FINAL REPORT

Glasgow Small Urban Area Study

Prepared for:

KENTUCKY TRANSPORTATION CABINET

Kentucky Transportation Cabinet
Central Office, Division of Planning
Highway District 3, Bowling Green

Prepared by:

Stantec

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Glasgow Small Urban Area Study
Executive Summary

The Kentucky Transportation Cabinet (KYTC) initiated the Small Urban Area (SUA) study for the city of Glasgow, Kentucky in Barren County. The goal of the study is to identify and examine transportation and multimodal issues related to safety and congestion in Glasgow and the surrounding area. The SUA study area includes the city limits of Glasgow which is a little over 38 square miles. The 2014 Barren County Comprehensive Plan requested the development of an urban transportation study for the Glasgow area, as the last Glasgow SUA Study was completed in 1988. This SUA planning study was funded with State Planning and Research (SPR) funds.

The basic elements accomplished under this SUA study include the following:

- Evaluate existing conditions, crash history, and geometric deficiencies to identify possible safety improvements.
- Evaluate existing traffic and estimate future traffic volumes on state-maintained and other major routes within the study area to evaluate capacity needs of the transportation network.
- Work with an Advisory Committee to identify problem areas and improvement alternatives.
- Produce a list of short-term recommendations which the KYTC, City of Glasgow, Barren County, and/or private developers can take for further project development and implementation.
- Address long-term concerns by examining the future transportation needs and determining options for future improvement projects.

The first Advisory Committee meeting was held on February 24, 2016 in Glasgow. At the meeting, attendees were asked to identify locations: 1) where congestion is an issue, 2) where there are trouble spots related to safety, 3) areas where growth is anticipated, and 4) locations for possible transportation and multimodal improvements. The Advisory Committee identified 18 locations with possible congestion issues, 14 trouble spots related to safety, seven growth areas (primarily south and west of downtown), and 19 locations for possible transportation and multimodal improvements.

The project team developed 23 conceptual improvement projects, as shown in **Figure ES-1**, based on a combination of input from the Advisory Committee, a review of the existing conditions, traffic analyses, and field reconnaissance.

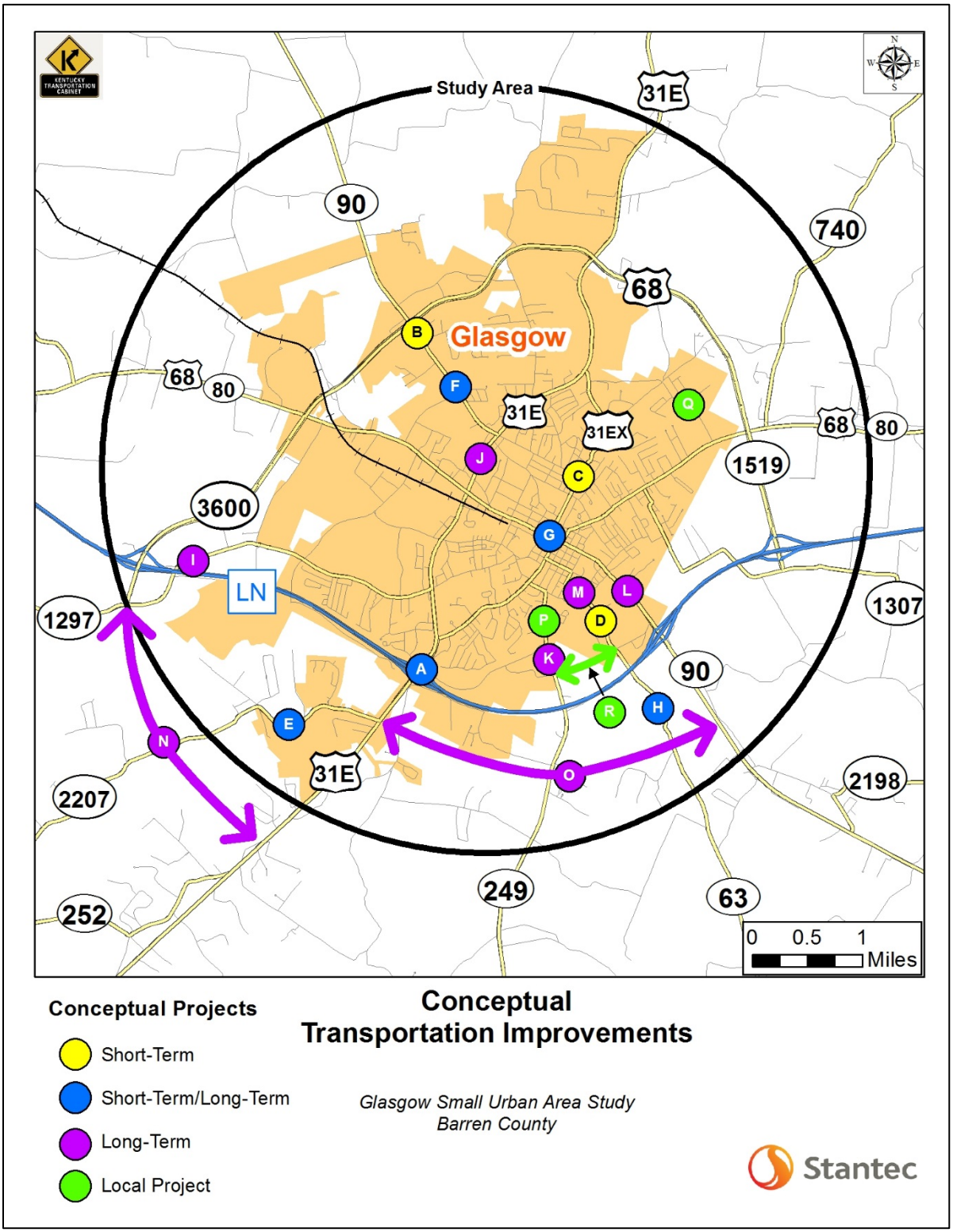

Figure ES-1: Glasgow Small Urban Area Study – Recommended Projects

Three classes of improvement projects were developed. The improvement concepts are categorized as follows:

- **Short-term**: The short-term concepts are typically lower-cost projects that can be implemented in the near future. These types of improvements should require little or no right-of-way to construct and in some cases may be implemented by the KYTC Division of Maintenance.
- **Long-term**: The long-term concepts are higher-cost projects that will require more significant resources to implement. These types of improvements are more likely to require additional right-of-way to construct and will need to be funded through the KYTC Highway Plan.
- **Local projects**: The local projects are not located on the state-maintained system and would likely need to be funded by the City of Glasgow or Barren County. A private developer may also take on this responsibility.

A second Advisory Committee Meeting was held on May 26, 2016 in Glasgow. During this meeting, attendees were asked to indicate their level of support for each of the improvement concepts, shown in **Figure ES-1**. Factoring in input from the Advisory Committee, the project team prioritized the conceptual improvements as high, medium, or low. **Tables ES-1**, **ES-2**, and **ES-3** present the improvement concepts based on this prioritization. Along with short and long-term projects, local improvements were also prioritized, shown in **Table ES-4**.

It was decided that Projects F1, F2, and B, all concepts to improve KY 90, should be combined and considered together in the design phase. During that phase, a traffic study should be conducted to determine the appropriate number of lanes for KY 90. Thus, Project F1 (road diet to restripe KY 90 as three lanes) and Project F2 (widening the corridor to a five-lane section) will both be considered. Project B, improvement of the intersection of KY 90 and US 68 near Walmart, would likely not move forward as a standalone project and should be considered with the corridor wide improvements to KY 90. The combination of these projects is ranked as a high priority.

Project A includes both a short-term (A1) and long-term (A2) solution to improve the US 31E interchange with the Louie B. Nunn Cumberland Parkway (LN 9008). Project A1, interchange improvement, includes the signalization of the westbound ramp terminal intersection and widening US 31E under the parkway bridge to accommodate additional turn lane storage. Project A2, reconstruction of the interchange, reconfigures the interchange to a new type (such as a single point urban interchange) to increase spacing between traffic signals. The project team recommended that both solutions be considered together in the design phase. The combination of these projects is ranked as a medium priority.

Cost estimates were prepared for each improvement concept, shown in **Table ES-5**, based on unit costs plus additional costs for special features (i.e. culverts and traffic signals). KYTC District 3 assisted in this effort by providing right-of-way and utility cost estimates.

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
F1, F2 and B	KY 90	US 68 (Veterans Outer Loop) to US 31E	1.3 Miles	Short-Term	Road Diet to convert the existing undivided four-lane section to a three-lane section (two travel lanes with a continuous center left-turn lane)	$830,000	High
				Long-Term	Corridor widening to provide a five-lane section and multimodal accommodations	$10,100,000	
		Near Walmart / US 68 (Veterans Outer Loop)	0.25 Miles	Short-Term	Intersection improvement to relocate the signalized entrance to Walmart at Max Wagoner Road	$650,000	
E1	KY 2207	Sugar Hill Dr. to Autumn Ridge Rd.	1.0 Miles	Short-Term	Application of high-friction pavement surface to minimize effects of wet weather, single vehicle crashes	$400,000	High
J	US 31E	US 68 to KY 90	0.6 Miles	Long-Term	Provide Access Management by constructing a raised median along US 31E, close portions of Smith Road (frontage road), and extend Wall Street	$6,750,000	High
G1	Downtown Square	Downtown	N/A	Short-Term	Intersection and pedestrian crossing improvements to eliminate the mid-block pedestrian crossings and reduce vehicular weaving conflicts	$180,000	High
C	US 31EX	Happy Valley Road	N/A	Short-Term	Intersection improvement to provide a left-turn lane from northbound US 31EX to Happy Valley Road	$60,000	High
H1	KY 63	South of LBN Cumberland Parkway	0.6 Miles	Short-Term	Application of high-friction pavement surface to minimize effects of wet weather, single vehicle crashes	$275,000	High
H2	KY 63	South of LBN Cumberland Parkway	0.6 Miles	Long-Term	Reconstruction of KY 63 to improve the horizontal and vertical alignment.	$2,750,000	High

Table ES-1: Recommended High Priority Projects

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
N	KY 3600 extension	KY 1297 to US 31E	2.7 Miles	Long-Term	New route to connect the LBN Cumberland Parkway interchange at KY 3600 to US 31E	$15,100,000	Medium
I	KY 1297	KY 3600 to Donnelly Drive	1.5 Miles	Long-Term	Minor widening to include wider lanes and shoulders	$5,900,000	Medium
G2	Downtown Square	Downtown	N/A	Long-Term	One-Way Conversion of Main Street and Washington Street, including intersection improvements within the Downtown Square	$3,700,000	Medium
A1 and A2	US 31E	LBN Cumberland Parkway Interchange	0.4 Miles	Short-Term	Interchange improvement to include signalization of the westbound exit ramp	$540,000	Medium
				Long-Term	Interchange Reconstruction	$20,900,000	
D	KY 63	South Fork Creek to Temple Trace	0.2 Miles	Short-Term	Maintenance and drainage improvements	$220,000	Medium

Table ES-2: Recommended Medium Priority Projects

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ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
L	KY 90	North of LBN Cumberland Parkway	0.4 Miles	Long-Term	Minor widening to provide a three-lane section and Access Management	$4,050,000	Low
O	Southern Beltway	US 31E to KY 90	3.3 Miles	Long-Term	New route to connect US 31E to KY 90 south of the LBN Cumberland Parkway	$16,500,000	Low
K	KY 249	LBN Cumberland Parkway Overpass to Trojan Trail	0.6 Miles	Long-Term	Realignment to address curvature issues from north of the LBN Cumberland Parkway to the proposed bridge replacement over South Fork	$4,650,000	Low
E2	KY 2207	Sugar Hill Dr. to Autumn Ridge Rd.	1.0 Miles	Long-Term	Reconstruction of KY 2207 to improve the horizontal and vertical alignment.	$5,050,000	Low
M	KY 63	S Franklin / E College Street	0.3 Miles	Long-Term	Realignment from near South Fork bridge to College Street	$7,650,000	Low

Table ES-3: Recommended Low Priority Projects

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ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
Q	Scottie Drive	US 68 Business to Glenview Drive	0.7 Miles	Local Project	Minor widening to provide a three-lane section	$3,550,000	High
R	KY 249 to KY 63 Connector	North of the LBN Cumberland Parkway	0.6 Miles	Local Project	New route to connect KY 249 to KY 63 north of the LBN Cumberland Parkway	$2,300,000	Medium
P	KY 249	Trojan Trail to Twyman Park	0.5 Miles	Local Project	Multimodal improvement to provide a shared-use path connection	$1,730,000	Low

Table ES-4: Recommended Local Projects

ID	Route	Improvement Type	2016 Cost Estimates					Priority
			Design	Right-of-Way	Utility Relocation	Construction	Total Cost	
A1	US 31E	Interchange Improvement	$90,000	$0	$0	$450,000	$540,000	Medium
A2	US 31E	Interchange Reconstruction	$1,800,000	$100,000	$1,000,000	$18,000,000	$20,900,000	Medium
B	KY 90	Intersection Improvement	$100,000	$0	$50,000	$500,000	$650,000	High
C	US 31EX	Intersection Improvement	$10,000	$0	$0	$50,000	$60,000	High
D	KY 63	Maintenance and Drainage Improvements	$20,000	$50,000	$50,000	$100,000	$220,000	Medium
E1	KY 2207	High-Friction Treatment	$50,000	$0	$0	$350,000	$400,000	High
E2	KY 2207	Reconstruction to Improve Curves	$300,000	$750,000	$1,000,000	$3,000,000	$5,050,000	Low
F1	KY 90	Road Diet	$80,000	$0	$0	$750,000	$830,000	High
F2	KY 90	Widening	$400,000	$3,000,000	$2,500,000	$4,200,000	$10,100,000	High
G1	Downtown Square	Intersection and Pedestrian Crossing Improvements	$30,000	$0	$0	$150,000	$180,000	High
G2	Downtown Square	One-way Conversion	$300,000	$250,000	$150,000	$3,000,000	$3,700,000	Medium
H1	KY 63	High-Friction Treatment	$50,000	$0	$0	$225,000	$275,000	High
H2	KY 63	Realignment	$200,000	$400,000	$400,000	$1,750,000	$2,750,000	High
I	KY 1297	Widening	$300,000	$900,000	$1,200,000	$3,500,000	$5,900,000	Medium
J	US 31E	Access Management	$500,000	$2,000,000	$750,000	$3,500,000	$6,750,000	High
K	KY 249	Realignment	$300,000	$750,000	$400,000	$3,200,000	$4,650,000	Low
L	KY 90	Minor Widening/ Access Management	$300,000	$500,000	$750,000	$2,500,000	$4,050,000	Low
M	KY 63	Realignment	$300,000	$2,500,000	$1,750,000	$3,100,000	$7,650,000	Low
N	KY 3600 extension	New Route	$1,000,000	$3,000,000	$1,500,000	$9,600,000	$15,100,000	Medium
O	Southern Beltway	New Route	$1,100,000	$3,500,000	$1,500,000	$10,400,000	$16,500,000	Low
P	KY 249	Multimodal	$80,000	$400,000	$750,000	$500,000	$1,730,000	Low
Q	Scottie Drive	Minor Widening	$200,000	$750,000	$1,000,000	$1,600,000	$3,550,000	High
R	KY 249 to KY 63	New Route	$200,000	$500,000	$300,000	$1,300,000	$2,300,000	Medium

Table ES-5: 2016 Cost Estimates

1.0 INTRODUCTION

In 2016, the Kentucky Transportation Cabinet (KYTC) initiated a Small Urban Area (SUA) study for the city of Glasgow, Kentucky in Barren County. The purpose of the study was to identify and examine transportation issues related to safety and congestion in the city and the surrounding area. The study's focus and primary goal was to recommend short-term improvements which the KYTC, City of Glasgow, Barren County, and/or private developers can quickly and effectively implement at both an individual intersection level and at an area-wide level. The study also sought to address long-term concerns by examining the future transportation needs and determining options for future improvement projects.

The Division of Planning conducts SUA transportation studies in Kentucky for areas with populations of 5,000 to 50,000. A SUA study provides a thorough examination of an area's transportation network, including an analysis of existing and future traffic conditions, with the goal of identifying needs and potential solutions to provide a more efficient transportation network.

The 2014 Barren County Comprehensive Plan requested the development of an urban transportation study for the Glasgow area, as the last Glasgow SUA Study was completed in 1988. This SUA planning study was funded with State Planning and Research (SPR) funds. Future design, right-of-way, utility, and construction phases for any projects identified are not included in the 2016 KYTC Highway Plan.

1.1 STUDY AREA

The study area includes the Glasgow incorporated limits and surrounding area, which is a little over 38 square miles, as shown in **Figure 1**. There are several planned and committed transportation improvements near the study area, as shown in **Figure 2.**

With an area of 491 square miles, Barren County is the thirteenth largest county in Kentucky. Population projections provided by the Kentucky State Data Center show Barren County has a current population of 44,305 and is anticipated to experience a 20 percent increase in population from 2015 to 2040. Population projections are not available for individual cities, but Glasgow's current population of 14,339 is expected to see a similar increase, based on the trend from the 2010 Census to the current estimate. Glasgow is the second largest urban area in KYTC District 3.

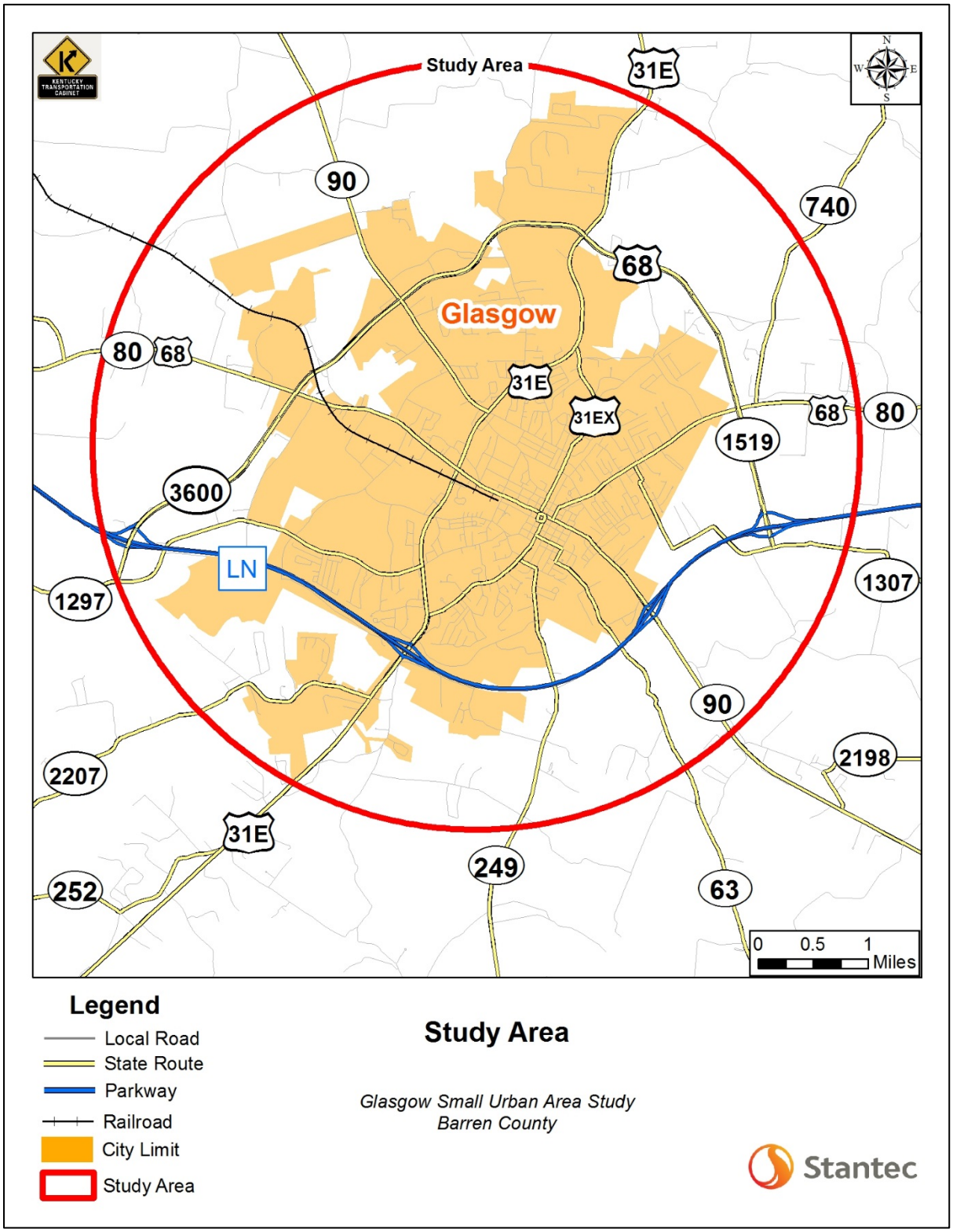


Figure 1: Study Area

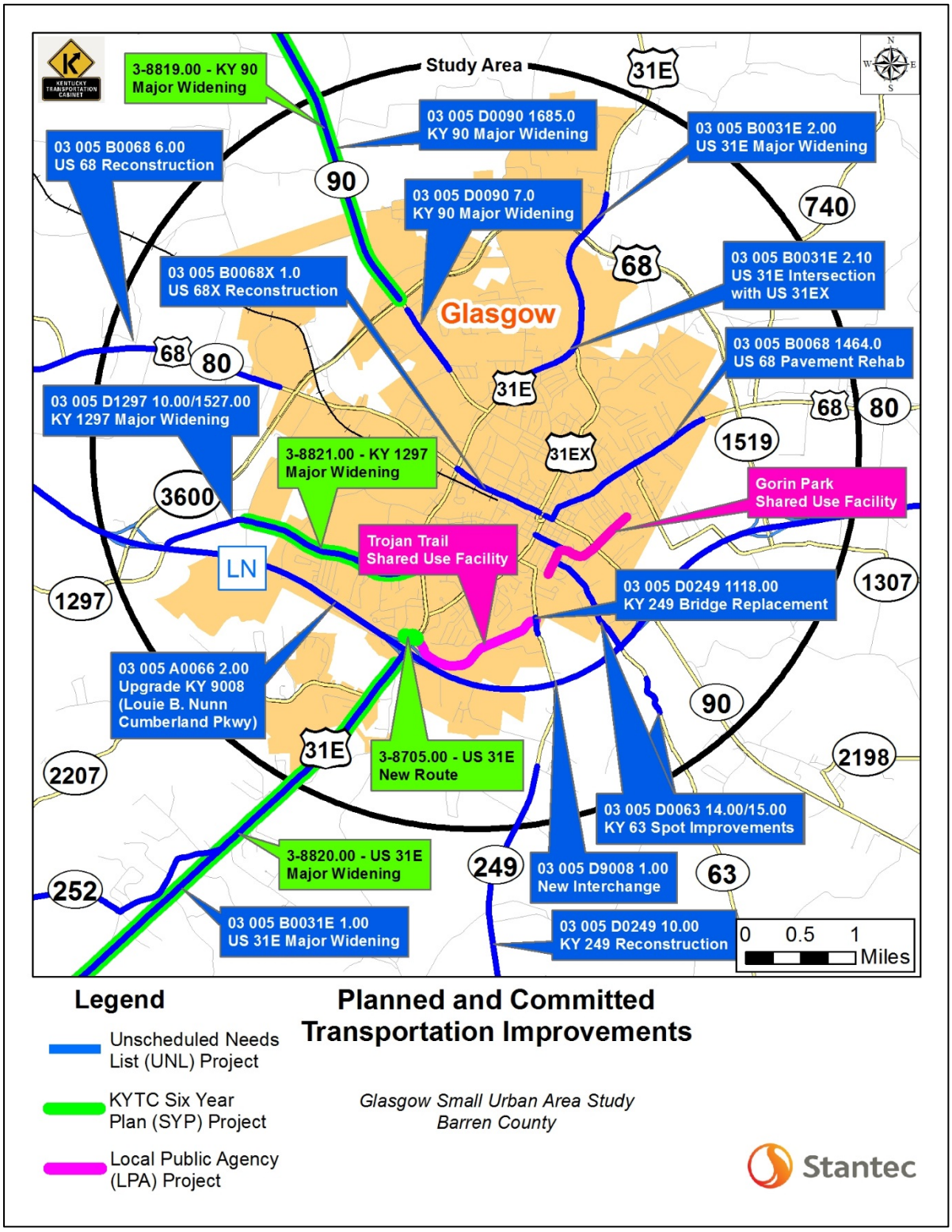


Figure 2: Planned and Committed Projects

1.2 STUDY SCOPE

The Glasgow SUA study has been conducted under the direction of the KYTC District 3 and the KYTC Division of Planning. The study examines existing transportation conditions in terms of both safety and operational characteristics. Following the analysis of these characteristics, the study recommends a list of transportation projects to address existing and long-term transportation needs for this portion of Barren County. The basic work items accomplished under the transportation study include the following:

- Review of previous planning documents and committed transportation projects.
- Data collection and analysis of existing transportation system.
- Travel demand model development update and recalibration (parallel effort).
- Develop a traffic forecast to analyze anticipated future conditions.
- Development of recommended projects, cost estimates, and strategies.
- Coordination with KYTC, City of Glasgow, Barren River Area Development District (BRADD), Barren County staff, and by the Glasgow SUA Advisory Committee, made up of local officials, emergency responders, transit, and other stakeholders.
- Disseminate information, gather input, and identify project needs and goals during the public involvement process.
- Study documentation.

2.0 EXISTING CONDITIONS

Conditions of the existing transportation network are examined in the following sections. The information compiled includes roadway facilities and geometrics, crash history, and traffic volumes within the study area. Data for this section were collected from the KYTC's Highway Information System (HIS) database, the Warren County Regional Travel Demand Model and from field review.

