALYSIS  
 -----

Analyst: Nick Liguori, EI  
 Agency/Co: Davenport  
 Date: 4/16/2013  
 Analysis Period:  
 Highway: Rankin Mill Rd  
 From/To: Huffine Mill/White St Ext  
 Jurisdiction:  
 Analysis Year: 2035 Future Build  
 Project ID: 12-073 East Greensboro

-----  
 INPUT DATA  
 -----

Total AADT volume, AADT	16500	vpd
Proportion AADT during peak hour, K	0.10	
Percent peak-hour traffic in heaviest direction, D	60	%
Trucks	2	%
Terrain type	Level	
Base free-flow speed, BFFS	55.0	mph

-----  
 ANALYSIS  
 -----

DDHV = AADT x D x K  
 DDHV = 16500 x 0.60 x 0.10 = 990

Volume for :		LOS
4-lane highway = 990	vph/2 lanes = 495	vphpl A
6-lane highway = 990	vph/3 lanes = 330	vphpl A

-----  
 LEVEL OF SERVICE  
 -----

	LOS	Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain		0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters



6/28/2013

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst Agency or Company Date Performed Analysis Time Period	Nick Liguori, EI Davenport 4/16/2013 12-073 East Greensboro
<b>Site Information</b>	
Highway From/To Jurisdiction Analysis Year	Willowlake Rd Rankin Mill/Flemingfield Rd 2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    1170 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 2 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.998
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1303
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	782
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS = S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> -f <sub>np</sub>	42.9
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	1.000
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	1300
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	780
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	68.1
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	68.1
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	D
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.41
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	293
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	1053
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	6.8
<b>Notes</b>	
1. If V <sub>p</sub> >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split V <sub>p</sub> >= 1,700 pc/h, terminated anlysis-the LOS is F.	

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Phone: Fax:  
E-mail:

PLANNING ANALYSIS

Analyst: Nick Liguori, EI  
Agency/Co: Davenport  
Date: 4/16/2013  
Analysis Period:  
Highway: Huffine Mill Rd  
From/To: Nealtown/Rankin Mill  
Jurisdiction:  
Analysis Year: 2035 Future Build  
Project ID: 12-073 East Greensboro

INPUT DATA

Total AADT volume, AADT 18100 vpd  
Proportion AADT during peak hour, K 0.10  
Percent peak-hour traffic in heaviest direction, D 60 %  
Trucks 2 %  
Terrain type Level  
Base free-flow speed, BFFS 55.0 mph

ANALYSIS

DDHV = AADT x D x K  
DDHV = 18100 x 0.60 x 0.10 = 1086

Volume for : LOS  
4-lane highway = 1086 vph/2 lanes = 543 vphpl B  
6-lane highway = 1086 vph/3 lanes = 362 vphpl A

LEVEL OF SERVICE

	LOS	Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain		0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters



6/27/2013

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
<b>General Information</b>	
Analyst Agency or Company Date Performed Analysis Time Period	Nick Liguori, EI Davenport 4/16/2013 12-073 East Greensboro
<b>Site Information</b>	
Highway From/To Jurisdiction Analysis Year	Huffine Mill Rd Wendover/Nealtown 2035
<b>Input Data</b>	
	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Rolling Two-way hourly volume    1850 veh/h Directional split    60 / 40 Peak-hour factor, PHF    0.90 No-passing zone    0 % Trucks and Buses, P <sub>T</sub> 2 % % Recreational vehicles, P <sub>R</sub> 0% Access points/ mi    8
<b>Average Travel Speed</b>	
Grade adjustment factor, f <sub>G</sub> (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	0.998
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	2060
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	1236
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S <sub>FM</sub> mi/h	Base free-flow speed, BFFS <sub>FM</sub> 55.0 mi/h
Observed volume, V <sub>f</sub> veh/h	Adj. for lane width and shoulder width <sup>3</sup> , f <sub>LS</sub> (Exhibit 20-5)    0.0 mi/h
Free-flow speed, FFS = S <sub>FM</sub> +0.00776(V <sub>f</sub> /f <sub>HV</sub> )    mi/h	Adj. for access points, f <sub>A</sub> (Exhibit 20-6)    2.0 mi/h
	Free-flow speed, FFS (FSS=BFFS-f <sub>LS</sub> -f <sub>A</sub> )    53.0 mi/h
Adj. for no-passing zones, f <sub>np</sub> ( mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS ( mi/h) ATS=FFS-0.00776v <sub>p</sub> -f <sub>np</sub>	37.0
<b>Percent Time-Spent-Following</b>	
Grade Adjustment factor, f <sub>G</sub> (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E <sub>T</sub> (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E <sub>R</sub> (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f <sub>HV</sub> =1/(1+P <sub>T</sub> (E <sub>T</sub> -1)+P <sub>R</sub> (E <sub>R</sub> -1))	1.000
Two-way flow rate <sup>1</sup> , v <sub>p</sub> (pc/h)=V/(PHF * f <sub>G</sub> * f <sub>HV</sub> )	2056
v <sub>p</sub> * highest directional split proportion <sup>2</sup> (pc/h)	1234
Base percent time-spent-following, BPTSF(%)=100(1-e <sup>-0.000879v<sub>p</sub></sup> )	83.6
Adj. for directional distribution and no-passing zone, f <sub>d/np</sub> (%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%)=BPTSF+f <sub>d/np</sub>	83.6
<b>Level of Service and Other Performance Measures</b>	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	E
Volume to capacity ratio, v/c=V <sub>p</sub> /3,200	0.64
Peak 15-min veh-miles of travel, VMT <sub>15</sub> (veh- mi)=0.25L <sub>t</sub> (V/PHF)	463
Peak-hour vehicle-miles of travel, VMT <sub>60</sub> (veh- mi)=V*L <sub>t</sub>	1665
Peak 15-min total travel time, TT <sub>15</sub> (veh-h)=VMT <sub>15</sub> /ATS	12.5
<b>Notes</b>	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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-----  
 PLANNING ANALYSIS  
 -----

Analyst: Nick Liguori, EI  
 Agency/Co: Davenport  
 Date: 4/16/2013  
 Analysis Period:  
 Highway: Wendover Avenue  
 From/To: Willowlake/Gboro Loop  
 Jurisdiction:  
 Analysis Year: 2035 Future Build  
 Project ID: 12-073 East Greensboro

-----  
 INPUT DATA  
 -----

Total AADT volume, AADT	49200	vpd
Proportion AADT during peak hour, K	0.10	
Percent peak-hour traffic in heaviest direction, D	60	%
Trucks	2	%
Terrain type	Level	
Base free-flow speed, BFFS	55.0	mph

-----  
 ANALYSIS  
 -----

DDHV = AADT x D x K  
 DDHV = 49200 x 0.60 x 0.10 = 2952

Volume for :		LOS
4-lane highway = 2952	vph/2 lanes = 1476	vphpl D
6-lane highway = 2952	vph/3 lanes = 984	vphpl C

-----  
 LEVEL OF SERVICE  
 -----

		Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain	LOS	0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters



Phone: Fax:  
E-mail:

PLANNING ANALYSIS

Analyst: Nick Liguori, EI  
Agency/Co: Davenport  
Date: 4/16/2013  
Analysis Period:  
Highway: Wendover Avenue  
From/To: Flemingfield/ Willow Lake  
Jurisdiction:  
Analysis Year: 2035 Future Build  
Project ID: 12-073 East Greensboro

INPUT DATA

Total AADT volume, AADT 56500 vpd  
Proportion AADT during peak hour, K 0.10  
Percent peak-hour traffic in heaviest direction, D 60 %  
Trucks 2 %  
Terrain type Level  
Base free-flow speed, BFFS 55.0 mph