2.1 ROADWAY SYSTEMS

Functional classification is the grouping of roads, streets, and highways into integrated systems ranked by the level of mobility for through movements and access to adjoining land. This grouping acknowledges that roads serve multiple functions and it provides a basis for comparing roads fairly. Functional classification can be used for, but is not limited to, the following purposes:

- Provide a framework for highways serving mobility and connecting regions and cities within a state.

- Provide a basis for assigning jurisdictional responsibility according to the roadway's importance.
- Provide a basis for development of minimum design standards according to function.
- Provide a basis for evaluating present and future needs.
- Provide a basis for allocation of limited financial resources.

Figure 3 shows the functional classification of roadways within the study area. In the southern portion, the Louie B. Nunn Cumberland Parkway (LN 9008) provides regional east-west connectivity to major destinations within central Kentucky. Four interchanges exist along the Cumberland Parkway within the study area, at KY 3600 (Veterans Outer Loop) exit 8, the US 31E (L. Rogers Wells Blvd) exit 11, KY 90 (E Main St) exit 14, and KY 1519 (Veterans Outer Loop) exit 15.

Other important roadways, which are functionally classified as Minor Arterials, include the following:

- US 68/ KY 80 (New Bowling Green Road)
- US 68/ KY 90 (Burkesville Road)
- US 31E (L. Rogers Wells Boulevard)
- US 68 (Veterans Outer Loop)
- KY 90 (Happy Valley Road)

Figure 4 depicts the truck weight classifications of the study area roadways.

In compliance with the Surface Transportation Assistance Act of 1982 (STAA), Kentucky has established a network of highways on which commercial vehicles with increased dimensions may operate. These "STAA" vehicles include semi-tractor trailers with 53-foot long trailers and single-unit trucks with a total length of 45 feet. These designated truck routes are shown on **Figure 5**. The Louie B. Nunn Cumberland Parkway and KY 90 (Happy Valley Road) are federally-designated truck routes. US 31E is a state-designated truck route.

2.2 ROADWAY GEOMETRIC CONDITIONS

The current number of lanes and estimated lane widths along study area roadways are shown on **Figure 6**. Current KYTC design guidelines suggest a minimum of 11-foot wide lanes on arterials and collector roadways. With one exception, all study area arterials have 11-foot or wider lanes. The exception is US 68X between US 31W and US 31EX. Several two-lane collector roadways (portions of US 68, KY 63, KY 1297, KY 249, KY 2207, and others) have lane widths less than 11 feet. All state-maintained, multi-lane facilities have lane widths of at least 11 feet.

Estimated shoulder widths are shown on **Figure 7**. Most arterial routes have shoulders at least eight feet wide, the recommended minimum for such roadways. Some of the more rural routes have shoulders between one and four feet in width. Many of the downtown streets have curb and gutter and, therefore, are shown as having a zero to one-foot shoulder.

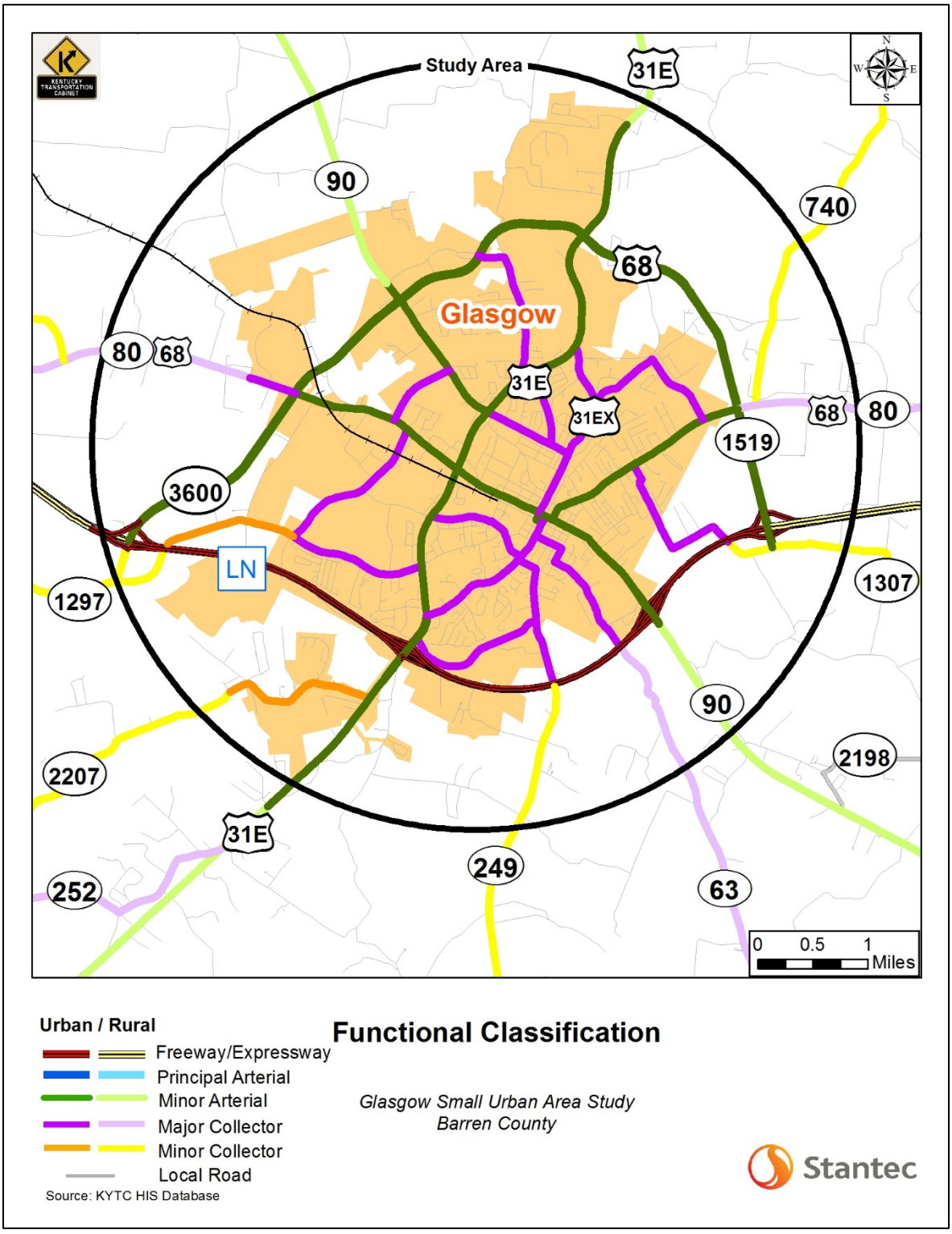


Figure 3: Functional Classification of Study Area Roadways

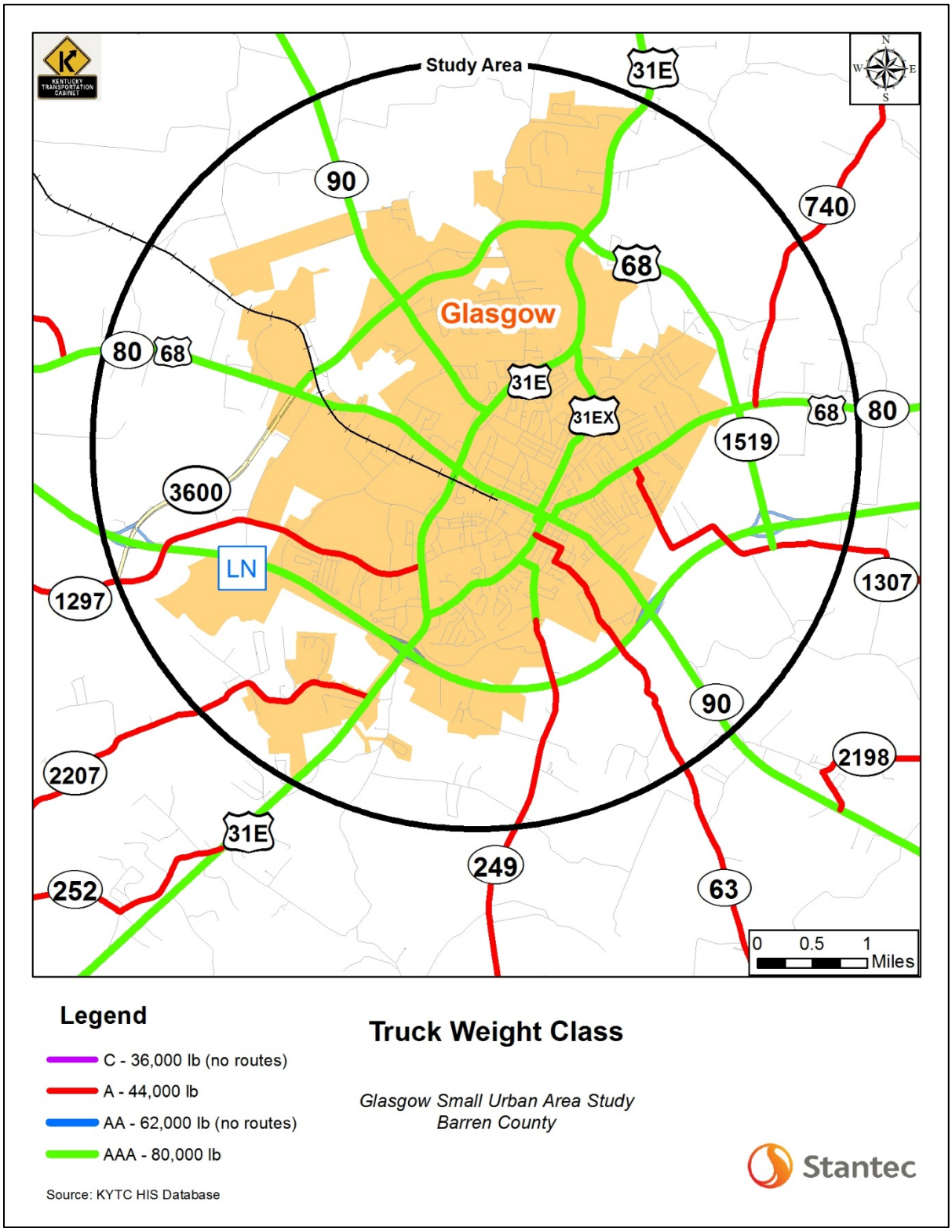


Figure 4: Truck Weight Classifications

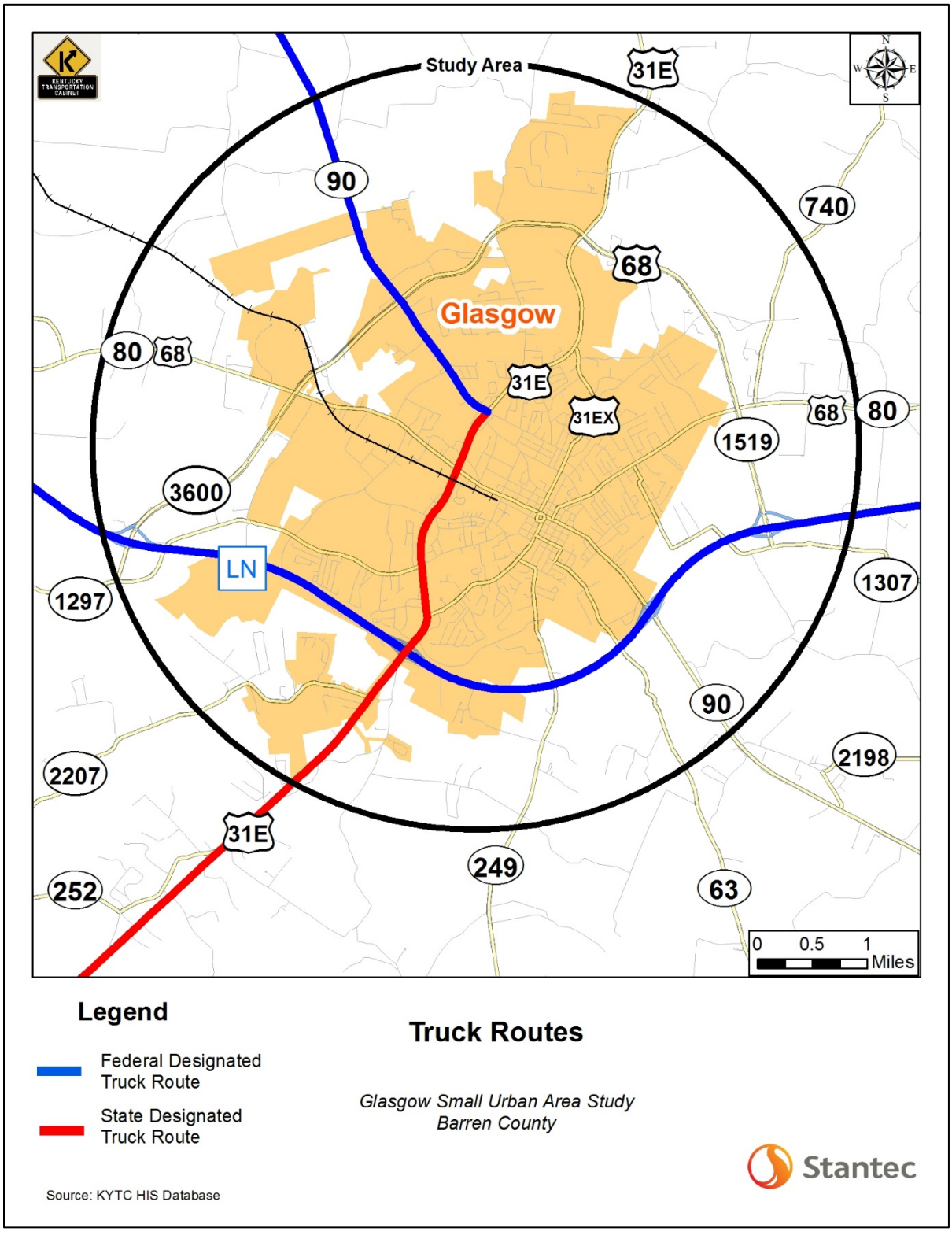


Figure 5: Designated Truck Routes

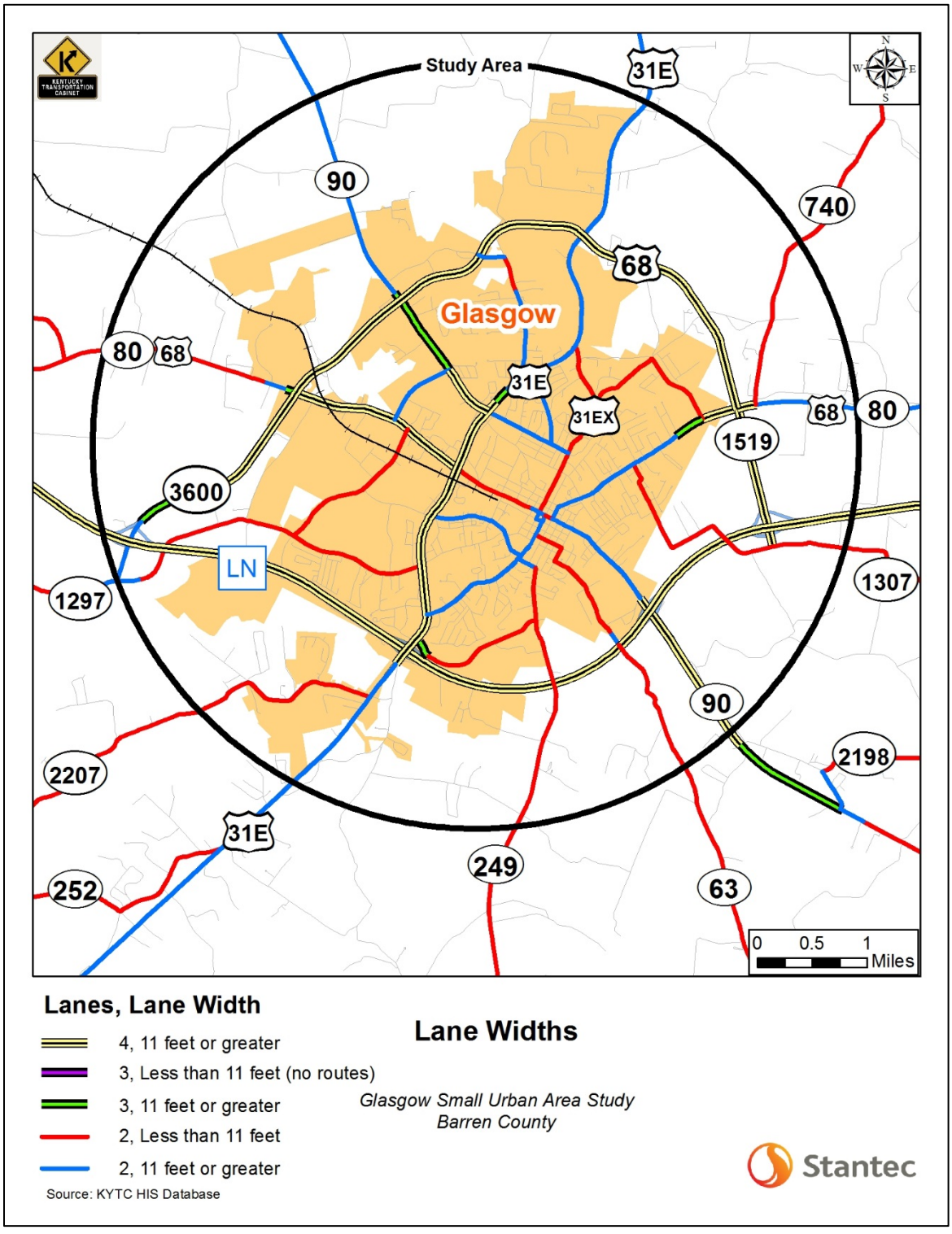


Figure 6: Number of Lanes and Lane Width

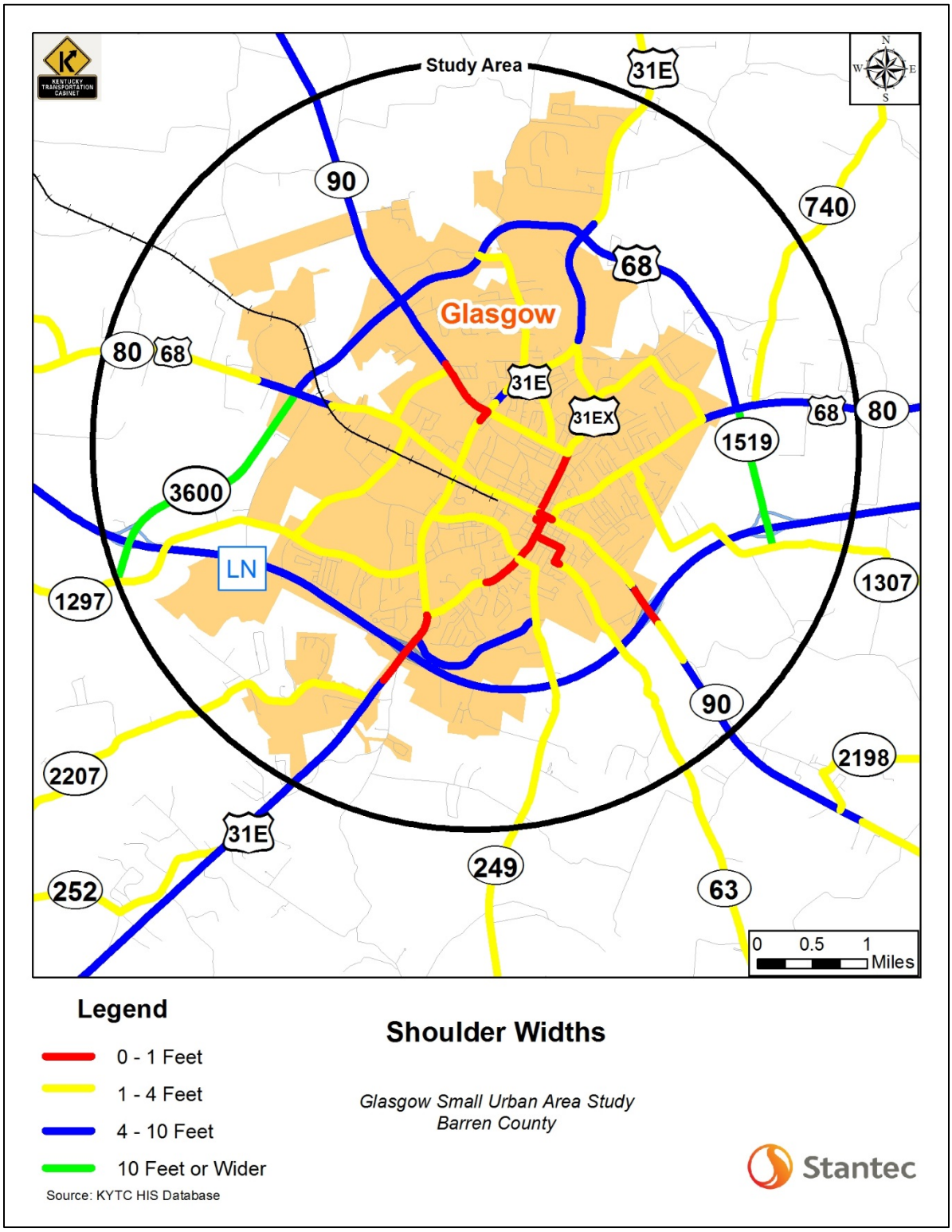


Figure 7: Shoulder Widths

2.3 EXISTING TRAFFIC VOLUMES

The most current average daily traffic (ADT) volumes from KYTC's traffic count stations are shown on **Figure 8**. ADT volumes on state-maintained routes in the study area range from 200 vehicles per day (VPD) on KY 2207 to 20,600 VPD on US 31E (L. Rogers Wells Blvd). KY 90 and portions of the Cumberland Parkway and US 68 have ADT's over 10,000 VPD.

To evaluate the adequacy of roadway segments, existing ADT volumes were compared to the road's theoretical capacity. This is the preferred KYTC methodology for evaluating the adequacy of roadway segments. A volume-to-capacity ratio (V/C) represents proportion of traffic demand for using the roadway for the designated time period in relation to its capacity to serve the demand.

Estimated 2015 daily traffic volumes developed from the updated Warren County travel demand model are shown on **Figure 9**. The target V/C ratio is 1.0 for urban areas. A V/C greater than this indicates the road is congested (i.e., operating above its design capacity). After performing a V/C analysis using Highway Capacity Manual (HCM) procedures, portions of US 31X and US 68X in downtown Glasgow have a V/C greater than 1.0, which indicates that mitigation measures (including additional lanes) may be warranted. All other roadway segments currently operate at less than capacity with a V/C less than 1.0, as shown in Figure 9.

2.4 CRASH HISTORY

Crash data were collected along existing roadways within the study area for a three-year period between January 1, 2013 and December 31, 2015. A total of 3,058 crashes were reported within the study area, as shown in **Figure 10**. The crash records and locations are included in **Appendix A**.

Crashes were geospatially referenced and compared to statewide data to identify locations experiencing above-average crash rates. The methodology is defined in the Kentucky Transportation Center research report Analysis of Traffic Crash Data in Kentucky (2010-2014)[1]. As defined in the methodology report, segments vary in length and are divided along roadways where geometry or traffic volumes change. For each segment, analysts examined the number of crashes, traffic volume, rural/urban, number of lanes, and segment length to determine the critical rate factor (CRF). The CRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the location compared to the critical crash rate for similar roadways throughout the state. A CRF of 1.00 or greater may indicate that crashes are occurring due to circumstances not attributed to random occurrence.

Segment locations with CRF values greater than 1.0 are shown in **Figure 11** and listed in **Table 1**.

[1] Green, E. R., et al. *Analysis of Traffic Crash Data in Kentucky*. KTC-15-21, September, 2015.