ANALYSIS

DDHV = AADT x D x K  
DDHV = 56500 x 0.60 x 0.10 = 3390

Volume for : LOS  
4-lane highway = 3390 vph/2 lanes = 1695 vphpl E  
6-lane highway = 3390 vph/3 lanes = 1130 vphpl C

LEVEL OF SERVICE

	LOS	Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain		0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters



Phone: Fax:  
E-mail:

PLANNING ANALYSIS

Analyst: Nick Liguori, EI  
Agency/Co: Davenport  
Date: 4/16/2013  
Analysis Period:  
Highway: Wendover Avenue  
From/To: Huffine Mill/Flemingfield  
Jurisdiction:  
Analysis Year: 2035 Future Build  
Project ID: 12-073 East Greensboro

INPUT DATA

Total AADT volume, AADT 62700 vpd  
Proportion AADT during peak hour, K 0.10  
Percent peak-hour traffic in heaviest direction, D 60 %  
Trucks 2 %  
Terrain type Level  
Base free-flow speed, BFFS 55.0 mph

ANALYSIS

DDHV = AADT x D x K  
DDHV = 62700 x 0.60 x 0.10 = 3762

Volume for : LOS  
4-lane highway = 3762 vph/2 lanes = 1881 vphpl F  
6-lane highway = 3762 vph/3 lanes = 1254 vphpl D

LEVEL OF SERVICE

	LOS	Free-Flow Speed = 60 mph					Free-Flow Speed = 50 mph				
		Percent Trucks					Percent Trucks				
Terrain		0	5	10	15	20	0	5	10	15	20
Level	A	560	550	530	520	510	440	430	420	410	400
	B	920	900	870	850	840	710	700	680	660	650
	C	1310	1280	1250	1220	1190	1030	1000	980	960	940
	D	1680	1640	1600	1570	1530	1350	1320	1290	1260	1230
	E	1870	1820	1780	1740	1700	1610	1570	1530	1500	1460
Rolling	A	560	520	490	460	430	440	410	380	360	340
	B	920	850	800	750	710	710	660	620	580	550
	C	1310	1220	1140	1070	1010	1030	960	900	840	790
	D	1680	1570	1470	1380	1300	1350	1260	1180	1100	1040
	E	1870	1740	1620	1520	1440	1610	1500	1400	1310	1240
Mountain	A	560	480	420	370	330	440	370	320	290	260

B	920	780	680	600	540	710	610	530	470	420
C	1310	1120	970	860	770	1030	880	760	680	610
D	1680	1430	1250	1100	990	1350	1150	1000	890	800
E	1870	1590	1380	1220	1100	1610	1370	1190	1050	950

Assumptions: highway with 60 mi/h FFS has 8 access points/mi; highway with 50 mi/h FFS has 25 access points/mi; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; all heavy vehicles are trucks and regular commuters

## INTERSECTION SUMMARY

Site: AM 2035 Build

White St Extension at Rankin Mill Road  
 2035 AM Peak  
 Roundabout  
 Design Life Analysis (Practical Capacity): Results for 20 years

Intersection Performance - Hourly Values		
Performance Measure	Vehicles	Persons
Demand Flows (Total)	1280 veh/h	1536 pers/h
Percent Heavy Vehicles	2.0 %	
Degree of Saturation	0.399	
Practical Spare Capacity	112.9 %	
Effective Intersection Capacity	3206 veh/h	
Control Delay (Total)	2.37 veh-h/h	2.85 pers-h/h
Control Delay (Average)	6.7 sec	6.7 sec
Control Delay (Worst Lane)	7.5 sec	
Control Delay (Worst Movement)	7.5 sec	7.5 sec
Geometric Delay (Average)	1.9 sec	
Stop-Line Delay (Average)	6.7 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	2.3 veh	
95% Back of Queue - Distance (Worst Lane)	59.4 ft	
Total Effective Stops	509 veh/h	611 pers/h
Effective Stop Rate	0.40 per veh	0.40 per pers
Proportion Queued	0.38	0.38
Performance Index	25.2	25.2
Travel Distance (Total)	435.7 veh-mi/h	522.9 pers-mi/h
Travel Distance (Average)	1797 ft	1797 ft
Travel Time (Total)	20.5 veh-h/h	24.6 pers-h/h
Travel Time (Average)	57.6 sec	57.6 sec
Travel Speed	21.3 mph	21.3 mph
Cost (Total)	276.64 \$/h	276.64 \$/h
Fuel Consumption (Total)	17.8 gal/h	
Carbon Dioxide (Total)	168.3 kg/h	
Hydrocarbons (Total)	0.270 kg/h	
Carbon Monoxide (Total)	8.91 kg/h	
NOx (Total)	0.274 kg/h	