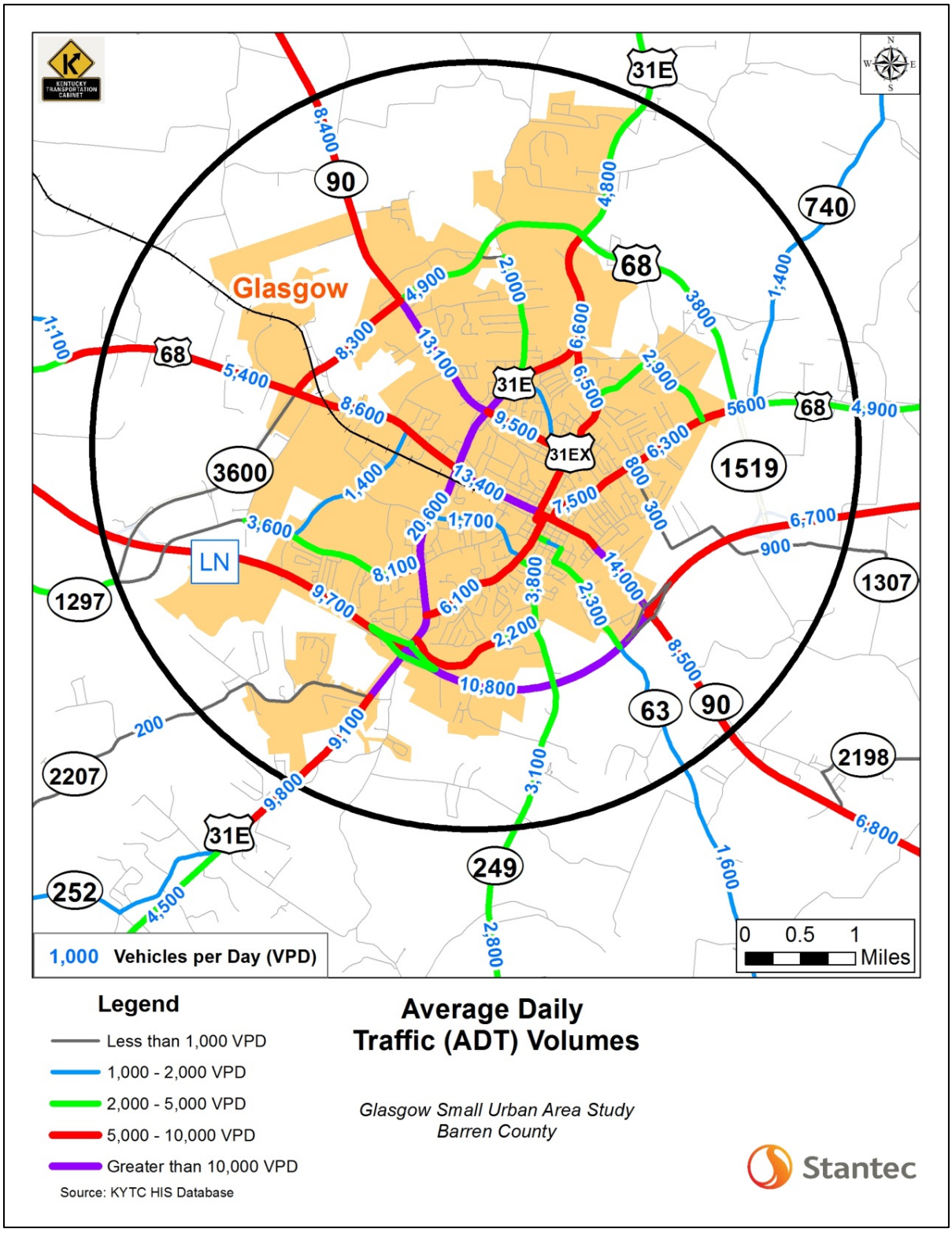


Figure 8: Most Current ADT Volumes from KYTC's Traffic Count Stations

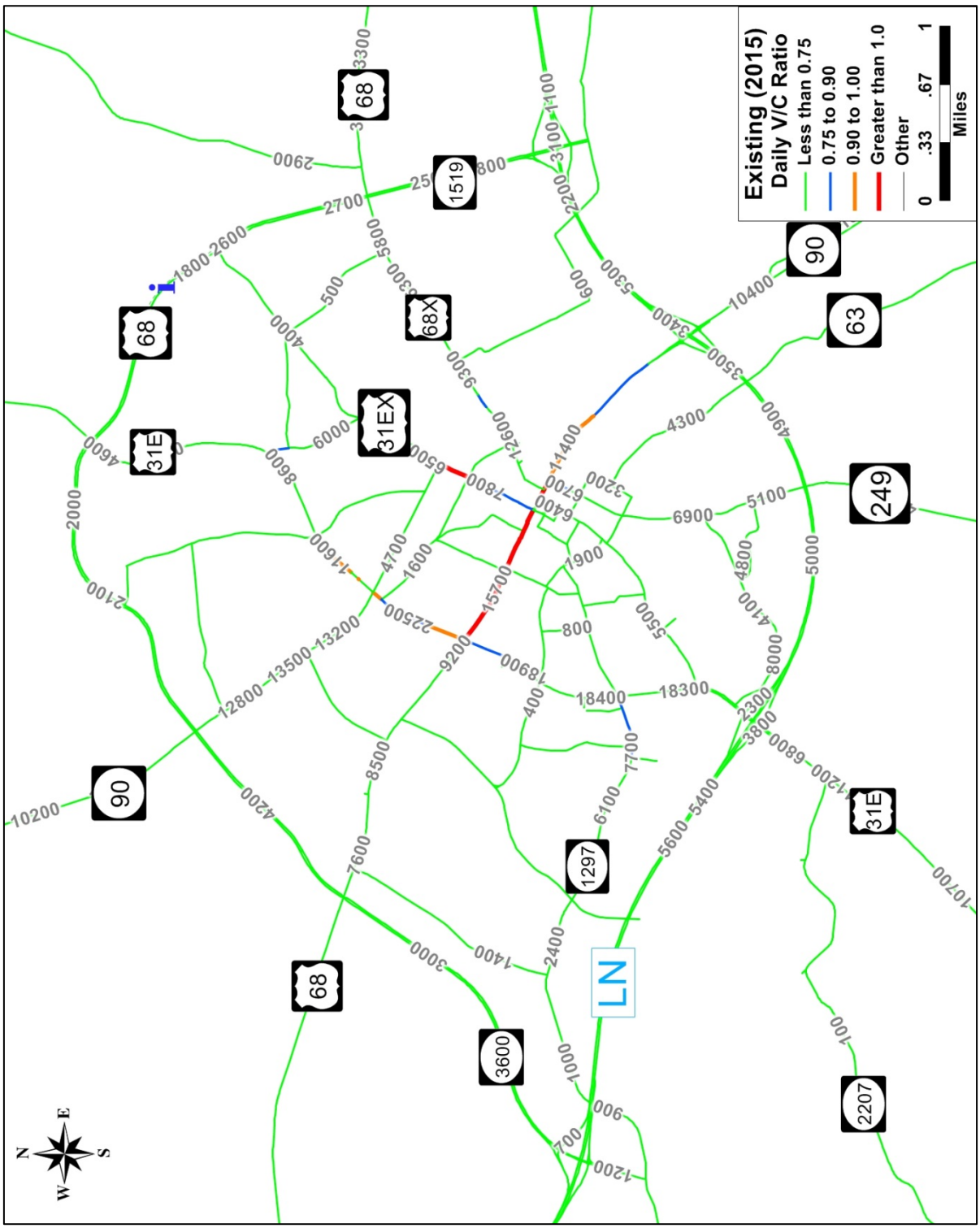


Figure 9: 2015 ADT's from the updated Warren County Travel Demand Model and Volume-to-Capacity Ratios

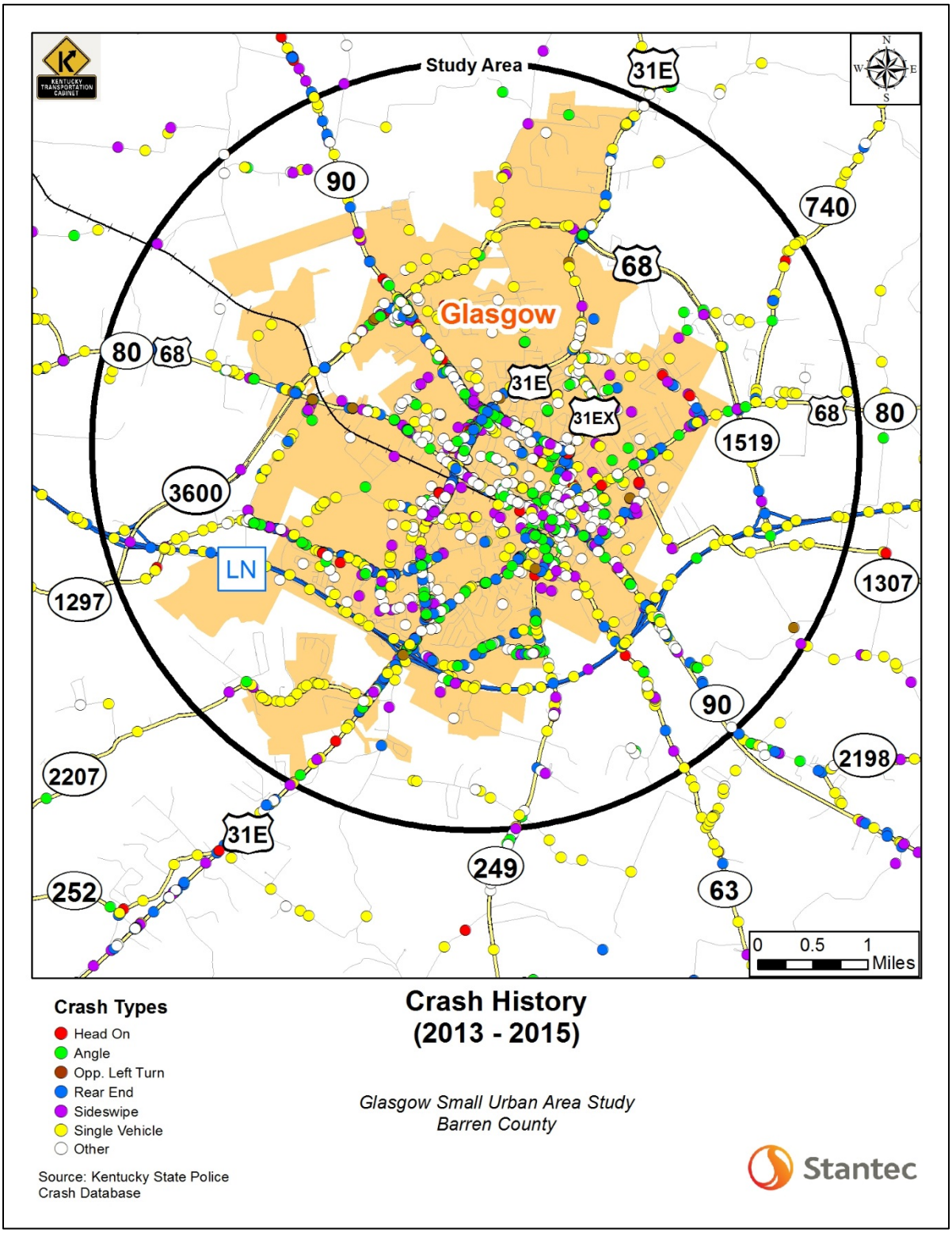


Figure 10: Study Area Crash History

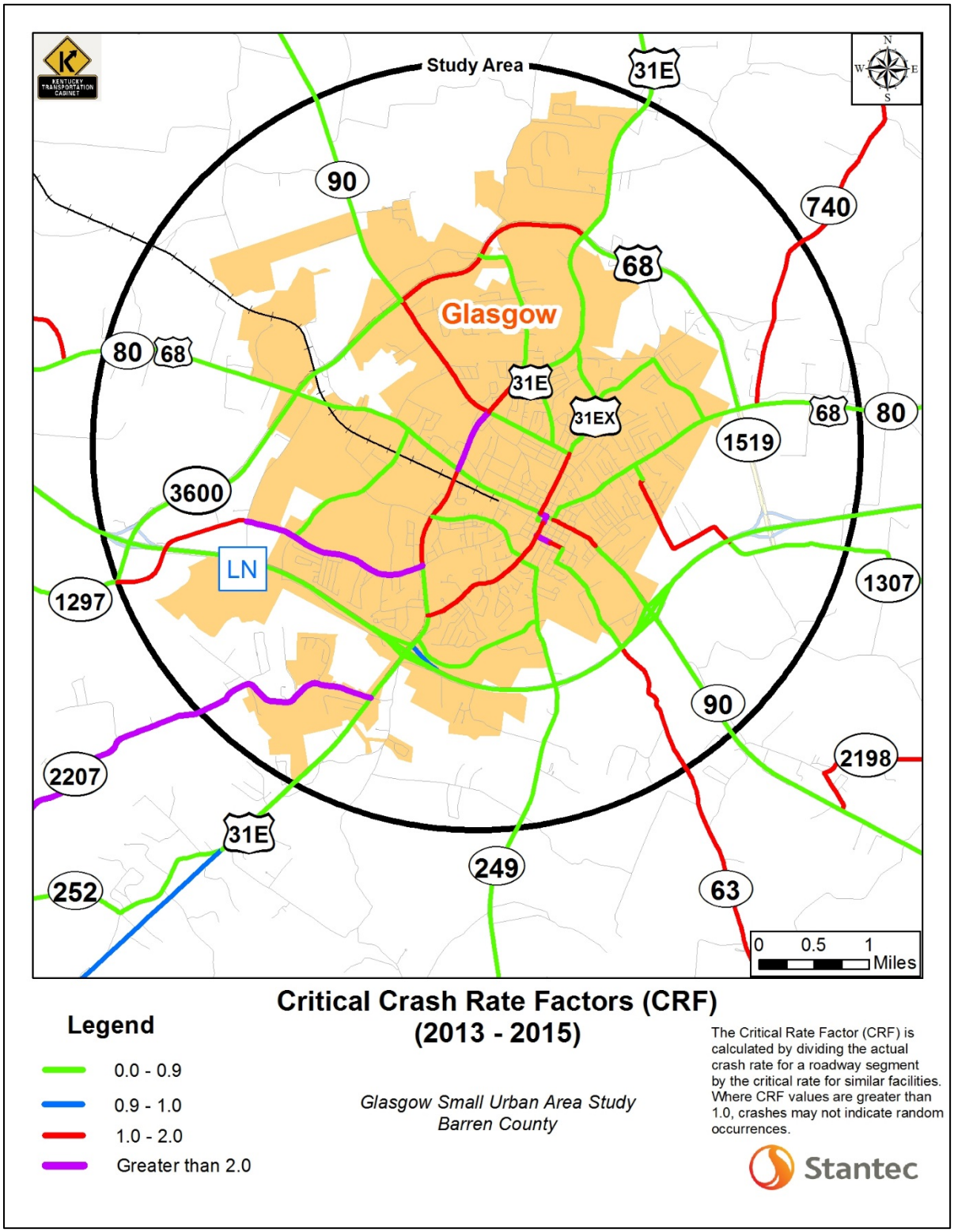


Figure 11: Critical Crash Rate Factors (CRF)

Route	Begin Milepoint	End Milepoint	ADT	Number of Crashes	CRF
US 31EX	1.406	1.516	8,200	41	4.4
KY 2207	0.000	4.477	250	28	3.5
KY 0063	14.436	14.569	3,200	12	2.8
US 31E	14.258	14.849	17,800	158	2.4
KY 1297	11.085	12.582	3,800	66	2.4
KY 1297	12.582	12.806	8,200	25	2.1
US 31EX	1.648	2.118	7,300	36	1.9
US 31EX	1.516	1.648	7,200	11	1.5
US 31EX	0.000	1.406	6,200	59	1.5
US 68	11.326	13.261	5,000	87	1.4
KY 63	14.305	14.436	1,700	4	1.4
KY 63	5.602	13.171	1,700	67	1.4
US 31E	14.849	15.300	11,100	48	1.4
KY 74	0.000	3.510	1,400	31	1.3
KY 1307	7.132	8.464	370	6	1.3
KY 90	8.587	9.923	13,100	125	1.2
KY 1297	9.681	11.078	1,700	13	1.0
KY 90	9.923	10.380	8,000	28	1.0
US 31E	13.299	14.258	20,600	114	1.0

Table 1: High CRF Segments

Analysts also conducted a spot analysis within the study area. Spots were defined by observing 0.3-mile sections where crashes were concentrated. Crashes were again geospatially referenced and compared to statewide data to identify locations experiencing above average crash rates. The CRF was again used as a measure of the safety of a particular spot. Roadway spots with high crash rates are shown in **Figure 12** and summarized in **Table 2**.

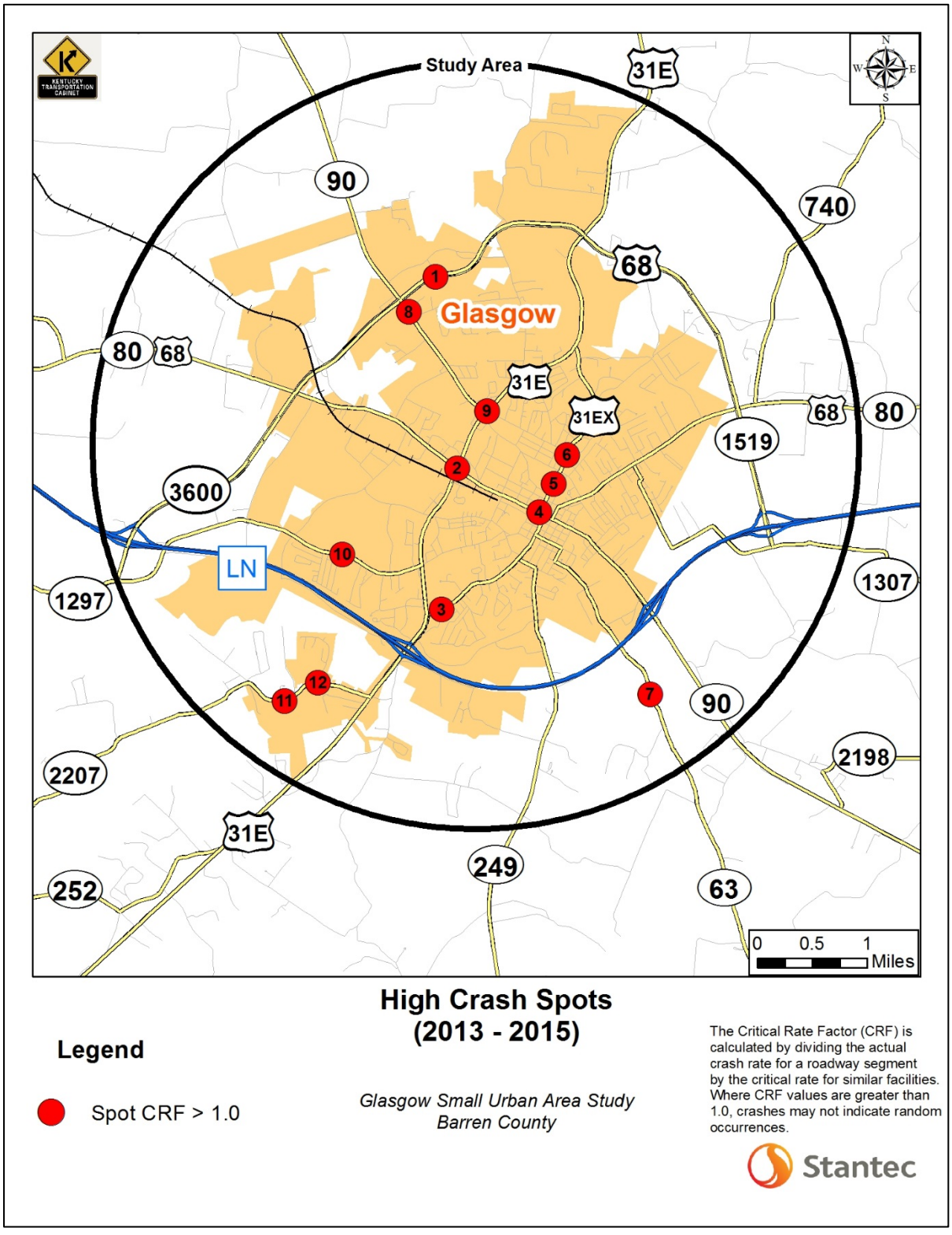


Figure 12: High Crash Spots

Location	Route	Beginning Milepoint	Ending Milepoint	Number of Crashes	ADT	CRF
1	US 68	11.555	11.845	38	9,100	1.4
2	US 31E	14.115	14.405	80	23,300	1.3
3	US 31EX	0.000	0.290	21	5,200	2.0
4	US 31EX	1.370	1.660	55	4,500	5.8
5	US 31EX	1.660	1.950	15	4,500	1.6
6	US 31EX	1.960	2.240	19	4,500	2.0
7	KY 63	12.514	12.736	12	1,400	2.7
8	KY 90	8.600	8.890	51	13,200	1.5
9	KY 90	9.775	10.065	50	14,700	1.3
10	KY 1297	11.875	12.165	15	4,200	1.0
11	KY 2207	3.482	3.772	5	360	1.6
12	KY 2207	3.843	4.133	6	1,100	1.1

Table 2: Summary of 0.3 Mile Crash Spots with CRF Greater than 1.0

3.0 ENVIRONMENTAL OVERVIEW

An environmental overview was performed to identify environmental resources of significance, potential jurisdictional features, and other environmental areas of concern that should be considered during project development. Natural and human environment resources within the study area were identified from a literature/database review, as well as a windshield survey. The study area assessed for the Glasgow SUA Study includes a circle that encompasses the entire Glasgow city limits in Barren County, Kentucky. As such, the study area includes adjoining parts of unincorporated Barren County, providing a total of 38 square miles roughly centered near the intersection of US 68 and Shane Drive, north of US 31E. The complete document is included in **Appendix B**.

More detailed environmental studies may be required as individual projects are further developed. If a future project is federally-funded, the National Environmental Policy Act (NEPA) requires that potential environmental impacts with regard to jurisdictional wetlands, archaeological sites, cultural historic sites, and federally endangered species must be avoided if at all possible. If not, then minimization efforts are required. Mitigation for the impacts, if unavoidable, may also be necessary.

3.1 NATURAL ENVIRONMENT

Natural environment resources include: surface streams, floodplains, wetlands, ponds, groundwater, threatened, endangered, and special concern species and habitat, woodland and terrestrial areas, and parks. Through a literature/database review and field reconnaissance, potentially sensitive resources that affect the natural environment were identified in the study area and are discussed in the following sections and presented in **Figure 13**.

3.1.1 USGS Streams

Three US Geological Survey (USGS) named streams (Beaver Creek, South Fork Beaver Creek, and Huggins Branch) and 73 unnamed streams are mapped within the study area. None of the three named streams are classified as Special Use Waters within the study area as defined by the Kentucky Division of Water (KDOW). Beaver Creek is designated as fully supporting Aquatic Life and Domestic Water Supply from Glasgow Airport upstream, and not supporting Primary Contact Recreation downstream of the airport. South Fork Beaver Creek is designated as partially supporting Aquatic Life from its confluence with Beaver Creek upstream to the Louie B. Nunn Parkway crossing. Watersheds in the study area include Park City, Little Beaver Creek-Beaver Creek, South Fork Beaver Creek, and Boyd's Creek-Skaggs Creek, from north to south, respectively.

The study area contains one Zone III Source Water Assessment and Protection Program (SWAPP; KDOW, 2013) area, associated with the Glasgow Water Company (Little Beaver Creek-Beaver Creek watershed).

3.1.2 Other Streams

Additional surface streams are likely present in the study area and would most likely consist of small, headwater streams and roadside drainage features.

3.1.3 Wetlands

There are 309 National Wetlands Inventory (NWI) wetlands mapped in the study area, with the highest number being ponds (88 percent by number), while the greatest area is contributed by forested wetlands (PFO, 65 percent by area). NWI-mapped wetlands are generally dispersed evenly outside the city center.

Hydric soils occur in approximately five percent of the study area, concentrated along the major stream valleys.

3.1.4 Ponds

There are 273 ponds mapped (NWI) within the study area. Several appear to be intermittent, occurring in sinkhole depressions and do not appear to hold water permanently.

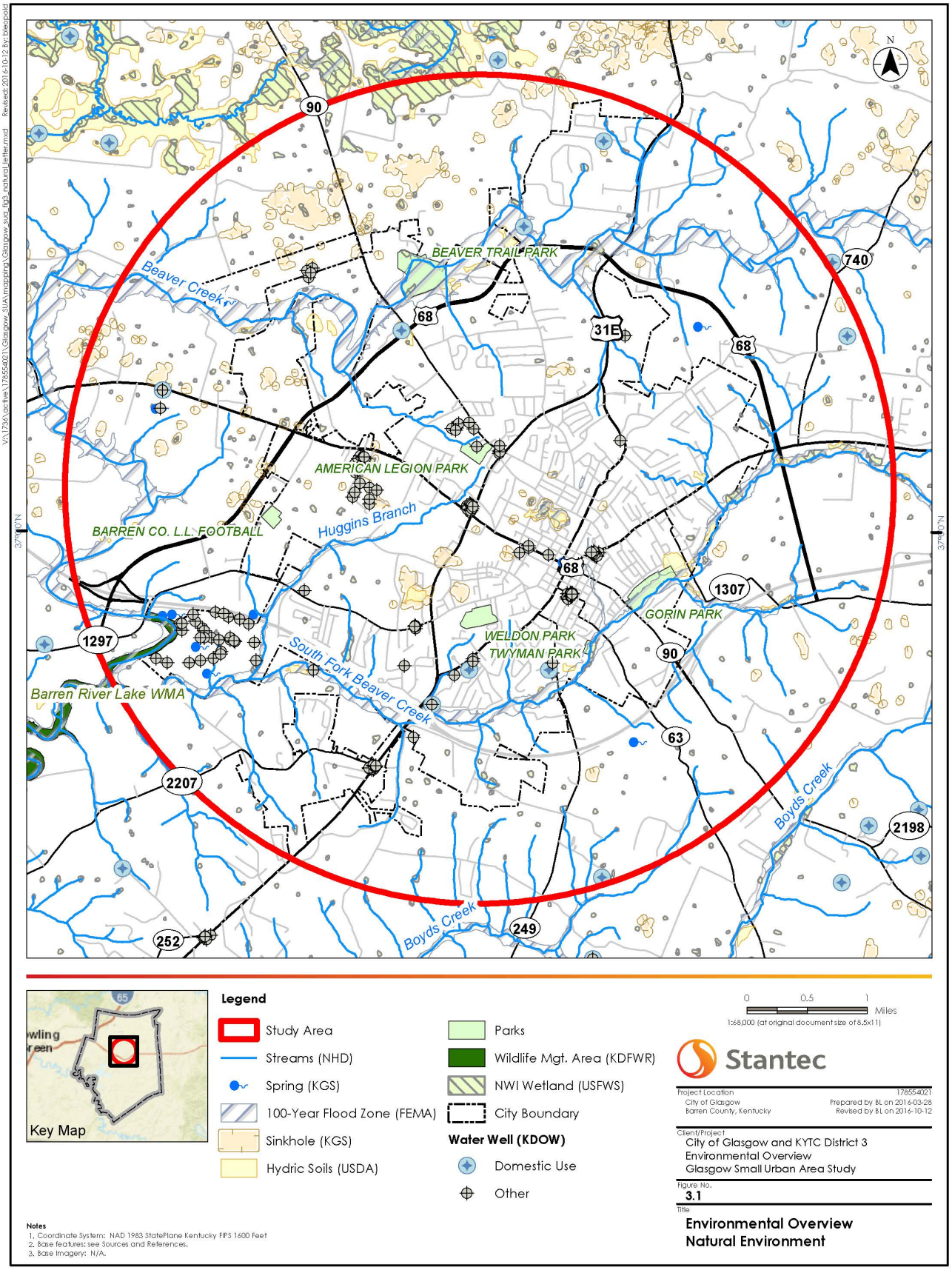


Figure 13: Natural Environment

3.1.5 USFWS Species List

Review of the US Fish and Wildlife Service (USFWS) Threatened and Endangered Species (T&E) list suggests the possibility for several listed species to be found in Barren County. Indiana bat (endangered), gray bat (endangered), and northern long-eared bat (threatened) have the potential to occur in Barren County. Three endangered mussels including fanshell, sheepnose, and snuffbox and one threatened mussel, the rabbitsfoot, have the potential to occur in the study area. Kentucky cave shrimp (endangered) has the potential to occur in Barren County.

The northwestern half of the study area (north and west of US 31E) lies within a Known Summer 1 + Swarming 1 habitat designated area for Indiana bat. Potential summer roost and foraging habitat for Indiana bat and northern long-eared bat (woodlots and riparian woodlands) is present in scattered woodlots primarily along major stream corridors.

Of the four federally-listed mussel species in the study area, only snuffbox and rabbitsfoot have the potential to occur as Beaver Creek and South Fork Beaver Creek may provide suitable habitat for these species that prefer small to medium sized creeks.

Habitat for gray bat and Kentucky cave shrimp may be present as nine cave entrances are known within the study area.

3.1.6 KDFWR Species List

The Kentucky Department of Fish and Wildlife Resources (KDFWR) lists 50 additional (beyond the nine species listed by the USFWS, above) State Threatened, Endangered, and Special Concern species as occurring (either recently or historically) in Barren County. These include:

- Nine state endangered species (one fish, one amphibian, six birds, one reptile)
- 20 state threatened species (10 birds, one mussel, six invertebrates, one gastropod, one reptile, one mammal)
- 19 state special concern species (five fish, one reptile, six birds, three crustaceans, one gastropod, one mussel, two mammals)
- Two historical records of state-listed Upland Sandpiper and American Bittern

3.1.7 KSNPC Species Database

The Kentucky State Nature Preserves Commission (KSNPC) provided five records for three federal or state endangered, threatened, or special concern listed species and communities within one-mile of the study area. These include:

- One mussel (federal-species of management concern)
- One fish (federal-species of management concern)

- One crustacean (one federal-endangered)
- One natural community (acidic mesophytic forest)

Occurrence records for the fish and crustacean species relate to cave-dwelling species. Additional federal-listed species known within five miles include Myotis grisescens (gray bat) listed as federal endangered.

The KSNPC data response specifically highlights a portion of the project lies within the Green River Biosphere Reserve, associated with the Green River and the Mammoth Cave Systems, with emphasis upon prevention of erosion and sedimentation. The cave-obligate Mammoth Cave shrimp along with two state-listed species (bottlebrush crayfish and Kentucky Creekshell mussel) are known within five miles of the project.

3.1.8 Groundwater

There are 277 water wells within the study area, of which 256 are listed as monitoring wells, nine are domestic use, and 12 have an unknown use. 19 springs are mapped within the study area, none of which are indicated as being used for consumption. No wellhead protection areas occur in the study area. The northwestern corner of the study area, north of the Glasgow Municipal Airport, contains extensive sub-surface drainage associated with the Turnhole Spring karst basin, with underground flow to the northwest. This basin is listed as a KDOW Outstanding State Resource Water (OSRW) and Cold Water Habitat (CAH) designated use, known to harbor the federal-endangered Kentucky cave shrimp outside of the study area.

3.1.9 Karst

The project area is underlain by bedrock with moderate to high potential for karst. Fifty-two sinkholes are mapped underlying the study area, accounting for approximately five percent of the area. Sinkholes are most prominent north of Beaver Creek and west of the city center. Nine cave entrances are known in the study area, all located near Beaver Creek in the north. Due to the sensitive nature of this resource, location information is not included in this report. KYTC has a karst policy for use of specific drainage design (grass swales and detention basins) in roadway improvement projects.

3.1.10 Floodplain

Federal Emergency Management Agency (FEMA) 100-Year floodplain occurs along Beaver Creek and South Fork Beaver Creek throughout the extent of the study area, the lower half of Huggins Branch, and within several sinkhole areas just north of the center of town.

3.1.11 Floodway

No FEMA designated floodway occurs in the study area or vicinity.

3.1.12 Farmland

Farmland soil classifications are shown on **Figure 14**. The majority of the soils in the study area and vicinity are identified as Prime Farmland (27 percent), Farmland of Statewide Importance (39 percent) and Prime Farmland if drained or protected from flooding (12 percent). Active farmlands are limited to the outer reaches of the study area, primarily north and west of US 68.

3.1.13 Section 4(f)

Six public parks are located in the study area including four city-owned (Beaver Trail, Gorin, Twyman, and Weldon) and two county-owned parks (American Legion and Barren County Little League Football field). Four are located in the city center area and one each north and west of the city center. Approximately 50 acres of the Barren River Lake Wildlife Management Area, owned by U.S. Army Corps of Engineers and administered by KDFWR, is located along Beaver Creek, west of the city center.

3.1.14 Section 6(f)

Based on current Land and Water Conservation Fund (LWCF) records, multiple LWCF properties are present in the study area including American Legion Park, Barren County Little League Football Field, Beaver Creek (Trail) Park, and Gorin Park.

3.1.15 Air Quality

The study area is not located in a non-attainment area for 8-hour ozone (2008 standard) or a maintenance area for PM 2.5 (1997 standard) for the transportation-related criteria pollutants for which the EPA has established National Ambient Air Quality Standards (NAAQS). 31 USEPA air emissions facilities are located within the study area, located primarily around the city center and along US 31E.

3.1.16 Noise

Noise sensitive land use areas are located throughout the study area including Activity Categories “B”, “C”, “D”, and “E”- consisting of residential neighborhoods, parks, cemeteries, places of worship, schools, hotels, and restaurants with exterior uses.

Approximately 30 percent of the study area is urbanized, about half of which consists of moderate density residential housing (single-family home developments).

Figure 14: Natural Environment- Farmland Classifications of Soils

3.1.17 Geotechnical

A geotechnical overview for the study area was completed based upon research of available published data and experience with highway design and construction within the region. The purpose of this overview was to provide a general summary of the bedrock, soil, and geomorphic features likely to be encountered within the proposed alignment and to identify geotechnical features that may have an adverse impact on roadway improvements. The complete document is included in **Appendix C**. The overview concluded:

- This portion of Kentucky is well known for its rolling terrain, red clay soils, and the karst behavior of the underlying bedrock (karst features may include sinkholes, caves, and solution features in the bedrock).
- Karst terrain in the study area will likely be the most detrimental factor to any new construction in the area. Rock cuts in the area can be problematic due to the karst topography. Solution features can cause the bedrock surface to be erratic.
- Geotechnical drilling will be critical in this region for new, replacement, or widened culverts, bridges, retaining walls, and design due to the karst potential. It is anticipated that conventional spread footing and/or pile foundation systems can be utilized for structures. However, if voids/caves are present, additional costs associated with karst mitigation should be anticipated.
- Because a portion of this project may be a widening project, information on pavement structure should be obtained to assist the team on pavement structure and California Bearing Ratio (CBR) information. Other projects in the vicinity have utilized rock roadbed and generally CBR values of approximately six or less.
- Once alignment and sections are identified, then open faced logging of exposed cuts and/or drilling should be performed. Sampling of foundation soils should be performed for embankment situations of sufficient height to evaluate stability.
- Several oil and gas wells have been drilled in the study area. Many have reportedly been abandoned. Future design teams should inventory and survey active wells. Additional costs could be incurred if the selected alignment(s) disturb a well site.

3.2 HUMAN ENVIRONMENT

Human environment is defined as what we live in and around and what we have built. Through a literature/database review and field reconnaissance, potentially sensitive resources that affect the human environment were identified in the study area and are discussed in the following sections and presented in **Figure 15**.

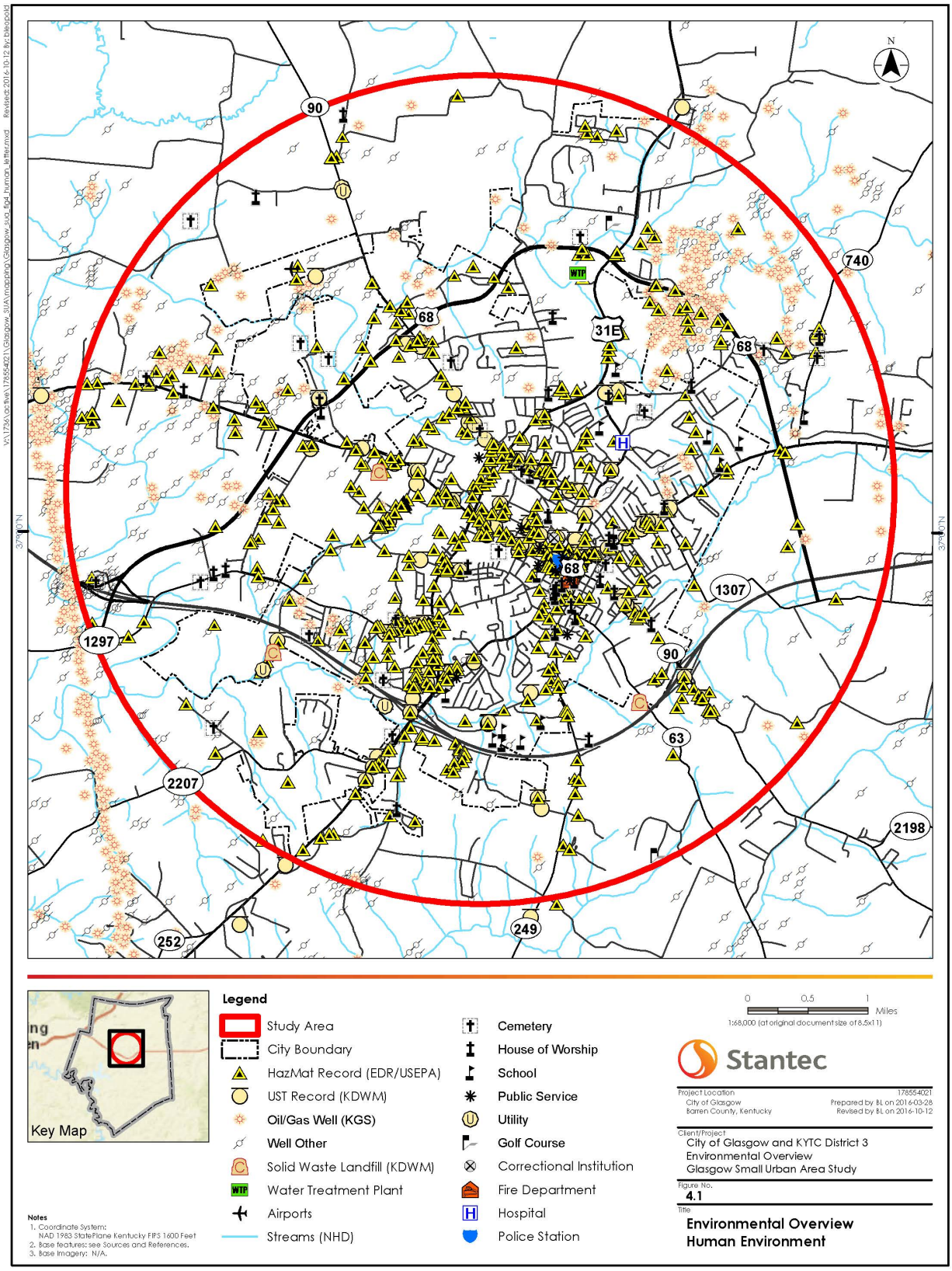


Figure 15: Human Environment

3.2.1 Hazardous Materials

A review of database records reveals approximately 616 sites of potential concern occur within the study area containing 770 database records. These include: one Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) record, three CERCLIS No Further Remedial Action Planned (NFRAP) records, 23 Resource Conservation and Recovery Act (RCRA) generator records, 42 RCRA Non-generator records, 24 State Hazardous Waste (SHWS) records, and 10 Solid Waste Landfill (SWF/LF) records.

The statewide Underground Storage Tank (UST) database indicates 384 UST records in the study area associated with 119 sites. Potential hazardous materials concern sites are located throughout the study area, concentrated around the city center, along US 68 west of the city, and US 31E south of the city.

Three landfills are located in the study area, including the Dana Corp Residual Landfill, the Glasgow Regional Landfill, and the KY 63 & Parkway Trenchfill Site.

3.2.2 Socioeconomic Study

Socioeconomic issues pertaining to minority, elderly, disability, and low income (persons living in poverty) populations in the project study area were evaluated and documented by the Barren River Area Development District (BRADD) in a Socioeconomic Study completed in March 2016. A copy of the Socioeconomic Study is found in **Appendix D.** The study area includes portions of Census Tracts 9501-9507 in Barren County.

Overall, approximately 9.7 percent of the study area population is minority, which is greater than the county percentages but less than the state percentages. Approximately 21.7 percent of the study area population is low income, which is greater than the state percentage.

3.2.3 Archaeology

Based on a review of National Register of Historic Places (NRHP) and Office of State Archaeology (OSA) records, one archaeological site listed on the NRHP is in the study area, the Fort Williams Site located on the west side of downtown Glasgow. Ten historic places and four historic districts are located within the study area. In addition, based on a review of historical maps, 29 previous surveys have recorded 70 archaeological sites within the study area. Approximately 5.5 percent of the study area has been previously surveyed for archaeological resources. Given the rate of the number of sites recorded by those surveys, the ready availability of prehistoric lithic resources and the high density of historic settlement, it is estimated that more than 1,320 sites could be present in the study area. Areas of particular concern for archaeological resources include alluvial soils and adjacent areas.

3.2.4 Historic

Based on a review of Kentucky Heritage Council (KHC) records, the following resources were identified:

- 10 NRHP Listed Properties: nine buildings and one site (Fort Williams)
- Four Historic Districts: Glasgow Central Business Historic District (one boundary expansion), North Race Street Residential Historic District (one boundary expansion), Ralph Bunche Historic District, and Southwest Glasgow Historic District (two boundary expansions)
- 291 contributing resources to the four historic districts
- 64 historic properties previously surveyed and having an undetermined NRHP status

3.2.5 Churches

There are 30 houses of worship (church, mosque, synagogue, etc.) identified in the study area from current and historical mapping resources, with a significant concentration in the city center area.

3.2.6 Schools

There are15 school facilities identified in the study area from current and historical mapping resources, including two high schools (Barren County and Glasgow High School) and two post-secondary institutions (Southcentral Kentucky C&TC/Glasgow Health Campus and Western Kentucky University Glasgow).

3.2.7 Cemeteries

There are 23 cemeteries identified in the study area from current and historical mapping resources, 19 of which may represent small, family cemetery plots scattered around the outskirts of the city limits.

3.2.8 Public Services

There are multiple public service facilities concentrated in the city center, including:

- Barren County services: Board of Education, Courthouse, Fairgrounds, Government Center, Health Department, Jail, Sheriff's Office
- Boys & Girls Club, Bunche Center
- Glasgow Fire Department
- Glasgow Police Department
- Mary Wood Weldon Memorial Library

- Southcentral Kentucky Cultural Center
- US Post Office
- Utilities: four pipeline crossings, roughly bounding the city limits, two electrical transmission line corridors, one each south and east of the city center, one railroad line extending northwest from the city center, Glasgow water treatment plant, Glasgow sewage treatment plant

3.2.9 Residences and Businesses

Residential land use comprises approximately 20 percent of the study area, predominantly as single-family residential neighborhoods. Multi-family residential developments are relatively limited in extent. Commercial and industrial land use comprises approximately 10 percent of the study area and includes the city center business district with industrial development primarily north and west of the city center.

4.0 ADVISORY COMMITTEE MEETING #1

Comprehensive public involvement plays a critical role in the success of a SUA study. The purpose of the public outreach component of the Glasgow SUA Study was to bring different groups of people together to express their ideas, clarify areas of agreement and disagreement, and to develop shared resolutions. The KYTC seeks to build partnerships among stakeholders to better understand the relationships among problems and to bring more resources and expertise together to develop alternate solutions. The public involvement component of this study was used to:

- Inform and educate stakeholders on the study and its goals
- Gauge the interest in the desire for transportation improvement projects
- Identify the needs of the study area
- Identify the project issues and goals
- Identify and prioritize potential improvement projects

Public involvement during the study was guided by the Glasgow SUA Advisory Committee, made up of local officials, emergency responders, transit agency representatives, and other stakeholders. Invitations to serve on the committee were sent to a diverse array of individuals. Two meetings were held with the Advisory Committee over the course of the study. At these meetings, the project team provided information and listened to local concerns. Summaries for all project meetings are found in **Appendix E**.

The first Advisory Committee Meeting was held on February 24, 2016. The primary goal of the meeting was to present the existing conditions analysis and to get feedback from the Advisory Committee on problem areas before developing improvement alternatives. A group exercise was undertaken at the first meeting to provide attendees an opportunity to work with each other to identify existing transportation issues and potential improvements. The committee was divided into small groups and provided maps depicting the study area and asked to identify key areas the study should focus on, referred to as "trouble spots". **Figure 16** presents the results from the identification of trouble spots related to congestion and **Figure 17** presents the trouble spots related to safety. As a follow-up to the safety discussion, KYTC District 3 performed an audit of the Cumberland Parkway interchange at KY 3600 (exit 8). Signage improvements were made at this location as a result of this audit.

The Advisory Committee was then asked to identify potential residential and commercial growth areas in Glasgow. During that discussion, it was mentioned that utility infrastructure was limited on the northeast side of town, which can limit growth. In addition, the terrain to the east is less than desirable for development. There is more potential for growth in the west where utilities are more readily available and the terrain is more conducive to development. **Figure 18** presents the growth areas that were identified by the committee members. The areas identified were to be used to update the Bowling Green/Warren County Travel Demand Model, which was used to develop 2040 traffic forecasts for the study.

At the end of the meeting, the Advisory Committee was asked to identify locations for possible transportation and multimodal improvements. The identified locations are shown on **Figure 19**. The locations identified by the Advisory Committee served as a starting point for the development of improvement concepts.

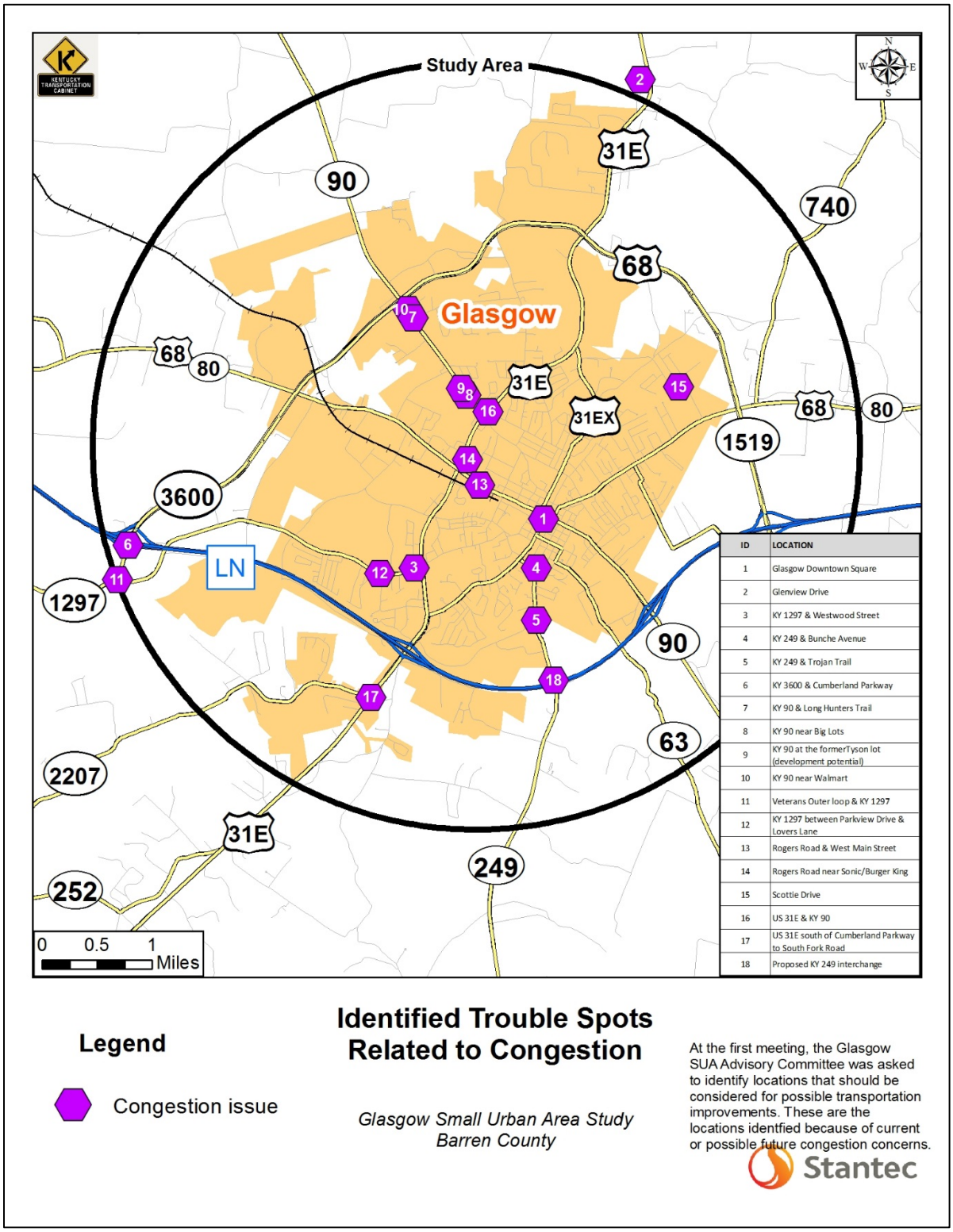


Figure 16: Congestion "Trouble Spots" Identified by the Glasgow SUA Advisory Committee

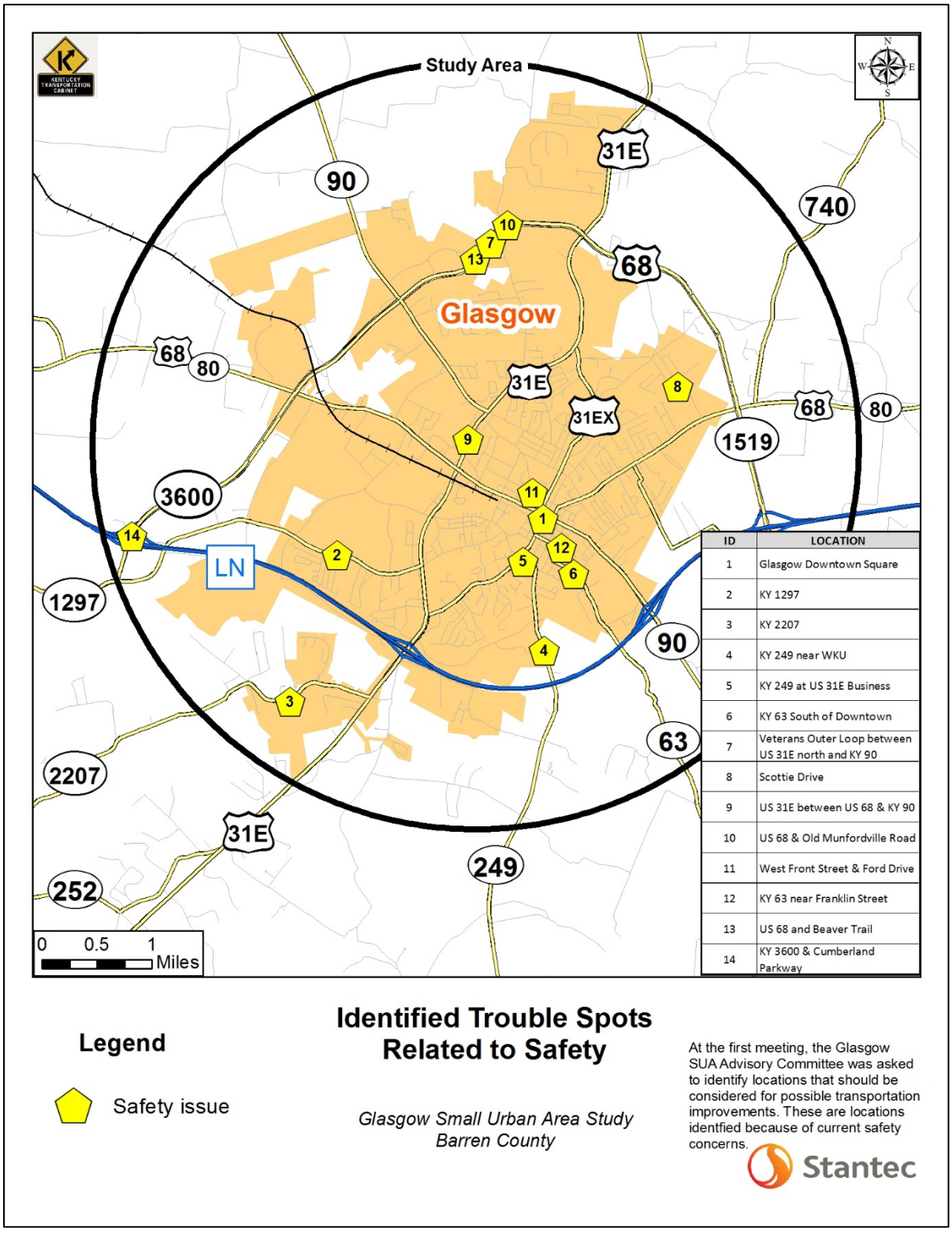


Figure 17: Safety "Trouble Spots" Identified by the Glasgow SUA Advisory Committee