Level of Service (LOS) Method: Delay (HCM 2000).  
 Roundabout LOS Method: Same as Signalised Intersections.  
 Intersection LOS value for Vehicles is based on average delay for all vehicle movements.  
 Roundabout Capacity Model: SIDRA Standard.  
 HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values		
Performance Measure	Vehicles	Persons
Demand Flows (Total)	614,400 veh/y	737,280 pers/y
Delay	1,140 veh-h/y	1,368 pers-h/y
Effective Stops	244,397 veh/y	293,277 pers/y
Travel Distance	209,158 veh-mi/y	250,990 pers-mi/y
Travel Time	9,830 veh-h/y	11,796 pers-h/y
Cost	132,787 \$/y	132,787 \$/y
Fuel Consumption	8,531 gal/y	
Carbon Dioxide	80,799 kg/y	
Hydrocarbons	129 kg/y	
Carbon Monoxide	4,279 kg/y	
NOx	132 kg/y	

## INTERSECTION SUMMARY

Site: PM 2035 Build

White St Extension at Rankin Mill Road  
 2035 PM Peak  
 Roundabout  
 Design Life Analysis (Practical Capacity): Results for 20 years

Intersection Performance - Hourly Values		
Performance Measure	Vehicles	Persons
Demand Flows (Total)	1270 veh/h	1524 pers/h
Percent Heavy Vehicles	2.0 %	
Degree of Saturation	0.286	
Practical Spare Capacity	196.9 %	
Effective Intersection Capacity	4435 veh/h	
Control Delay (Total)	2.19 veh-h/h	2.63 pers-h/h
Control Delay (Average)	6.2 sec	6.2 sec
Control Delay (Worst Lane)	8.3 sec	
Control Delay (Worst Movement)	8.3 sec	8.3 sec
Geometric Delay (Average)	2.0 sec	
Stop-Line Delay (Average)	6.2 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	1.5 veh	
95% Back of Queue - Distance (Worst Lane)	38.3 ft	
Total Effective Stops	541 veh/h	649 pers/h
Effective Stop Rate	0.43 per veh	0.43 per pers
Proportion Queued	0.40	0.40
Performance Index	25.1	25.1
Travel Distance (Total)	433.1 veh-mi/h	519.7 pers-mi/h
Travel Distance (Average)	1801 ft	1801 ft
Travel Time (Total)	20.2 veh-h/h	24.2 pers-h/h
Travel Time (Average)	57.3 sec	57.3 sec
Travel Speed	21.4 mph	21.4 mph
Cost (Total)	273.40 \$/h	273.40 \$/h
Fuel Consumption (Total)	17.6 gal/h	
Carbon Dioxide (Total)	167.0 kg/h	
Hydrocarbons (Total)	0.267 kg/h	
Carbon Monoxide (Total)	8.90 kg/h	
NOx (Total)	0.273 kg/h	