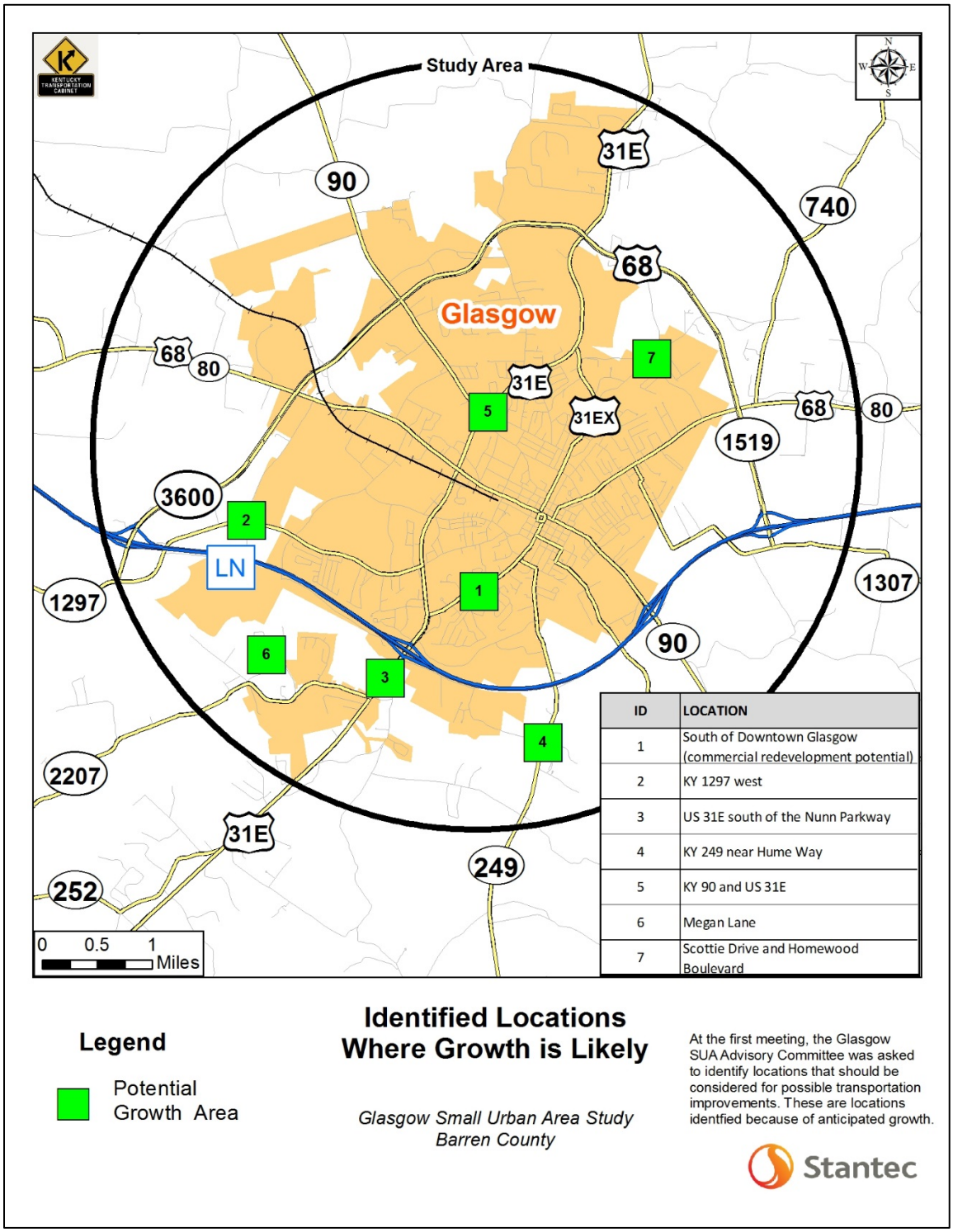


Figure 18: Growth Areas Identified by the Glasgow SUA Advisory Committee

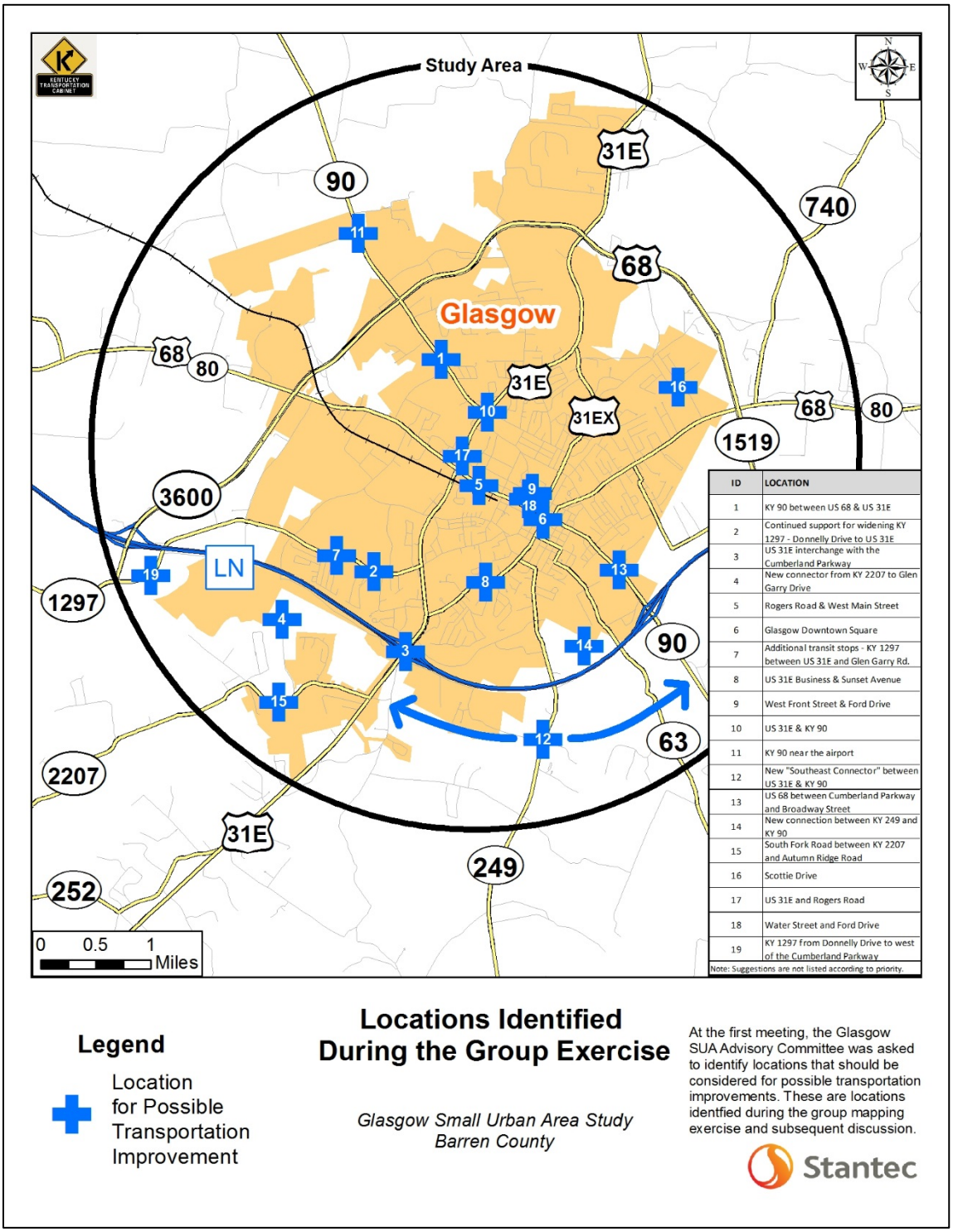


Figure 19: Transportation Improvements Identified by the Glasgow SUA Advisory Committee

5.0 TRAFFIC FORECAST AND FUTURE YEAR ANALYSES

To determine the need for and purpose of potential transportation improvement projects, it is necessary to estimate future conditions within the study area. This chapter summarizes the anticipated future conditions within the study area portion of Barren County. The complete Traffic Forecast Memorandum can be found in **Appendix F**.

5.1 WARREN COUNTY TRAVEL DEMAND MODEL

Traffic forecasts for the Glasgow SUA were developed from the Warren County Regional Travel Demand Model, which covers Warren County and the six counties surrounding it, including Barren County. The model was completely redeveloped in 2014 based on KYTC's preferred model structure and contains household and employment information and an updated roadway network for the 2012 base year. As a part of the development of the Glasgow SUA Study, the Glasgow area was further updated to reflect 2015 socioeconomic conditions and roadway updates. Household and employment data for the 2040 forecast year were also revised to more accurately reflect the local development patterns expected to occur.

Traffic Analysis Zones (TAZs) form the geographical basis for delineating and organizing the socioeconomic data used by the model to generate the vehicular trips that are assigned to the roadway network. Household and population data, as well as employment and school enrollment, are stored in each zone, with forecast values for households and population used to determine the levels of travel demand throughout the model area. The Warren model is delivered with separate TAZ map files for each model scenario, including the 2012 base year and the 2040 future year.

The TAZ boundaries from the Kentucky Statewide model initially served as the basis for the development of the model's TAZ boundaries for those zones outside of Warren County, including Barren County. These zones are relatively large and therefore do not necessarily depict the interaction of local trips within a small city the size of Glasgow to the level of detail needed for the SUA. Therefore, KYTC staff redefined the TAZ boundaries, splitting zones to create 46 new TAZs within the general Glasgow SUA study area. Within these redefined zones, households and particularly employment were reapportioned to accurately match their actual locations. These smaller, more defined zones made it possible to represent the distribution of trips between zones more accurately, which meant a better fit of traffic assignments and observed counts on the study area roadway network.

Initially, household growth forecast in Barren County for the 2040 future year model was developed from county-wide level growth factors calculated from population forecasts produced by the Kentucky State Data Center. Employment growth was based on a third party forecast using trends from the Bureau of Labor Statistics. The relationship between population growth and employment growth was not well coordinated. The KYTC consulted with local planning staff to update the socioeconomic data for the 2040 future year model within Barren

County. The locations of proposed developments were identified and the physical and infrastructure-related constraints influencing the placement of future growth were taken into account in the placement of future households and employment centers. For example, while land is available to the east and northeast near several new school campuses, utilities are not available to support such growth. Water and especially waste water infrastructure will need to be planned and constructed before these areas will develop. In contrast, available land to the west has infrastructure capacity for additional development. As a result, household growth in the 2040 future year was shifted from the east and northeast to the west and south. While the population projections were reasonable, the amount of job growth was tempered and was redirected to grow inside the new western interchange and beltway. The changes in population and employment within each of the 46 new TAZs are shown in **Figure 20** and **Figure 21**, respectively.

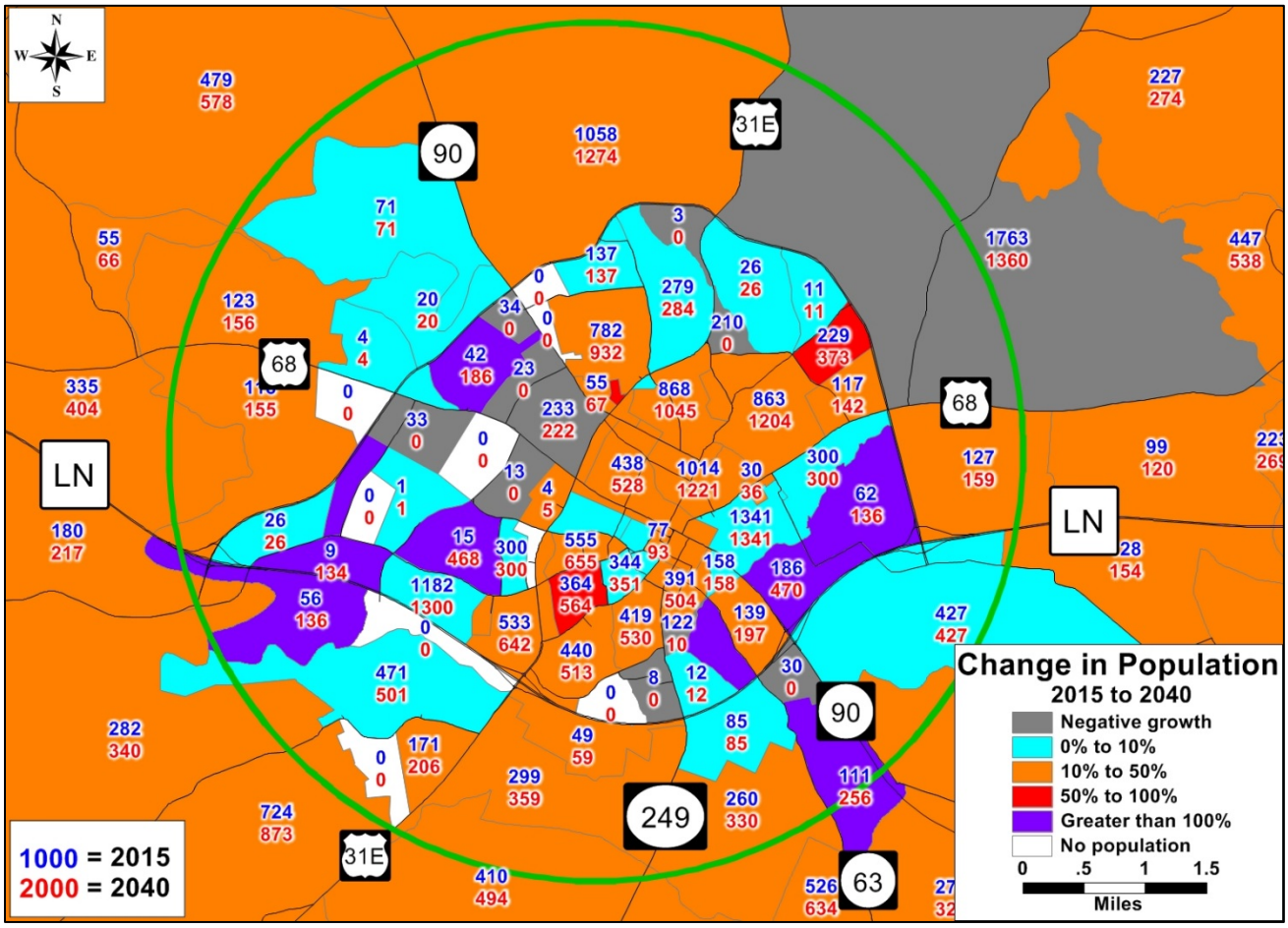


Figure 20: Traffic Analysis Zones - Change in Population

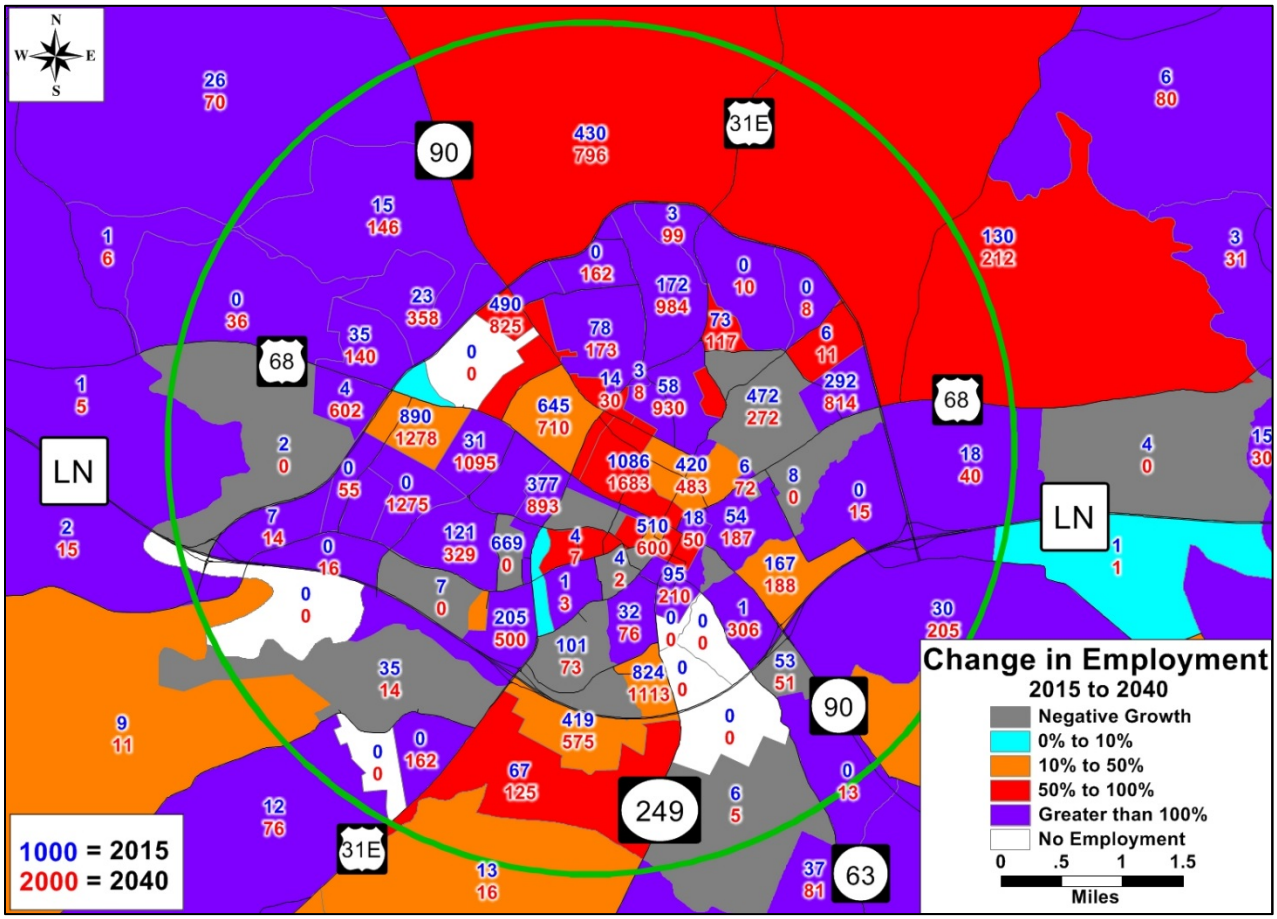


Figure 21: Traffic Analysis Zones - Change in Employment

5.2 2040 TRAFFIC FORECAST

The 2040 average daily traffic volumes (ADT) developed from the updated Warren County travel demand model are shown on **Figure 22**. The 2040 model includes projects listed in the 2016 KYTC Highway Plan, shown in **Figure 23**. To evaluate the adequacy of roadway segments, 2040 ADT volumes were compared to the road's theoretical capacity. A V/C analysis using Highway Capacity Manual (HCM) procedures shows that portions of US 31X, US 68X, US 31E, and US 31EX have a V/C greater than 1.0. A V/C greater than 1.0 indicates that mitigation measures (including adding additional lanes) may be warranted. All other roadway segments are expected to operate at less than capacity with a V/C less than 1.0, as shown in Figure 22.

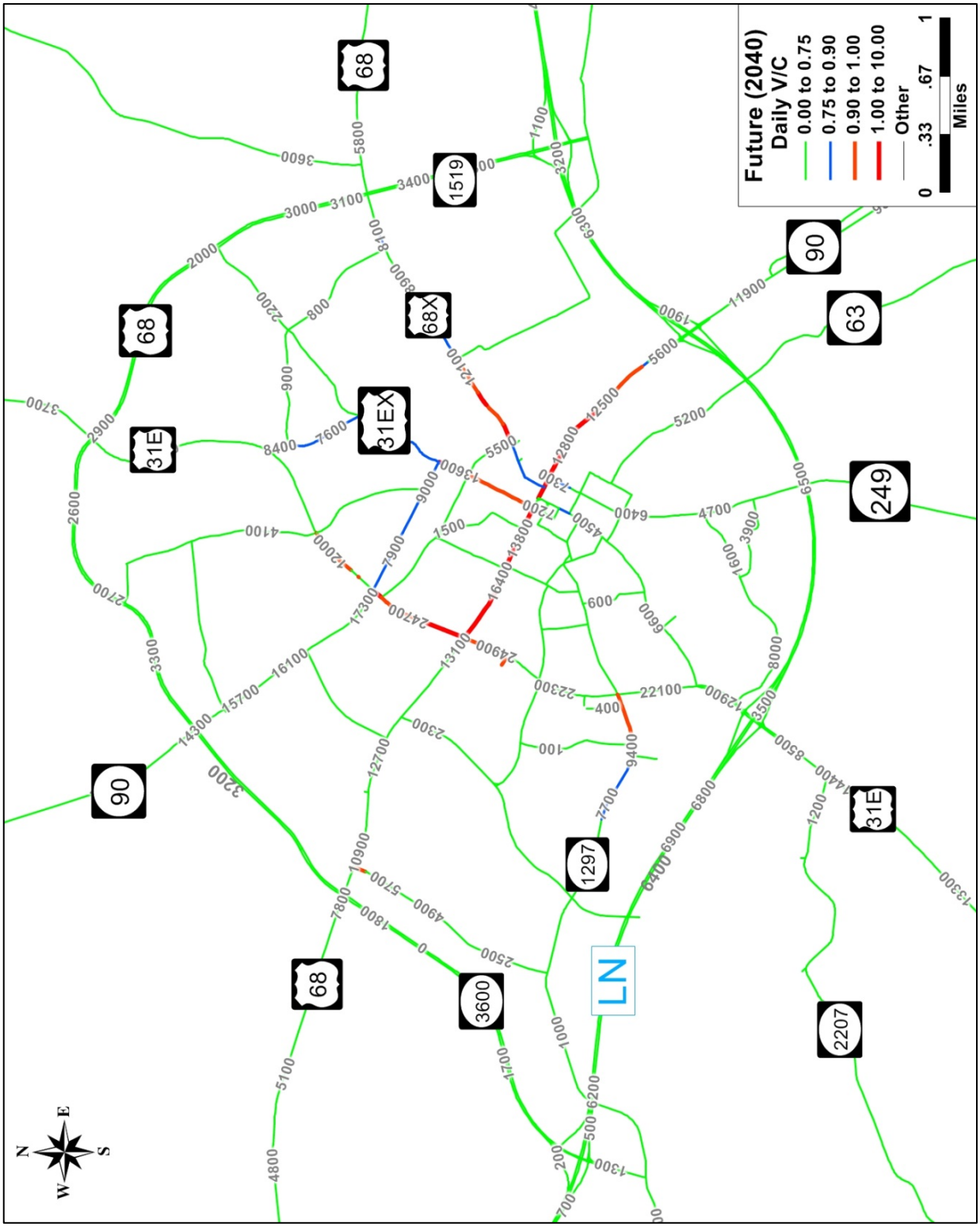


Figure 22: 2040 No Build ADT's from the updated Warren County Travel Demand Model and Volume-to-Capacity Ratios

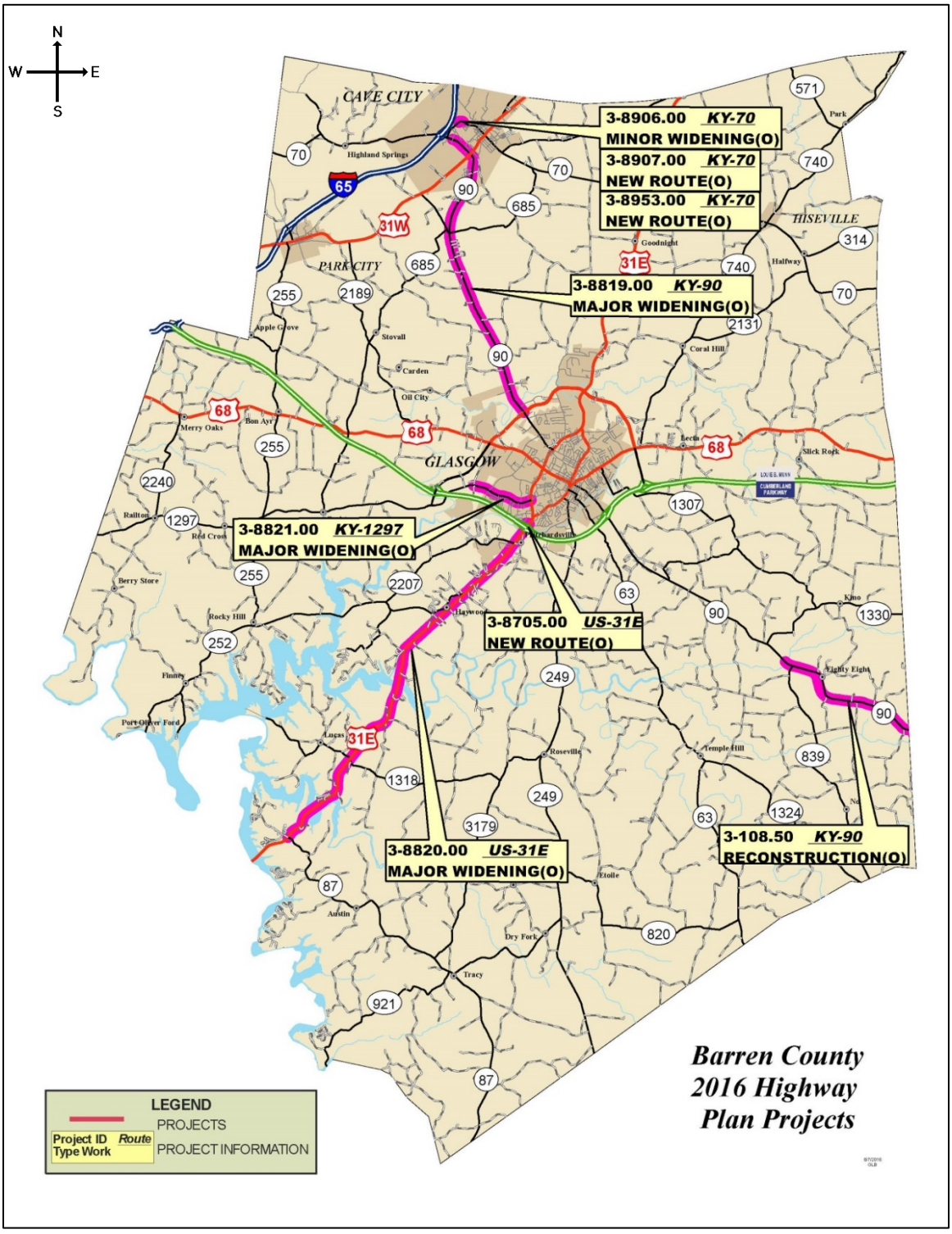


Figure 23: Committed Projects from the KYTC 2016 Highway Plan
(Source: KYTC Division of Program Management)

6.0 ALTERNATIVES DEVELOPMENT

The conceptual improvement projects were based on a combination of input from the first Advisory Committee meeting, a review of the existing conditions, traffic analyses, and field reconnaissance. Initially, only construction cost estimates were provided for each concept, and it was noted that several could have significant right-of-way and utility costs.