Level of Service (LOS) Method: Delay (HCM 2000).  
 Roundabout LOS Method: Same as Signalised Intersections.  
 Intersection LOS value for Vehicles is based on average delay for all vehicle movements.  
 Roundabout Capacity Model: SIDRA Standard.  
 HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values		
Performance Measure	Vehicles	Persons
Demand Flows (Total)	609,600 veh/y	731,520 pers/y
Delay	1,051 veh-h/y	1,262 pers-h/y
Effective Stops	259,445 veh/y	311,334 pers/y
Travel Distance	207,880 veh-mi/y	249,456 pers-mi/y
Travel Time	9,697 veh-h/y	11,637 pers-h/y
Cost	131,230 \$/y	131,230 \$/y
Fuel Consumption	8,463 gal/y	
Carbon Dioxide	80,153 kg/y	
Hydrocarbons	128 kg/y	
Carbon Monoxide	4,271 kg/y	
NOx	131 kg/y	



## APPENDIX C: Traffic Volume Data



Location #	Street	Section (between)	2035 Background	Residential	Commercial	Pass-by Reduction	Light Industrial	Heavy Industrial	Research and Recreation	2035 Total
100	Wendover Avenue	West of Flemingfield Rd	30900	7033	26024	-3390	2111	0	0	62678
200	Wendover Avenue	Flemingfield Rd to Willowlake Rd	33900	3516	20386	-3390	2111	0	0	56523
300	Wendover Avenue	Willowlake Rd to Urban Loop	33900	3516	13012	-3390	2111	0	0	49150
400	Huffine Mill Rd	West of Nealtown Rd	10000	7033	0		0	0	1497	18530
500	Huffine Mill Rd	Nealtown Rd to Rankine Mill Rd	9720	7033	0		0	0	1310	18063
600	Willowlake Rd Ext	Rankine Mill Rd to Flemingfield Rd (relocated)	4420	1172	0		2111	2672	1310	11684
700	Huffine Mill Rd	Flemingfield Rd to Urban Loop	4420	5861	4337		10555	2672	1310	29154
800	Huffine Mill Rd	East of Urban Loop	4520	0	0		6333	0	0	10853
900	Rankin Mill Rd	Huffine Mill Rd to Future White Street Extension	5300	7033	0		0	2672	1497	16501
1000	Rankin Mill Rd	Future White St Extension to Hines Chapel Rd	5100	0	0		0	2672	748	8520
1100	Cone Blvd	West of Nealtown Rd	14300	0	0		0	2672	187	17159
1200	Cone Blvd Extension	East of Nealtown Rd	12400	0	0		0	4007	0	16407
1250	White Street Extension	East of Nealtown Road	1700	0	0		0	1336	561	3597
1300	Flemingfield Road	Wendover Ave to Huffine Mill Road	300	8205	3904		0	0	0	12409
1400	Willowlake Road	Wendover Ave to Huffine Mill Road	2300	2344	6506		2111	0	0	13261
1500	Nealtown Rd	Huffine Mill Rd to White St	6000	0	0		0	0	374	6374
1600	Nealtown Rd Ext.	White St Ext to McKnight Mill Rd	2100	0	0		1055	0	187	3343



April 8, 2013

To: Frank Amey, PE, PTOE, Davenport Transportation Consulting  
From: Lydia McIntyre, EI, Greensboro MPO, GDOT  
Subject: Northeast Greensboro Roadway Forecast

This memorandum summarizes the assumptions, methodology, and results of the traffic forecast prepared for Northeast Greensboro Economic Development Analysis. The forecast was prepared at the request of Davenport Transportation Consulting. The forecast includes two Scenarios based on the Piedmont Triad Regional Model (PTRM) version 3.0 approved in 2012. The scenarios include a 2035 Existing+ Committed (E+C) and a 2035 Full Build Out. The 2035 E+C includes only existing projects and proposed projects for which funds have been committed (*city bond or NCDOT TIP*). The second scenario 2035 Full Build Out includes all proposed projects listed in the MPO's *2035 Long Range Transportation Plan Update* approved January 2013. Due to Davenport's tight timeline, obtaining new turning movements was not feasible. Existing city turning movements and NCDOT AADTs were reviewed and were obtained between 2005 and 2009.