The improvement concepts were categorized as follows:

- **Short-term:** The short-term concepts are typically lower-cost projects that can be implemented in the near future. These types of improvements should require little or no right-of-way to construct and in some cases may be implemented by the KYTC Division of Maintenance.
- **Long-term:** The long-term concepts are higher cost projects that will require more significant resources to implement. These types of improvements will require additional right-of-way to construct and will need to be funded through the KYTC Highway Plan.
- **Local projects:** The local projects are not located on the state-maintained system and would likely need to be funded by the City of Glasgow or Barren County. A private developer may also take on this responsibility.

The concepts are shown in **Figure 24** and in the project sheets beginning on page 55 and are discussed as follows:

- **Concepts A1 and A2**: US 31E at Louie B. Nunn Cumberland Parkway – This section of US 31E carries about 22,000 vehicles per day (VPD) and the volume is expected to increase. The issue is the proximity of the unsignalized westbound ramp terminal to the signalized intersection with Trojan Trail. Making the issue worse, this signalized intersection will become four-legged under the proposed Cavalry Drive Project (KYTC Item No. 3-8705.00), which connects Cavalry Drive to Trojan Trail. Project A1 presents a short-term project that includes signalizing the ramp terminal intersection and widening US 31E under the parkway bridge to accommodate additional turn lane storage. Project A2 presents a long-term project to reconfigure the interchange to a new type (such as single point urban interchange) to increase spacing between traffic signals.

- **Concept B:** KY 90 at Walmart – The signalized entrance from KY 90 to Walmart at Max Wagoner Road is less than 500 feet from the US 68 intersection. This location sees about 13,000 VPD and has a CRF of 1.4; the majority of the reported crashes have been rear-end or angle crashes. South of the Walmart parking lot, there is space for additional development. Concept B relocates the signalized intersection south away from the US 68 intersection. This could serve as a standalone project or could be included in project F. A short-term project would add signal ahead warning signage on KY 90 south of the signal at Max Wagoner Road and put reflector back plates on the signal heads.

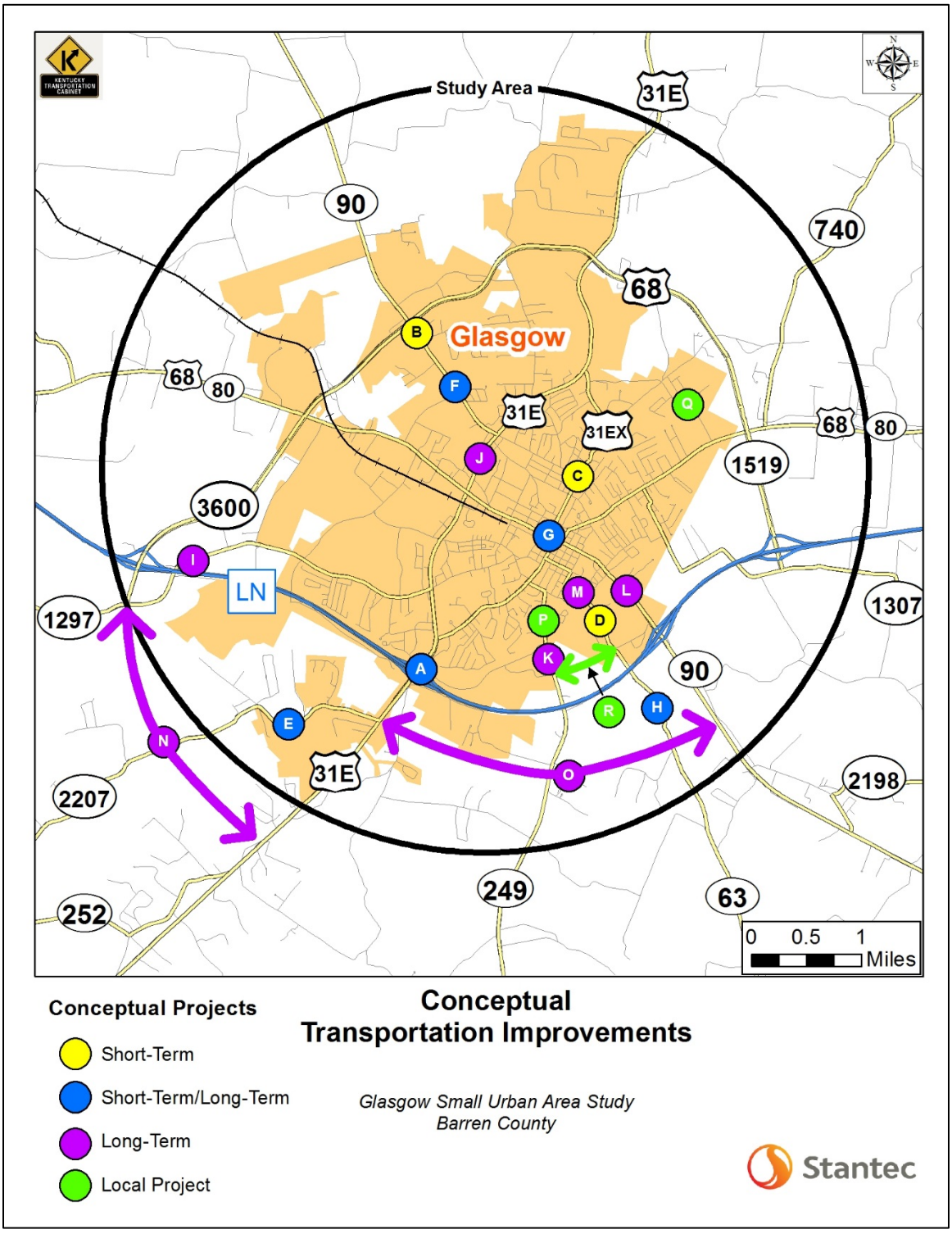


Figure 24: Conceptual Transportation Improvements

- **Concept C:** US 31EX at Happy Valley Road – The traffic signal located at the intersection at US 31EX (Race Street) and Happy Valley Road is a diagonal span. There are currently no turn lanes on US 31EX, and based on observation it appears that a northbound left-turn lane from US 31EX onto Happy Valley Road may be warranted. A left-turn lane was provided at this location previously. This short-term project would provide a left-turn lane on US 31EX and replace the diagonal span traffic signal with a conventional span wire arrangement.

- **Concept D:** KY 63 north of Temple Trace – The western ditch along KY 63 in this section has suffered from severe erosion/washing, and there is no shoulder in the area as a result of the erosion. KYTC maintenance has attempted to minimize the erosion by placing channel lining in the ditch. The ditch connects to a tributary of South Fork that passes beneath the roadway north of Temple Trace. During a site visit, it was noted the culvert beneath the roadway was nearly full of water even though there had been no recent heavy rainfall event. The water did not appear to be moving. A short-term project includes improvements to better control the drainage issues. This could include a combination of ditching to clean the existing channel and culvert, or to either lower/increase the ditch area or to increase the size of the culvert beneath the roadway. The latter would require increasing the elevation on KY 63. As-built plans are not available for the route, and a hydraulic analysis will be required to determine which option is more feasible.

- **Concepts E1 and E2:** KY 2207 (Southfork Road) between MP 3.0 and MP 4.0 – This portion of the route includes four horizontal curves and has a Critical Crash Rate Factor (CRF) of 3.0. Of the 20 reported crashes over the past three years, 14 were wet-weather related. A short-term option includes the application of a high-friction pavement surface. A long-term improvement is the reconstruction of KY 2207 to improve the horizontal and vertical alignment.

- **Concepts F1 and F2:** KY 90 between US 68 and US 31E – This section of KY 90 is commercial in character. It is predominately an undivided four-lane section that carries about 13,000 vehicles per day and has a CRF of 1.2. The lack of left-turn lanes affects traffic operations and safety. With future traffic projected to be about 19,000 VPD by 2040, one through lane in each direction should be capable of accommodating travel demand; that assumes the turn lanes already in place at US 68 and US 31E remain in place. Therefore, the short-term project (F1) includes a road diet to restripe the roadway as three lanes, with one travel lane per direction and a continuous center left-turn lane. Should future demand warrant the need for more lanes, a long-term project (F2) includes widening the corridor to a five-lane section. Project B could also be included with projects F1 and F2.

- **Concepts G1 and G2:** Downtown Square – The Downtown Square in Glasgow is the confluence of KY 90, US 68 Business, and US 31EX. Lined with on-street parking, traffic passing through the square follows a circular traffic pattern as each facility enters as a

two-way street and traverses the square one-way. The traffic volumes on the one-way segments range from 7,200 to 8,200 VPD. One issue is the location of four mid-block crosswalks on the one-way segments. Another issue is the volume of traffic traversing the square and the merging/weaving movements required. Traffic often backs up well beyond the intersections adjacent to the square, particularly along KY 90 (Main Street). A short-term project (G1) would relocate the mid-block crosswalks to the four corners of the square which are currently stop-controlled or signalized. A long-term solution (G2) would convert Main Street and Washington Street to a one-way couplet to better facilitate travel through the square.

- **Concepts H1 and H2:** KY 63 south of the Louie B. Nunn Cumberland Parkway – Between milepoints 12.4 and 13.0, KY 63 suffers from a combination of poor horizontal and vertical alignment. This section carries about 2,400 VPD and there have been 11 crashes reported in the last three years (CRF = 1.1), 10 of which were single vehicle. Of the 10 single vehicle crashes, eight occurred during wet weather. A short-term option (H1) includes the application of a high-friction pavement surface. A long-term improvement (H2) includes the reconstruction of KY 63 to improve the horizontal and vertical alignment. However, this would not result in a significant reduction in the grade.

- **Concept I:** KY 1297 between KY 3600 and Donnelly Drive – This section of KY 1297 carries about 3,700 VPD and the volume is not expected to increase significantly. The existing earth shoulder is generally one to two feet wide. Of the 12 reported crashes over the last three years, 10 were single vehicle and most involved a roadway departure. A long-term improvement would be a minor widening to include wider lanes and shoulders.

- **Concept J:** US 31E between US 68 and KY 90 – This portion of US 31E carries about 17,800 VPD and has a CRF of 2.4. Traffic is expected to increase to about 23,000 VPD by 2040. Smith Road serves as a frontage road along the east side of US 31E but is located too close (about 75 feet) to provide effective spacing to serve both US 31E and frontage road traffic. Wall Street is currently a backage road connecting Happy Valley Road and many of the businesses along Cherry Street. A long-term improvement concept would construct a raised median along US 31E, eliminating non-signalized left-turn movements from the busy corridor. Smith Road would be eliminated and Wall Street would instead be extended to serve as a backage road for all the businesses fronting US 31E.

- **Concept K:** KY 249 between the Louie B. Nunn Cumberland Parkway overpass and Trojan Trail – Carrying about 3,000 VPD, KY 249 suffers from a combination of poor horizontal and vertical alignment in this area. As a result, the intersection with Hilltopper Way is in an area with less than desirable sight distance. North of Hilltopper Way, the alignment includes S-curves and downgrades towards the bridge over the South Fork, just south of Trojan Trail. The KYTC has plans to replace the bridge, and the current plan is to replace and widen the bridge on its current alignment. A long-term improvement is the realignment of KY 249, both horizontally and vertically, to connect to the proposed bridge improvement.

- **Concept L:** KY 90 north of the Louie B. Nunn Cumberland Parkway – South and through the parkway interchange, is a four-lane facility. It transitions to a two-lane roadway north of the interchange, carrying about 14,000 VPD. A shopping center is located about 1,200 feet north of the interchange, and access to the shopping center and nearby businesses is poorly defined. There were 12 reported crashes in the vicinity over the last three years. A long-term solution would widen KY 90 to a three-lane section between the interchange and north of the shopping center and to implement access management improvements to better define the business access.

- **Concept M:** KY 63 at College Street and Mill Street – Entering Downtown Glasgow, KY 63 includes two 90-degree curves. Carrying between 1,800 and 2,400 VPD, the curves have advisory speeds posted as 15 miles per hour (MPH) but the speed limit is 35 MPH. A long-term project would realign KY 63 to the north to connect directly into the College Street corridor, eliminating the 90-degree curves.

- **Concept N:** KY 3600 Extension – In order to provide an alternative connection from the Louie B. Nunn Cumberland Parkway to US 31E, and consequently an alternative north-south route passing over the parkway, a southern extension of KY 3600 would be constructed as a long-term concept to provide a connection to US 31E. The project could be phased, with KY 2207 providing a logical breakpoint for a first construction segment. This would effectively serve as a southwestern portion of the Veterans Outer Loop.

- **Concept O:** Southern Beltway – There are no state-maintained east-west connections south of the Louie B. Nunn Cumberland Parkway between US 31E and KY 90. As a long-term concept, a new route would be constructed to provide that connection.

- **Concept P:** KY 249 north of Trojan Trail – The City of Glasgow is currently pursuing two Local Public Agency (LPA) projects to construct shared-use facilities along Trojan Trail and east of KY 249. Once constructed, these facilities would not be connected to one another. A local project would construct a shared-use facility along KY 249 to connect the two amenities currently under development.

- **Concept Q:** Scottie Drive – Scottie Drive is a city street that carries about 2,900 vehicles per day. It serves several neighborhoods as well as the Glasgow City Schools campus, located near the south end of the route near US 68 Business. At the Advisory Committee meeting, Scottie Drive was mentioned as a potential high-growth corridor as land remains available for residential development. A local project would widen Scottie Drive to a three-lane section to better accommodate access as the corridor grows.

- **Concept R:** KY 249 to KY 63 Connector – East-west travel alternatives are limited in the southeast area of Glasgow. There has been some suggestion that a fifth interchange with the Louie B. Nunn Cumberland Parkway would be desirable to increase access to the area. However, the spacing of the existing interchanges would not accommodate a

new interchange that meets FHWA requirements. As an alternative, a long-term concept would construct a new east-west connector between KY 249 and KY 63, ideally connecting Hilltopper Way to Lenna Drive. This connector would provide access at the west end to the US 31E interchange (via Hilltopper Way and Trojan Trail) and at the west end to the KY 90 interchange (via Lenna Drive).

7.0 ADVISORY COMMITTEE MEETING #2

A second Advisory Committee meeting was held on May 26, 2016. At the meeting, 23 improvement concepts were presented and discussed. The Advisory Committee members were asked to indicate their level of support for each conceptual improvement by rating them with colored stickers. Each member was given six green stickers, six yellow stickers, and six red stickers. Green stickers indicated attendee's first list of priorities (10 points), yellow stickers indicated attendee's second list of priorities (6 points), and red stickers indicated attendee's third list of priorities (2 points). Committee members were also given two black stickers. Black stickers indicated strong disapproval of a concept (-10 points). **Figures 25** and **26** show the stickers placed on each of the conceptual improvement alternatives and the concepts ranked from highest priority to lowest priority based on the results from the sticker exercise. Summaries for all project meetings are found in **Appendix D**.

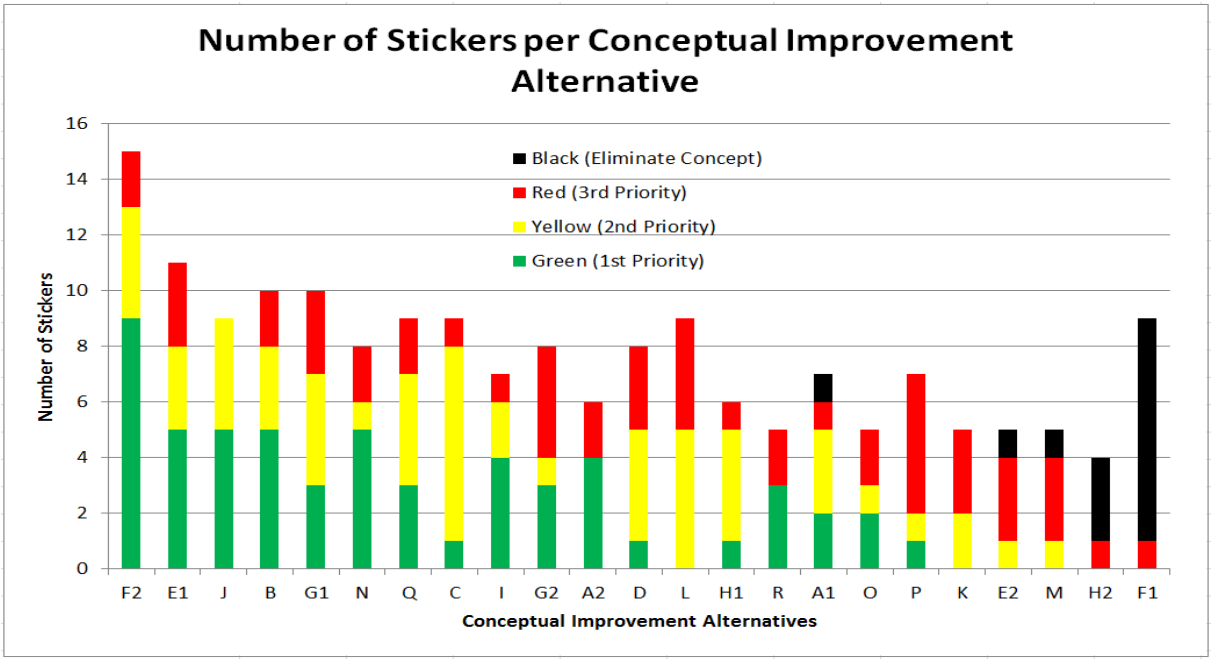


Figure 25: Stickers Received for Each Conceptual Improvement Alternative

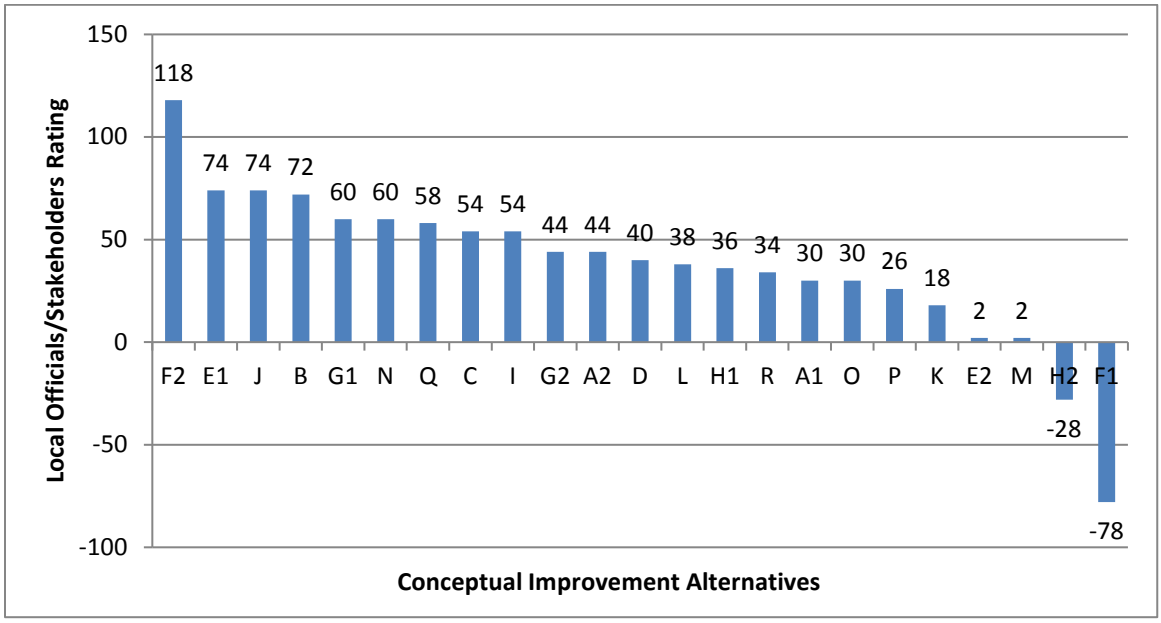


Figure 26: Ranking of Conceptual Improvement Alternatives

8.0 RECOMMENDATIONS

The Glasgow Small Urban Area Study resulted in a number of conceptual improvement alternatives recommended for future implementation. These improvement concepts focus on areas with existing safety concerns, congestion, and other transportation deficiencies identified by the Project Team and Advisory Committee. The nature and likely causes of problems identified over the course of the study were examined through field reconnaissance, and improvement alternatives were developed to address the identified problems. The project team developed 23 conceptual improvement projects, as shown in **Table 3**, based upon input from the Advisory Committee.

Cost estimates were prepared for each improvement concept and are shown in **Table 3** and in the project sheets at the end of this report. KYTC District 3 assisted in this effort by providing right-of-way and utility cost estimates.

During the development of the study recommendations, the project team decided to combine Projects F1, F2, and B and consider them together in the design phase. During that phase, a traffic study should be conducted to determine the appropriate number of lanes for KY 90. As a result, Project F1 (road diet to restripe KY 90 as three lanes) and Project F2 (widening the corridor to a five-lane section) will both be considered. Project B, improvement of the intersection of KY 90 and US 68 near Walmart, would likely not move forward as a standalone project and should be considered alongside the corridor-wide improvements to KY 90. The combination of these projects is ranked as a high priority.

ID	Route	Improvement Type	2016 Cost Estimates					Priority
			Design	Right-of-Way	Utility Relocation	Construction	Total Cost	
A1	US 31E	Interchange Improvement	$90,000	$0	$0	$450,000	$540,000	Medium
A2	US 31E	Interchange Reconstruction	$1,800,000	$100,000	$1,000,000	$18,000,000	$20,900,000	Medium
B	KY 90	Intersection Improvement	$100,000	$0	$50,000	$500,000	$650,000	High
C	US 31EX	Intersection Improvement	$10,000	$0	$0	$50,000	$60,000	High
D	KY 63	Maintenance and Drainage Improvements	$20,000	$50,000	$50,000	$100,000	$220,000	Medium
E1	KY 2207	High-Friction Treatment	$50,000	$0	$0	$350,000	$400,000	High
E2	KY 2207	Reconstruction to Improve Curves	$300,000	$750,000	$1,000,000	$3,000,000	$5,050,000	Low
F1	KY 90	Road Diet	$80,000	$0	$0	$750,000	$830,000	High
F2	KY 90	Widening	$400,000	$3,000,000	$2,500,000	$4,200,000	$10,100,000	High
G1	Downtown Square	Intersection and Pedestrian Crossing Improvements	$30,000	$0	$0	$150,000	$180,000	High
G2	Downtown Square	One-way Conversion	$300,000	$250,000	$150,000	$3,000,000	$3,700,000	Medium
H1	KY 63	High-Friction Treatment	$50,000	$0	$0	$225,000	$275,000	High
H2	KY 63	Realignment	$200,000	$400,000	$400,000	$1,750,000	$2,750,000	High
I	KY 1297	Widening	$300,000	$900,000	$1,200,000	$3,500,000	$5,900,000	Medium
J	US 31E	Access Management	$500,000	$2,000,000	$750,000	$3,500,000	$6,750,000	High
K	KY 249	Realignment	$300,000	$750,000	$400,000	$3,200,000	$4,650,000	Low
L	KY 90	Minor Widening/ Access Management	$300,000	$500,000	$750,000	$2,500,000	$4,050,000	Low
M	KY 63	Realignment	$300,000	$2,500,000	$1,750,000	$3,100,000	$7,650,000	Low
N	KY 3600 extension	New Route	$1,000,000	$3,000,000	$1,500,000	$9,600,000	$15,100,000	Medium
O	Southern Beltway	New Route	$1,100,000	$3,500,000	$1,500,000	$10,400,000	$16,500,000	Low
P	KY 249	Multimodal	$80,000	$400,000	$750,000	$500,000	$1,730,000	Low
Q	Scottie Drive	Minor Widening	$200,000	$750,000	$1,000,000	$1,600,000	$3,550,000	High
R	KY 249 to KY 63	New Route	$200,000	$500,000	$300,000	$1,300,000	$2,300,000	Medium

Table 3: Conceptual Improvement Concepts and 2016 Cost Estimates

Project A has a short-term (A1) and long-term (A2) solution. Project A1, the reconstruction of the interchange of the Louie B. Nunn Cumberland Parkway and US 31E, reconfigures the interchange to a new type (such as a single point urban interchange) to increase spacing between traffic signals. Project A2, interchange improvement, includes the signalization of the ramp terminal intersection and widening US 31E under the parkway bridge to accommodate additional turn lane storage. The project team recommended that both solutions be considered together in the design phase. The combination of these projects is ranked as a medium priority.

Project H2 was the realignment of KY 63 to eliminate the curves. The Advisory Committee was concerned that straightening this section would encourage faster speeds throughout the remaining curves along KY 63, creating a less than desirable situation. To address the concerns of the Advisory Committee, the project could improve the curves to meet a 45 mph design speed rather than reconstructing the alignment for a higher design speed. The project team ultimately recommended changing the project description to "reconstruction of KY 63 to improve the horizontal and vertical alignment" rather than "realign KY 63 to eliminate curves." As a result, the project is ranked as a high priority.

The Kentucky Transportation Center (KTC) created a statewide ranking of the most cost effective locations needing high friction pavement surface treatment. Based on these rankings, Projects E1 and H1 are unlikely to receive funding through the Highway Safety Improvement Program (HSIP). The project team recommends that separate funding be pursued and that both projects be rated as a high priority.