NCDOT's traffic forecast completed in June 2006 for NCDOT TIP# U-2525B was also referenced. The forecast only reflects the construction of the Urban Loop from US 70 to US 29. Therefore, the forecast was primarily referenced for Design Hourly Volume information.

#### **Project Description**

The City of Greensboro is currently evaluating economic development opportunities in Eastern Greensboro. The Northeast Analysis focuses on the area north of US 70, east of US 29, and just west of the proposed Eastern Urban Loop (U-2525B). The forecast provides base volumes in the future year based on proposed transportation improvements as reflected in the *2035 LRTP Update*. This forecast will be used to evaluate land uses and infrastructure improvements proposed by the consultant.

#### **Forecast Methodology**

The traffic forecasts for this project are based on the new Piedmont Triad Regional Model (PTRM). The PTRM was approved in 2012 and has a base year of 2009 and future year of 2035. The base year traffic (2009) is based on counts collected by the City of Greensboro or NCDOT. The counts collected by the city were obtained between 2005 and 2009. All counts from NCDOT were obtained in 2009.

#### **Planning for the transportation future**

LEAD PLANNING AGENCY: CITY OF GREENSBORO DEPARTMENT OF TRANSPORTATION  
P.O. BOX 3136 GREENSBORO, NORTH CAROLINA 27402-3136 · 336 373-4368 · fax 336 412-6171 ·  
[www.aquamdo.org](http://www.aquamdo.org)

A growth rate was calculated for each mainline volume requested based on the 2009 and 2035 model volumes. The growth rate was used to forecast 2035 volumes, but was also used to calculate 2009 volumes where otherwise unavailable.

#### **Scenario I: 2035 E+C**

The forecast for this scenario was developed based on the 2035 E+C model network. Growth rates were calculated based on model volumes from the 2009 and 2035 E+C networks. Growth rates ranged from 1% up to 4.7%. The following roadway improvements are included in the forecast and are in the vicinity of the analysis area:

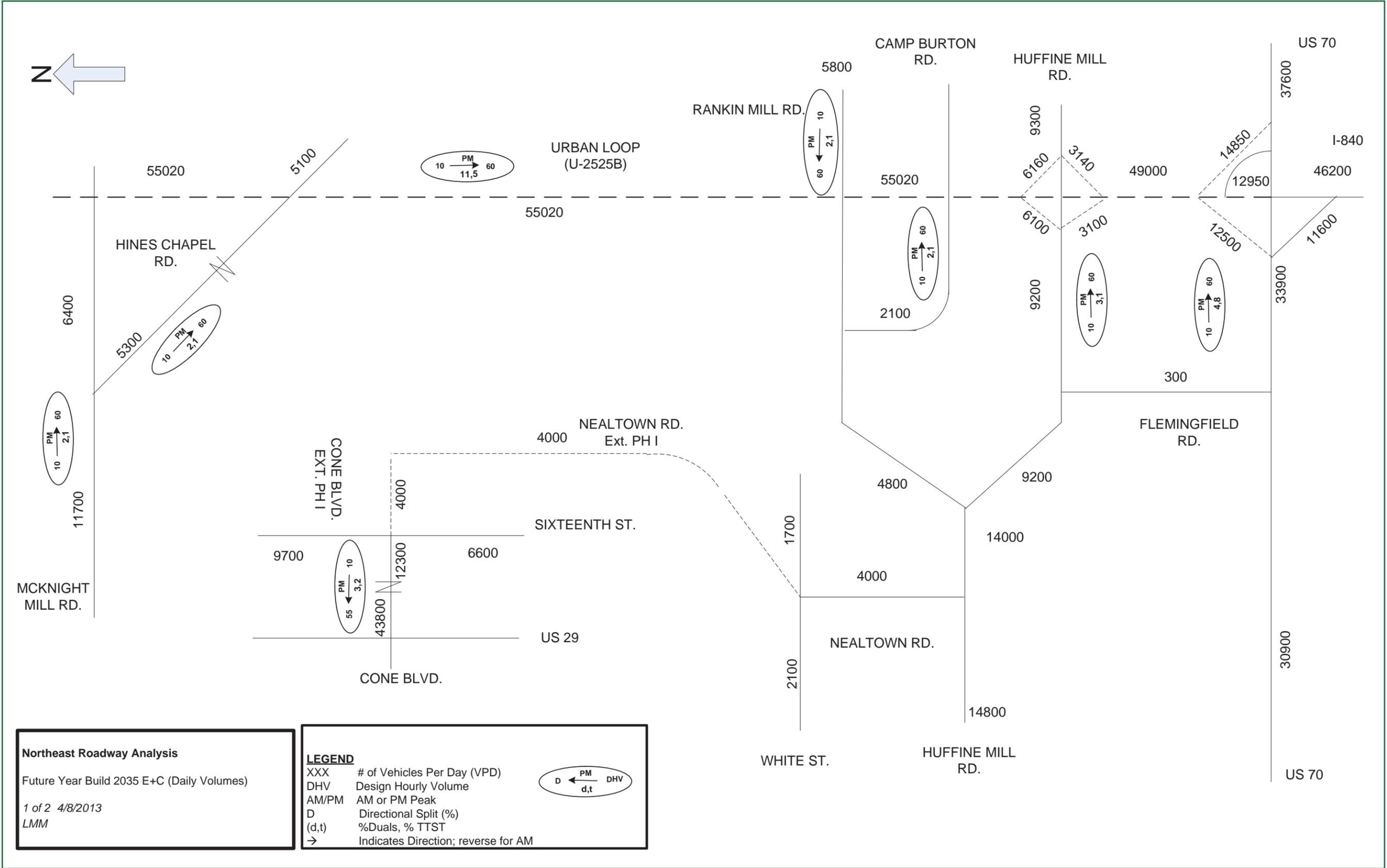
- Entire Urban Loop (US 70 to Bryan Blvd.)
- Huffine Mill Interchange with Urban Loop
- Nealtown Road Extension PH I
- Cone Boulevard Extension PH I

#### **Scenario II: 2035 Full Build Out**

The forecast for this scenario was developed based on the 2035 model network. Growth rates were calculated based on model volumes from the 2009 and 2035 networks. Growth rates ranged from 1% up to 5.8%. The following roadway improvements are included the forecast and are in the vicinity of the analysis area:

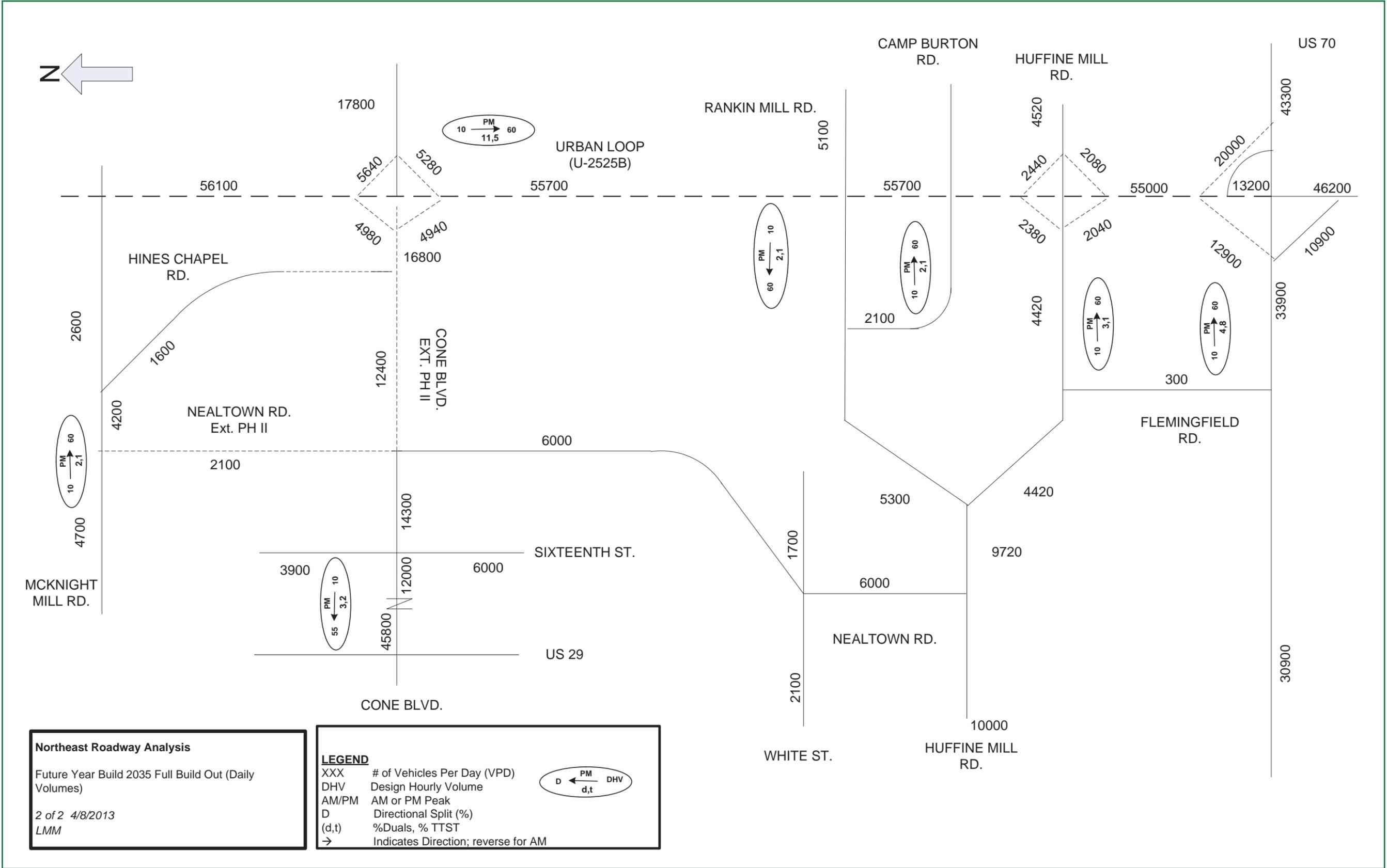
- Entire Urban Loop (US 70 to Bryan Blvd.)
- Huffine Mill Interchange with Urban Loop
- Nealtown Road Extension PH I and PH II
- Cone Boulevard Extension PH I and PH II
- US 70 widening from Mt. Hope Church Road to Rock Creek Dairy Road

If you have questions or comments about the forecast, please call me at 336-373-3117 or email me at [lydia.mcintyre@greensboro-nc.gov](mailto:lydia.mcintyre@greensboro-nc.gov).



**Northeast Roadway Analysis**  
 Future Year Build 2035 E+C (Daily Volumes)  
 1 of 2 4/8/2013  
 LMM

**LEGEND**  
 XXX # of Vehicles Per Day (VPD)  
 DHV Design Hourly Volume  
 AM/PM AM or PM Peak  
 D Directional Split (%)  
 (d,t) %Duals, % TTST  
 → Indicates Direction; reverse for AM



**Northeast Roadway Analysis**  
 Future Year Build 2035 Full Build Out (Daily Volumes)  
 2 of 2 4/8/2013  
 LMM

**LEGEND**  
 XXX # of Vehicles Per Day (VPD)  
 DHV Design Hourly Volume  
 AM/PM AM or PM Peak  
 D Directional Split (%)  
 (d,t) %Duals, % TTST  
 → Indicates Direction; reverse for AM