Although Project N, a new route connecting the LBN Parkway interchange at KY 3600 to US 31E, received the 5th highest ranking by the Advisory Committee, it was ranked as medium priority rather than high priority. Projected traffic volumes do not fully support the need for a new route in this area.

At the second Advisory Committee Meeting, attendees raised concerns that the extension of Wall Street as a part of Project J would not be possible due to limited space between Holiday Inn Express and O'Reilly Auto Parts. After further investigation, the extension appears feasible with minor disturbance of the Holiday Inn parking lot.

Factoring in input from the Advisory Committee, the project team prioritized the conceptual improvements as high, medium, or low. Along with short- and long-term projects, local improvements were also prioritized. **Tables 4**, ***5***, **6**, and **7** present the improvement concepts based on this prioritization. **Figures 27**, **28**, and **29** present maps of the improvement concept locations.

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
F1, F2 and B	KY 90	US 68 (Veterans Outer Loop) to US 31E	1.3 Miles	Short-Term	Road Diet to convert the existing undivided four-lane section to a three-lane section (two travel lanes with a continuous center left-turn lane)	$830,000	High
				Long-Term	Corridor widening to provide a five-lane section and multimodal accommodations	$10,100,000	
		Near Walmart / US 68 (Veterans Outer Loop)	0.25 Miles	Short-Term	Intersection improvement to relocate the signalized entrance to Walmart at Max Wagoner Road	$650,000	
E1	KY 2207	Sugar Hill Dr. to Autumn Ridge Rd.	1.0 Miles	Short-Term	Application of high-friction pavement surface to minimize effects of wet weather, single vehicle crashes	$400,000	High
J	US 31E	US 68 to KY 90	0.6 Miles	Long-Term	Provide Access Management by constructing a raised median along US 31E, close portions of Smith Road (frontage road), and extend Wall Street	$6,750,000	High
G1	Downtown Square	Downtown	N/A	Short-Term	Intersection and pedestrian crossing improvements to eliminate the mid-block pedestrian crossings and reduce vehicular weaving conflicts	$180,000	High
C	US 31EX	Happy Valley Road	N/A	Short-Term	Intersection improvement to provide a left-turn lane from northbound US 31EX to Happy Valley Road	$60,000	High
H1	KY 63	South of LBN Cumberland Parkway	0.6 Miles	Short-Term	Application of high-friction pavement surface to minimize effects of wet weather, single vehicle crashes	$275,000	High
H2	KY 63	South of LBN Cumberland Parkway	0.6 Miles	Long-Term	Reconstruction of KY 63 to improve the horizontal and vertical alignment.	$2,750,000	High

Table 4: Recommended High Priority Projects

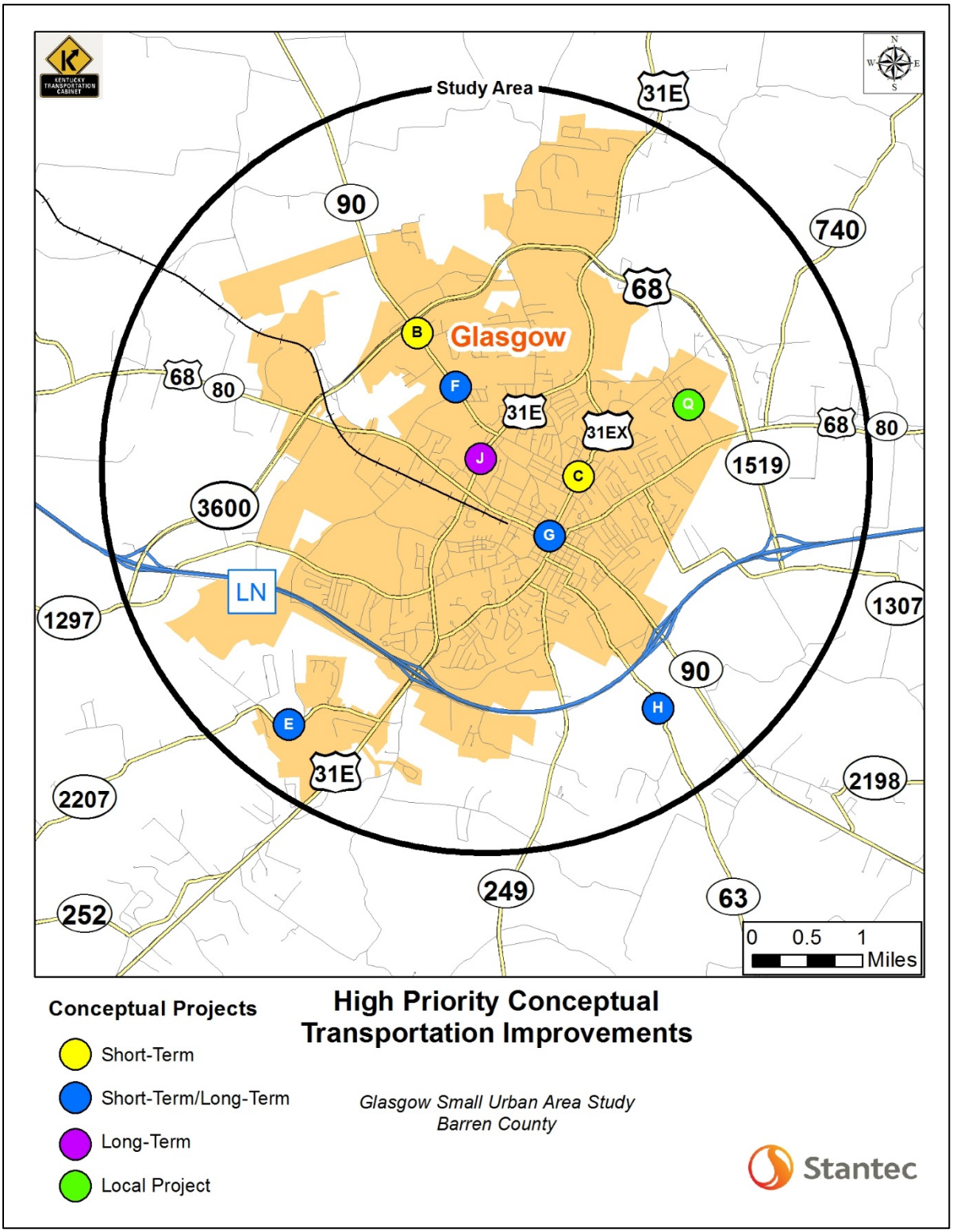


Figure 27: High Priority Conceptual Improvements

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
N	KY 3600 extension	KY 1297 to US 31E	2.7 Miles	Long-Term	New route to connect the LBN Cumberland Parkway interchange at KY 3600 to US 31E	$15,100,000	Medium
I	KY 1297	KY 3600 to Donnelly Drive	1.5 Miles	Long-Term	Minor widening to include wider lanes and shoulders	$5,900,000	Medium
G2	Downtown Square	Downtown	N/A	Long-Term	One-Way Conversion of Main Street and Washington Street, including intersection improvements within the Downtown Square	$3,700,000	Medium
A1 and A2	US 31E	LBN Cumberland Parkway Interchange	0.4 Miles	Short-Term	Interchange improvement to include signalization of the westbound exit ramp	$540,000	Medium
				Long-Term	Interchange Reconstruction	$20,900,000	
D	KY 63	South Fork Creek to Temple Trace	0.2 Miles	Short-Term	Maintenance and drainage improvements	$220,000	Medium

Table 5: Recommended Medium Priority Projects

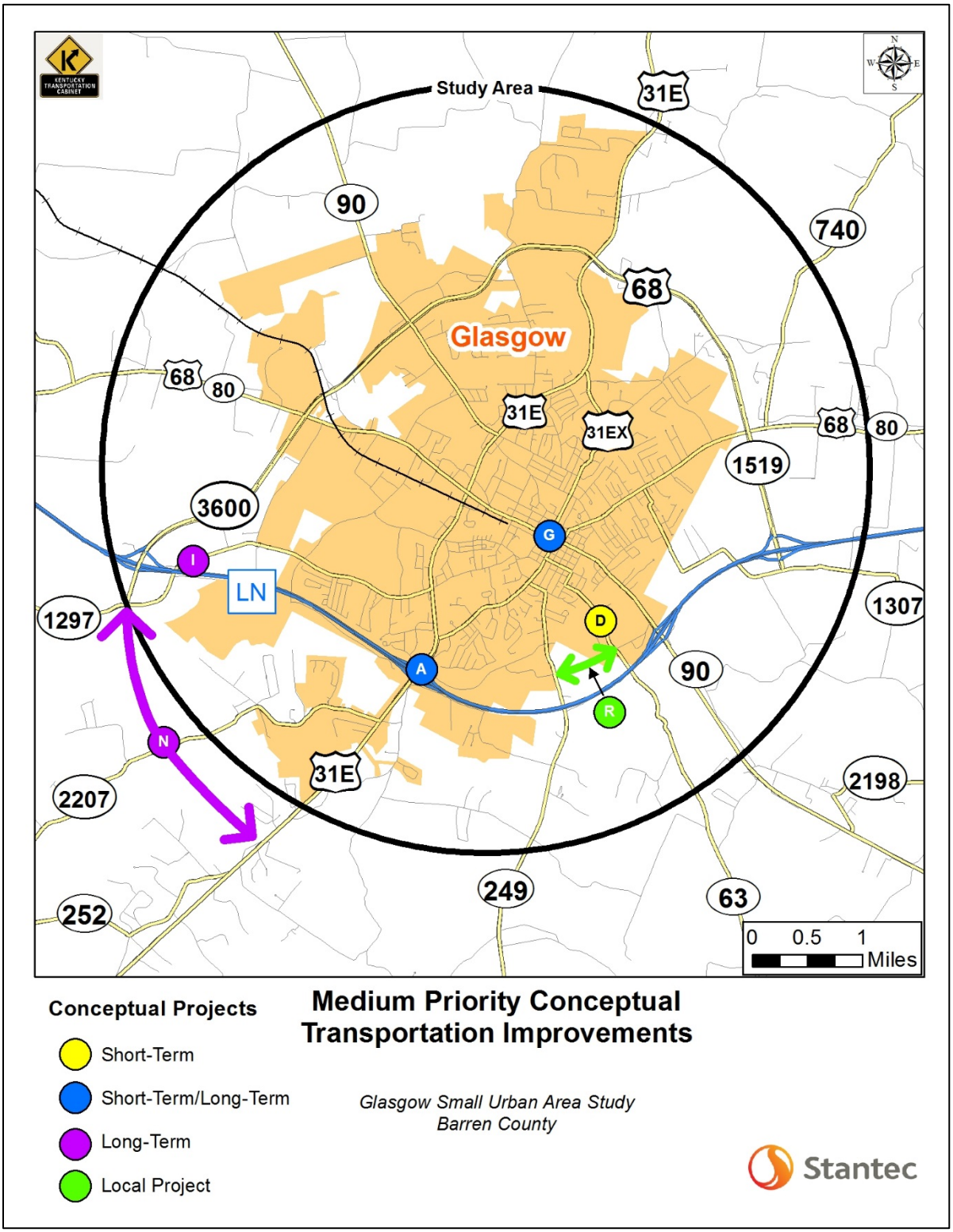


Figure 28: Medium Priority Conceptual Improvements

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
L	KY 90	North of LBN Cumberland Parkway	0.4 Miles	Long-Term	Minor widening to provide a three-lane section and Access Management	$4,050,000	Low
O	Southern Beltway	US 31E to KY 90	3.3 Miles	Long-Term	New route to connect US 31E to KY 90 south of the LBN Cumberland Parkway	$16,500,000	Low
K	KY 249	LBN Cumberland Parkway Overpass to Trojan Trail	0.6 Miles	Long-Term	Realignment to address curvature issues from north of the LBN Cumberland Parkway to the proposed bridge replacement over South Fork	$4,650,000	Low
E2	KY 2207	Sugar Hill Dr. to Autumn Ridge Rd.	1.0 Miles	Long-Term	Reconstruction of KY 2207 to improve the horizontal and vertical alignment.	$5,050,000	Low
M	KY 63	S Franklin / E College Street	0.3 Miles	Long-Term	Realignment from near South Fork bridge to College Street	$7,650,000	Low

Table 6: Low Priority Improvement Concepts

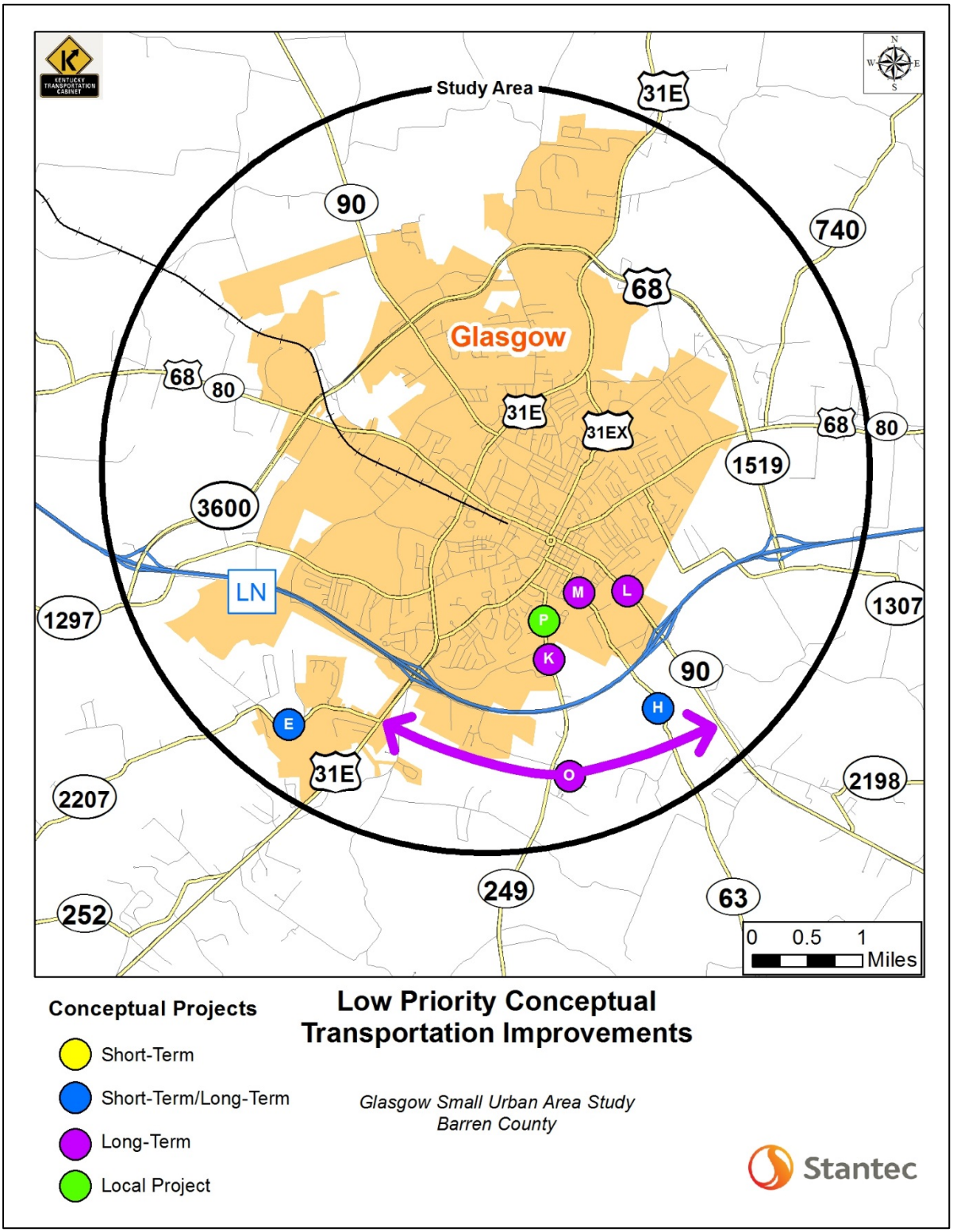


Figure 29: Low Priority Conceptual Improvements

ID	Route	Location	Length	Short-Term or Long-Term	Improvement Type	2016 Cost Estimate (All Phases)	Priority
Q	Scottie Drive	US 68 Business to Glenview Drive	0.7 Miles	Local Project	Minor widening to provide a three-lane section	$3,550,000	High
R	KY 249 to KY 63 Connector	North of the LBN Cumberland Parkway	0.6 Miles	Local Project	New route to connect KY 249 to KY 63 north of the LBN Cumberland Parkway	$2,300,000	Medium
P	KY 249	Trojan Trail to Twyman Park	0.5 Miles	Local Project	Multimodal improvement to provide a shared-use path connection	$1,730,000	Low

Table 7: Recommended Local Projects

A1&A2 **Short-Term/ Long-Term**	**LOCATION** US 31E Interchange at LBN Cumberland Parkway (KY 9008)	**PROJECT PRIORITY:** Medium	
DESCRIPTION A1 – Interchange improvement to include signalization of the westbound exit ramp. A2 – Interchange Reconstruction. (MP 12.2 – MP 12.6)		**A1 COST ESTIMATE** Design: $90,000 ROW: $0 Utilities: $0 Construction: $450,000 **Total: $540,000**	**A2 COST ESTIMATE** Design: $1,800,000 ROW: $100,000 Utilities: $1,000,000 Construction: $18,000,000 **Total: $20,900,000**

This section of US 31E carries about 22,000 vehicles per day (VPD) and the volume is expected to increase. The issue is the proximity of the unsignalized westbound ramp terminal to the signalized intersection with Trojan Trail. Adding additional congestion, this signalized intersection will become 4-legged under the proposed Cavalry Drive Project (KYTC Item No. 3-8705.00), which connects Cavalry Drive to Trojan Trail. Shift changes at nearby employers in IDEA Park coincide with the end of the school day (approximately 3 p.m.) causing congestion at the interchange.

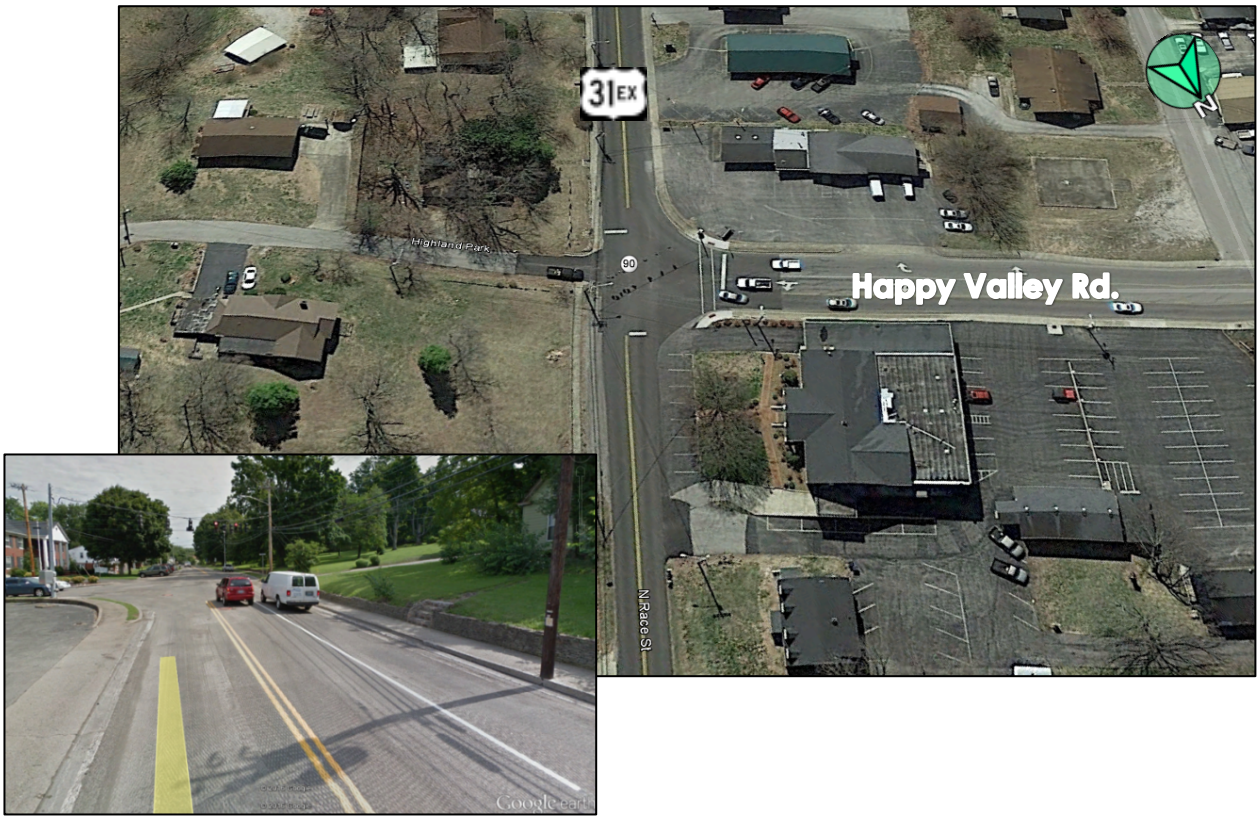
The proposed short-term improvements (A1) include signalizing the ramp terminal intersection and widening US 31E under the parkway bridge to accommodate additional turn lane storage. New traffic volumes will need to be collected and a signal warrant analysis will need to be completed before a recommendation is made on traffic control for the intersection.

During the second meeting, the advisory committee suggested a long-term project to reconfigure the interchange to a new type (such as single point urban interchange) to increase spacing between traffic signals. Therefore, Concept A2 was added as a long-term solution at the interchange. It should be noted that an interchange reconfiguration would require replacement of the Cumberland Parkway bridge as well as the bridges on the eastern ramps. **It is recommended that Projects A1 and A2 be combined and considered together in the design phase.**

C **Short-term**	**LOCATION** US 31EX at Happy Valley Road	**PROJECT PRIORITY:** High
DESCRIPTION Intersection improvement to provide a left-turn lane from northbound US 31EX to Happy Valley Road. (MP 2.1)		**COST ESTIMATE** Design: $10,000 ROW: $0 Utilities: $0 Construction: $50,000 **Total: $60,000**

The traffic signal located at the intersection at US 31EX (Race Street) and Happy Valley Road is a diagonal span. There are currently no turn lanes on US 31EX, and based on observation it appears that a northbound left-turn lane from US 31EX onto Happy Valley Road may be warranted. A left-turn lane was provided at this location previously.

The proposed improvement would provide a left-turn lane on US 31EX and replace the diagonal span traffic signal with a conventional span wire arrangement.



Previous Left Turn Marking (2013)

D **Short-term**	**LOCATION** KY 63 from South Fork Creek to Temple Trace	**PROJECT PRIORITY:** Medium
DESCRIPTION Maintenance and drainage improvements. (MP 13.75 – MP 13.95)		**COST ESTIMATE** Design: $20,000 ROW: $50,000 Utilities: $50,000 Construction: $100,000 **Total: $220,000**

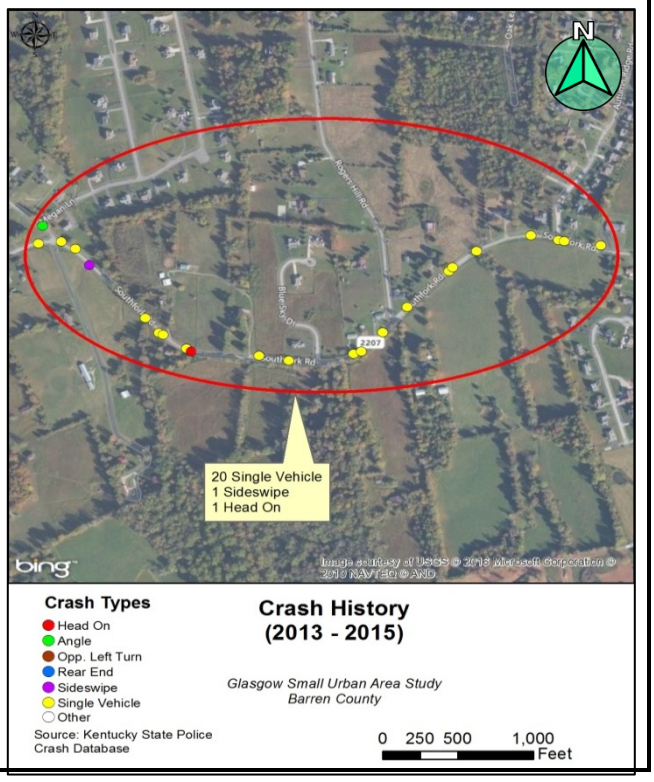
The western ditch along KY 63 north of Temple Trace has suffered from severe erosion/washing, and there is no shoulder in the area because of the erosion. KYTC maintenance has attempted to minimize the erosion by placing channel lining in the ditch. The ditch connects to a tributary of South Fork that passes beneath the roadway north of Temple Trace. During a site visit, it was noted the culvert beneath the roadway was nearly full of water even though there had been no recent heavy rainfall event. The water did not appear to be moving.

A short-term project includes improvements to better control the drainage issues. This includes a combination of ditching to clean the existing channel and culvert, or to either lower/increase the ditch area or to increase the size of the culvert beneath the roadway. The latter would require increasing the elevation on KY 63. As-built plans are not available for the route, and a hydraulic analysis will be required to determine which option is more feasible.

E1 **Short-term**	**LOCATION** KY 2207 from Sugar Hill Dr. to Autumn Ridge Rd.	**PROJECT PRIORITY:** High
DESCRIPTION Application of high-friction pavement surface to minimize occurrence of wet weather, single vehicle crashes. (MP 3.0 – MP 4.0)		**COST ESTIMATE** Design: $50,000 ROW: $0 Utilities: $0 Construction: $350,000 **Total: $400,000**

KY 2207 (Southfork Road) between Sugar Hill Dr. and Autumn Ridge Rd. includes four horizontal curves and has a CRF of 3.0. Of the 20 reported single vehicle crashes over the past three years, 14 were wet-weather related. The application of a high-friction pavement surface treatment can restore pavement friction and counteract polishing of the roadway due to braking around the curves.

Using a Safety Performance Function modified by the Empirical Bayes method, the Kentucky Transportation Center (KTC) performs a high friction surface analysis on locations with high numbers of wet-weather crashes. Based on the findings of this research, KY 2207 (MP 3.0 - MP 3.838) has an average statewide rank of 8,117 with an average potential savings of $10,428. It is unlikely that funding will be available from the Highway Safety Improvement Program (HSIP), and the project team recommends that separate funding be pursued through KYTC's annual resurfacing program.



E2 **Long-Term**	**LOCATION** KY 2207 from Sugar Hill Dr. to Autumn Ridge Rd.	**PROJECT PRIORITY:** Low
DESCRIPTION Reconstruction of KY 2207 to improve the horizontal and vertical alignment. (MP 3.0 – MP 4.0)		**COST ESTIMATE** Design: $300,000 ROW: $750,000 Utilities: $1,000,000 Construction: $3,000,000 **Total: $5,050,000**

KY 2207 (Southfork Road), between Sugar Hill Dr. and Autumn Ridge Rd., includes four horizontal curves and has a CRF of 3.0. Of the 20 reported single vehicle crashes over the past three years, 14 were wet-weather related.

Reconstruction of KY 2207 to improve the horizontal and vertical alignment would require a higher level of right-of-way acquisitions than Project E1 but would provide a more permanent, long-term solution. Project E1 is a high priority project to apply a high friction pavement surface on this segment. If the surface treatment is found to significantly reduce the crash frequency, Project E2 may not be necessary and was therefore determined to be a low priority.

F1, F2 & B **Short-Term/ Long-Term**	**LOCATION** KY 90 from US 68 (Veterans Outer Loop) to US 31E	**PROJECT PRIORITY:** High	
DESCRIPTION F1 – Road diet to convert the existing undivided four-lane section to a three-lane section (two travel lanes with a continuous center left-turn lane). F2 – Corridor widening to provide a five-lane section and multimodal accommodations. B – Intersection improvement to relocate the signalized entrance to Walmart at Max Wagoner Road. (MP 8.6 – MP 9.9)		**F1 COST ESTIMATE** Design: $80,000 ROW: $0 Utilities: $0 Construction: $750,000 **Total: $830,000**	**F2 COST ESTIMATE** Design: $400,000 ROW: $3,000,000 Utilities: $2,500,000 Construction: $4,200,000 **Total: $10,100,000**
		B COST ESTIMATE Design: $100,000 ROW: $0 Utilities: $50,000 Construction: $500,000 **Total: $650,000**	

KY 90 between US 68 and US 31E is commercial in character. It is predominately an undivided four-lane section that carries about 13,000 vehicles per day and has a CRF of 1.2. The lack of left-turn lanes affects traffic operations and safety. With future traffic projected to be about 19,000 VPD by 2040, one through lane in each direction should be capable of accommodating travel demand; that assumes the turn lanes already in place at US 68 and US 31E remain in place. Congestion has increased since the Police Department has recently moved into the area, directly across from Big Lots.

A short-term project (F1) would include restriping the roadway as three lanes, with one travel lane per direction and a continuous center left-turn lane. A more thorough traffic analysis will need to be completed before moving forward.

Should future demand warrant the need for more lanes, a long-term project (F2) would include widening the corridor to a five-lane typical section. This widening concept was preferred by the Advisory Committee over the road diet.

Project B would relocate the signalized intersection south away from the US 68 intersection. A short-term project would add signal ahead warning signage on KY 90 south of the signal at Max Wagoner Road and put reflector back plates on the signal heads.

It is recommended that Projects F1, F2, and B be combined and considered together in the design phase.

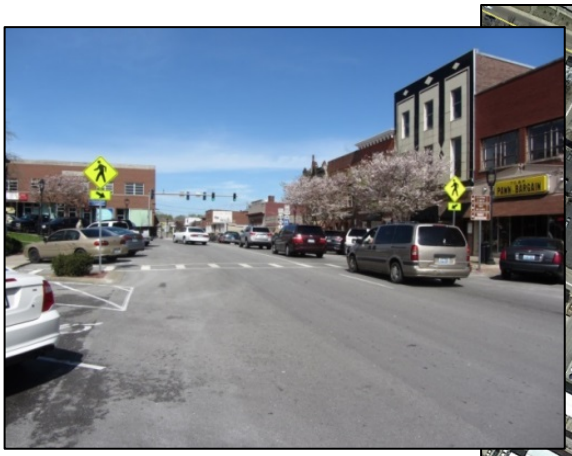

N
68
90
31E
68


N
68
Walmart
Max Wagner Dr
Long Hunters Trl
Relocate Entrance and Signal
90

G1 Short-term	**LOCATION** Downtown Square	**PROJECT PRIORITY:** High
DESCRIPTION Intersection and pedestrian crossing improvements to eliminate the mid-block pedestrian crossings and reduce vehicular weaving conflicts.		**COST ESTIMATE** Design: $30,000 ROW: $0 Utilities: $0 Construction: $150,000 **Total: $180,000**

The Downtown Square in Glasgow is the confluence of KY 90, US 68 Business, and US 31EX. Lined with on-street parking, traffic passing through the square follows a circular traffic pattern as each facility enters as a two-way street and traverses the square one-way. The traffic volumes on the one-way segments range from 7,200 to 8,200 VPD. One issue is the location of four mid-block crosswalks on the one-way segments. Another issue is the volume of traffic traversing the square and the merging/weaving movements required. Traffic often backs up well beyond the intersections adjacent to the square, particularly along KY 90 (Main Street). It was suggested that eliminating some on-street parking may be feasible to facilitate additional lanes and improved traffic flow.

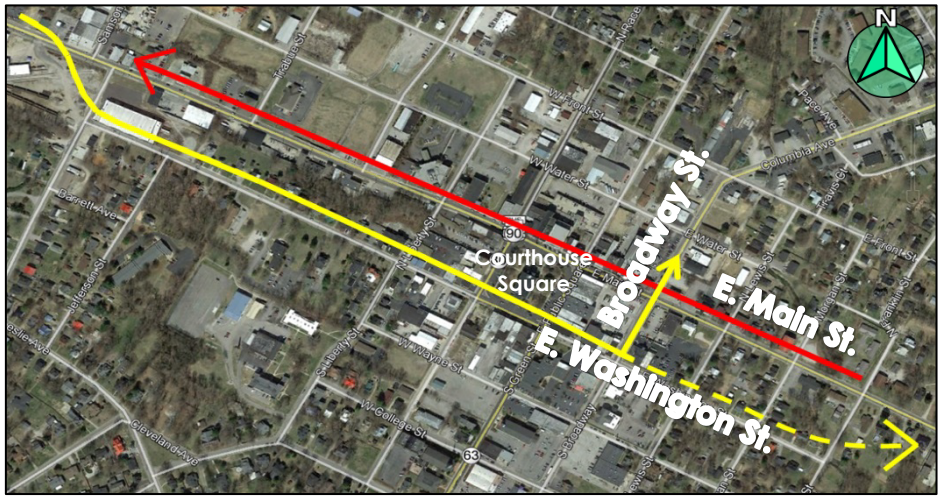
A short-term project would relocate the mid-block crosswalks to the four corners of the square which are currently stop-controlled or signalized. To minimize merging and weaving issues, the channelized left-turn movements at the intersections should be evaluated to determine if stop or traffic signal control is warranted.



G2 Long-Term	**LOCATION** Downtown Square	**PROJECT PRIORITY:** Medium
DESCRIPTION One-way conversion of Main street and Washington street, including intersection improvements within the Downtown Square.		**COST ESTIMATE** Design: $300,000 ROW: $250,000 Utilities: $150,000 Construction: $3,000,000 **Total: $3,700,000**

The Downtown Square in Glasgow is the confluence of KY 90, US 68 Business, and US 31EX. Lined with on-street parking, traffic passing through the square follows a circular traffic pattern as each facility enters as a two-way street and traverses the square one-way. The traffic volumes on the one-way segments range from 7,200 to 8,200 VPD. One issue is the location of four mid-block crosswalks on the one-way segments. Another issue is the volume of traffic traversing the square and the merging/weaving movements required. Traffic often backs up well beyond the intersections adjacent to the square, particularly along KY 90 (Main Street). It was suggested that eliminating some on-street parking may be feasible to facilitate additional lanes and improved traffic flow.

A long-term solution would be to convert Main Street and Washington Street to a one-way couplet to better facilitate travel through the square. This concept would improve traffic flow by eliminating the need to travel around the square to remain on KY 90. It would also improve pedestrian safety by eliminating vehicular traffic on E Public Square and Court House Square. One option for this couplet would be for E Washington to use Broadway (shown below as the solid yellow line) to connect back to Main Street. A second option would extend Washington Street to the east and connect to Main Street southeast of the downtown square (shown below as the dashed yellow line). This option would require the acquisition of several houses and businesses.



H1 Short-term	**LOCATION** KY 63 south of LBN Cumberland Parkway	**PROJECT PRIORITY:** High
DESCRIPTION Application of high-friction pavement surface to minimize occurrence of wet-weather, single vehicle crashes. (MP 12.4 – MP 13.0)		**COST ESTIMATE** Design: $50,000 ROW: $0 Utilities: $0 Construction: $225,000 **Total: $275,000**

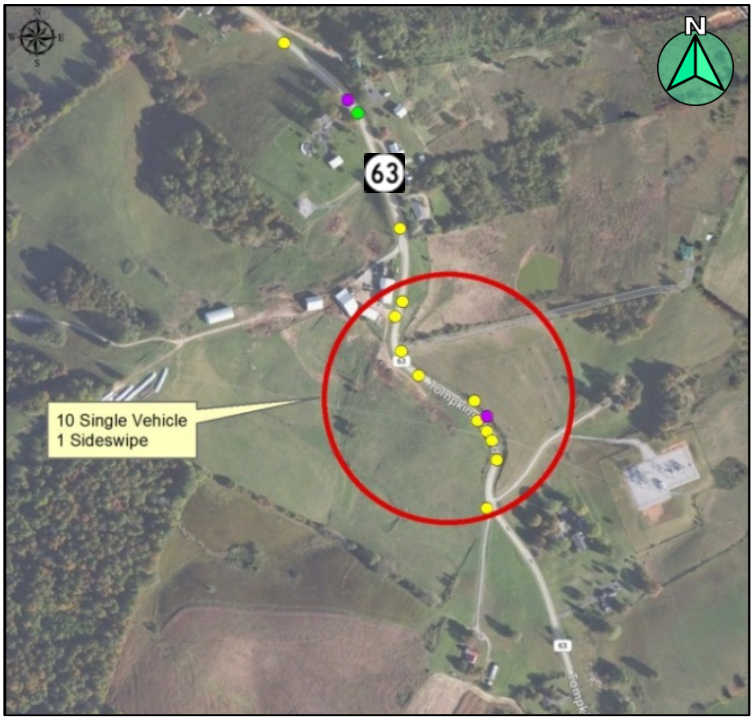
KY 63, South of the Louie B. Nunn Cumberland Parkway, suffers from a combination of poor horizontal and vertical alignment. Locally referred to as "Payne Hill", this section carries about 2,400 VPD and there have been 11 crashes reported in the last three years (CRF = 1.1). Of the 10 single vehicle crashes reported over the last three years, eight occurred during wet weather. The application of a high-friction pavement surface could improve pavement friction and enable vehicles to gain traction even in wet conditions.

Based on findings from KTC's research, KY 63 (MP 12.503- MP 12.802) has a statewide ranking of 569 with a potential savings of $175,891. Based on these rankings, it is unlikely that funding will be available from the Highway Safety Improvement Program (HSIP), and it's recommended that separate funding be pursued through KYTC's annual resurfacing program.

H2 Long-Term	**LOCATION** KY 63 south of LBN Cumberland Parkway	**PROJECT PRIORITY:** High
DESCRIPTION Reconstruction of KY 63 to improve the horizontal and vertical alignment. (MP 12.4 – MP 13.0)		**COST ESTIMATE** Design: $200,000 ROW: $400,000 Utilities: $400,000 Construction: $1,750,000 **Total: $2,750,000**

KY 63, South of the Louie B. Nunn Cumberland Parkway, suffers from a combination of poor horizontal and vertical alignment. This section carries about 2,400 VPD and there have been 11 crashes reported in the last three years (CRF = 1.1), 10 of which were single vehicle crashes. Of the 10 single vehicle crashes, eight occurred during wet weather.

A long-term improvement would include reconstructing the route to improve or increase the radii on the horizontal curves. This improvement concept would not result in a significant reduction in the grade. The Advisory Committee was concerned that straightening this section would encourage faster speeds throughout the remaining curves along KY 63, creating a dangerous situation. To address these concerns, the curves could be improved to meet a 45 mph design speed rather than reconstructing the alignment into a straight line.



I **Long-term**	**LOCATION** KY 1297 from KY 3600 to Donnelly Drive	**PROJECT PRIORITY:** Medium
DESCRIPTION Minor widening to include wider lanes and shoulders. (MP 9.6 – MP 11.1)		**COST ESTIMATE** Design: $300,000 ROW: $900,000 Utilities: $1,200,000 Construction: $3,500,000 **Total: $5,900,000**

KY 1297, between KY 3600 and Donnelly Drive, carries about 3,700 VPD and the volume is not expected to increase significantly. The existing earth shoulder is generally one to two feet wide. Of the 12 reported crashes over the last three years, 10 were single vehicle crashes and most involved a roadway departure.

A long-term improvement would be a minor widening to include wider lanes and shoulders.

J **Long-term**	**LOCATION** US 31E from US 68 to KY 90	**PROJECT PRIORITY:** High
DESCRIPTION Provide access management by constructing a raised median along US 31E, close portions of Smith Road (frontage road), and extend Wall Street. (MP 14.2 – MP 14.8)		**COST ESTIMATE** Design: $500,000 ROW: $2,000,000 Utilities: $750,000 Construction: $3,500,000 **Total: $6,750,000**

US 31E, between US68 and KY 90, carries about 17,800 VPD and has a CRF of 2.4. Traffic is expected to increase to about 23,000 VPD by 2040. Smith Road serves as a frontage road along the east side of US 31E but is located too close (about 75 feet) to provide effective intersection spacing to serve both US 31E and frontage road traffic. Wall Street is currently a backage road connecting Happy Valley Road and many of the businesses along Cherry Street.

A long-term improvement concept would construct a raised median along US 31E, eliminating non-signalized left-turn movements to/from the busy corridor. Smith Road would be largely eliminated (except where business access requires it to remain open) and Wall Street would instead be extended to serve as a backage road for all the businesses fronting US 31E.

K **Long-term**	**LOCATION** KY 249 from LBN Cumberland Parkway Overpass to Trojan Trail	**PROJECT PRIORITY:** Low
DESCRIPTION Realignment to address curvature issues from north of the LBN Cumberland Parkway to the proposed bridge replacement over South Fork. (MP 15 – MP 15.6)		**COST ESTIMATE** Design: $300,000 ROW: $750,000 Utilities: $400,000 Construction: $3,200,000 **Total: $4,650,000**

KY 249, between the Louie B. Nunn Cumberland Parkway overpass and Trojan Trail, carries about 3,000 VPD. This section suffers from a combination of poor horizontal and vertical alignment in this area. As a result, the intersection with Hilltopper Way is located in an area with less than desirable sight distance. North of Hilltopper Way, the alignment includes S-curves as it travels downgrade towards the bridge over the South Fork, just south of Trojan Trail. The KYTC has plans to replace the bridge (KYTC Item No. 3-1091.00), and the current plan is to replace and widen the bridge on its current alignment.

A long-term improvement would include the realignment of KY 249, both horizontally and vertically, to connect to the proposed bridge improvement.

L Long-term	**LOCATION** KY 90 North of LBN Cumberland Parkway	**PROJECT PRIORITY:** Low
DESCRIPTION Minor widening to provide a three-lane section and Access Management. (MP 10.6 – MP 11.0)		**COST ESTIMATE** Design: $300,000 ROW: $500,000 Utilities: $750,000 Construction: $2,500,000 **Total: $4,050,000**

South and through the Louie B. Nunn Parkway interchange, KY 90 is a four-lane facility. It transitions to a two-lane roadway north of the interchange, carrying about 14,000 VPD. A shopping center is located about 1,200 feet north of the interchange, and access to the shopping center and nearby businesses is poorly defined.

A long-term solution would be to widen KY 90 to a three-lane section between the interchange and north of the shopping center and to implement access management improvements to better define the business access.

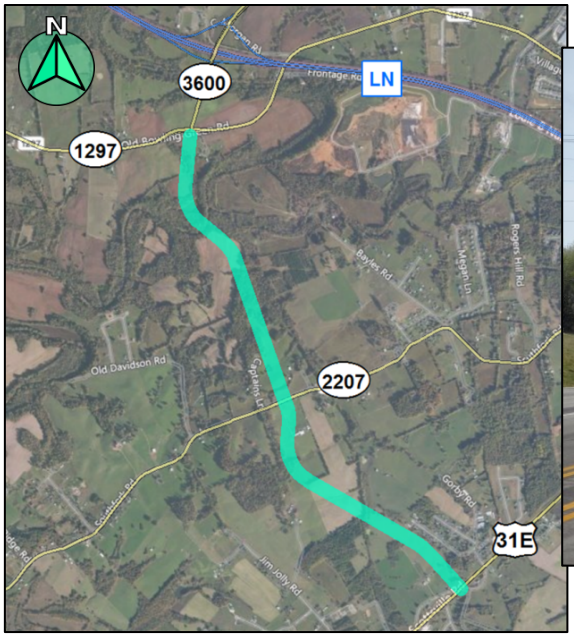
M **Long-term**	**LOCATION** KY 63 at S Franklin/ E College Street	**PROJECT PRIORITY:** Low
DESCRIPTION Realignment from near South Fork bridge to College Street. (MP 14.1 – MP 14.4)		**COST ESTIMATE** Design: $300,000 ROW: $2,500,000 Utilities: $1,750,000 Construction: $3,100,000 **Total: $7,650,000**

Entering Downtown Glasgow, KY 63 at College and Mill Streets includes two 90-degree curves. Carrying between 1,800 and 2,400 VPD, the curves have advisory speeds posted as 15 miles per hour (MPH) but the speed limit is 35 MPH.

A long-term project would realign KY 63 to the north to connect directly into the College Street corridor, eliminating the 90-degree curves. A shared-use path and a pedestrian bridge crossing the proposed corridor are proposed in the area. The location and plans for the facility will need to be confirmed prior to the concept moving forward.

N Long-term	**LOCATION** KY 3600 extension from KY 1297 to US 31E	**PROJECT PRIORITY:** Medium
DESCRIPTION New route to connect the LBN Cumberland Parkway interchange at KY 3600 to US 31E.		**COST ESTIMATE** Design: $1,000,000 ROW: $3,000,000 Utilities: $1,500,000 Construction: $9,600,000 **Total: $15,100,000**

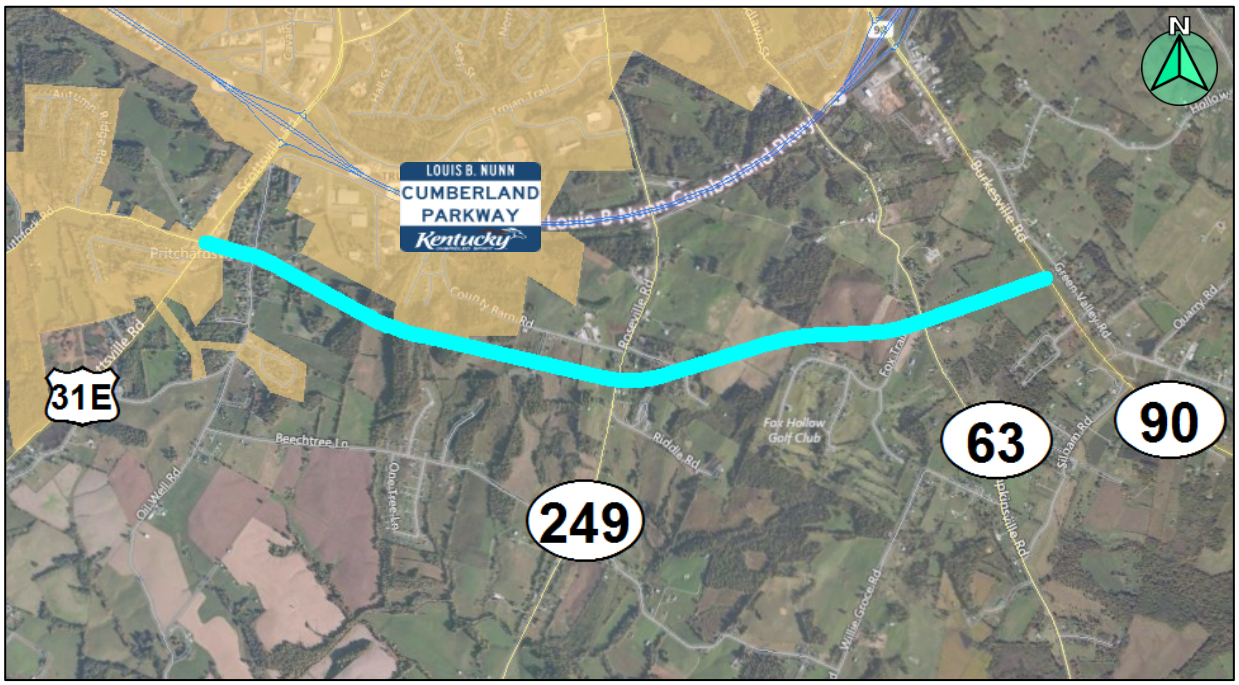
In order to provide an alternative connection from the Louie B. Nunn Cumberland Parkway to US 31E, and consequently an alternative north-south route passing over the parkway, a southern extension of KY 3600 would be constructed as a long-term concept. The project could be phased, with KY 2207 providing a logical breakpoint for a first construction segment. This would effectively serve as a southwestern portion of the Veterans Outer Loop. 2040 traffic forecasts suggest about 600 VPD may use this route.



KY 3600 intersection with KY 1297

O **Long-term**	**LOCATION** Southern Beltway from US 31E to KY 90	**PROJECT PRIORITY:** Low
DESCRIPTION New route to connect US 31E to KY 90 south of the LBN Cumberland Parkway.		**COST ESTIMATE** Design: $1,100,000 ROW: $3,500,000 Utilities: $1,500,000 Construction: $10,400,000 **Total: $16,500,000**

There are no state-maintained east-west connections between US 31E and KY 90 south of the Louie B. Nunn Cumberland Parkway. As a long-term concept, a new route would be constructed to provide that connection, provisionally called the "Southern Beltway". Much of the area within the vicinity of the proposed corridor is a certified Agriculture District and will require an Environmental Analysis. 2040 traffic forecasts suggest as many as 1,900 VPD may use portions of this route.



P Local	**LOCATION** KY 249 from Trojan Trail to Twyman Park	**PROJECT PRIORITY:** Low
DESCRIPTION Multimodal improvement to provide a shared-use path connection between Trojan Trail and Twyman Park. (MP 15.5 – 16.0)		**COST ESTIMATE** Design: $80,000 ROW: $400,000 Utilities: $750,000 Construction: $500,000 **Total: $1,730,000**

The City of Glasgow is currently pursuing two Local Public Agency (LPA) projects to construct shared-use facilities along Trojan Trail and east of KY 249 at Twyman Park. Once constructed, these facilities would not be connected to one another. A local project would construct a shared-use facility along KY 249 to connect the two amenities currently under development.

Q Local	**LOCATION** Scottie Drive from US 68 Business to Glenview Drive	**PROJECT PRIORITY:** High
DESCRIPTION Minor widening to provide a three-lane section.		**COST ESTIMATE** Design: $200,000 ROW: $750,000 Utilities: $1,000,000 Construction: $1,600,000 **Total: $3,550,000**

Scottie Drive is a city street that carries about 2,900 vehicles per day. It serves several neighborhoods as well as the Glasgow City Schools campus, located near the south end of the route near US 68 Business. At the Advisory Committee meeting, Scottie Drive was mentioned as a potential high-growth corridor as land remains available for residential development, particularly near Glenview Drive.

A local project would widen Scottie Drive to a three-lane section to better accommodate access as the corridor grows. It was noted that the area has the potential for high density residential development. The future traffic projections for the corridor (800 VPD in 2040) were generally thought to be conservatively low given the high potential for additional residential development.

R Local	**LOCATION** KY 249 to KY 63 connector north of the LBN Cumberland Parkway	**PROJECT PRIORITY:** Medium
DESCRIPTION New route to connect KY 249 to KY 63 north of the LBN Cumberland Parkway.		**COST ESTIMATE** Design: $200,000 ROW: $500,000 Utilities: $300,000 Construction: $1,300,000 **Total: $2,300,000**

East-west travel alternatives are limited in the southeast area of Glasgow. There has been some suggestion that a fifth interchange with the Louie B. Nunn Cumberland Parkway would be desirable to increase access to the area. However, the spacing of the existing interchanges would not accommodate a new interchange that meets FHWA requirements. As an alternative, a long-term concept would construct a new east-west connector between KY 249 and KY 63, ideally connecting Hilltopper Way to Lenna Drive. This connector would provide access at the west end to the US 31E interchange (via Hilltopper Way and Trojan Trail) and at the east end to the KY 90 interchange (via Lenna Drive). 2040 traffic forecasts suggest about 2,600 VPD may use this route.

9.0 NEXT STEPS

The next phase for any of the recommended projects would be Phase 1 Design (Preliminary Engineering and Environmental Analysis). Further funding will be necessary to advance an improvement to the design phase.

10.0 CONTACTS/ADDITIONAL INFORMATION

Written requests for additional information should be sent to John Moore, Director, KYTC Division of Planning, 200 Mero Street, Frankfort, KY 40622. Additional information regarding this study can also be obtained from the KYTC District 3, Deneatra Henderson, at (270) 746-7898 (email at Deneatra.Henderson@ky.gov).