

PROPOSED KIRBY PARKWAY

Memphis, Shelby County, Tennessee
Walnut Grove Road to Macon Road

SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT STATEMENT



Submitted Pursuant To 42 U.S.C. 4332(2)(c), by
U.S. Department of Transportation
Federal Highway Administration
Tennessee Department of Transportation Environmental Division

January 2012

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For Tennessee Dept of Transportation

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This document is a supplement of a segment of the Kirby Parkway project for which a Final Environmental Impact Statement was approved in 1991. This document is intended to update the environmental reevaluation of potential environmental impacts and investigate alternatives that have been developed since 2001.

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PROJECT SUMMARY

Brief Description of the Proposed Action

The city of Memphis, in conjunction with the Federal Highway Administration (FHWA) and the Tennessee Department of Transportation (TDOT), is proposing to construct the 2.5-mile Kirby Parkway from Walnut Grove Road to the intersection of Whitten and Macon Roads in Memphis, Shelby County, Tennessee. The new road design consists of a four-lane, median-divided, access-controlled highway.

The entire Kirby Parkway project study area involves a 10-mile-long north-to-south corridor in eastern Shelby County. This new travel corridor will benefit people at local, state, and regional levels by improving accessibility to nearby and remote employment opportunities, markets, and services. The new route will facilitate not only through traffic between Interstate 240 (I-240) and I-40, but it shall also serve the commuting populations of Bartlett, Germantown, and the surrounding residential areas via improved connectivity. As a result, both accident potentials and travel times in the area of impact will be reduced.

Development and Purpose of SFEIS and FEIS

Based on public comments to previous alternatives, Shelby County, the city of Memphis, and the Federal Highway Administration (FHWA) deemed it necessary to examine additional Kirby Parkway alternatives by preparing a Supplemental Final Environmental Impact Statement (SFEIS). According to 23 CFR 771.130(f), a SEIS may be required to address issues of limited scope, such as the extent of proposed mitigation or the evaluation of location and design variations for a limited portion of the overall project. The Draft Supplemental Environmental Impact Statement, signed October 17, 2007, was prepared to address changes that have occurred since the approval of both the Environmental Reevaluation (March 2001) and the Final Environmental Impact Statement (August 1991), as well as FHWA's issuance of a Record of Decision (ROD) on November 11, 1991. It was not intended to replace or reconsider the information presented in these documents as a whole, but rather to apply new knowledge about the project since FEIS approval and Reevaluation of Kirby Parkway. The purpose of the SFEIS will be to evaluate three alternatives, Q, L, and M (see Figures 2.9-2.11), of Kirby Parkway from the north intersection of Humphreys Boulevard and Walnut Grove Road through Shelby Farms to the south of I-40 ending at Macon Road. The proposed new designs include the addition of a new interchange, intersection modifications and design change from six lanes to four lanes split by a landscaped median. The new route would involve improving and connecting existing sections of Whitten Road/Kirby Parkway, ending at Macon Road.

History of Shelby Farms Advisory Team and Context Sensitive Solution (CSS)

In 2002, Governor Phil Bredesen and TDOT Commissioner Gerald Nicely requested a detailed study of 15 controversial transportation projects across the state by the University of Tennessee Center for Transportation Research. Governor Bredesen and Commissioner Nicely based their decision to target these 15 projects following comments received during the 2002 political campaign. After the review, TDOT decided to refer a proposal to relocate Walnut Grove Road in Shelby County back to local government officials for future planning in October 2003. The University of Tennessee report suggested that the city of Memphis and Shelby County, in consultation with interest groups and the general public, re-affirm support and interest in pursuing the project to completion before development occurs. It was assumed that if there was continued local government support, the appropriate local entities would work to select a preferred alternative and perform the necessary environmental, economic, and social impact studies. Due to the public nature of this project, Context Sensitive Solution

(CSS) principles were deemed critical in planning/designing phase of the Parkway. CSS is defined as “a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist.”

Community representatives formed the Shelby Farms Parkway Advisory Team in 2005. The Team, made up of 17 individuals from organizations, major employers, and community members, was assembled in order to convey expert and public opinion concerning the decision-making process regarding the Shelby Farms area. They were guided by CSS principles and were challenged to come to an agreement on alternatives and design criteria that reflected the unique characteristics of Shelby Farms and the surrounding residential and natural areas.

After six meetings and two public workshops, The Advisory Team (an inclusive list is located in Table 5.1) identified three alternatives as well as the evaluation of a no-build alternative. These alternatives were designed specifically to avoid the controversy that surrounded the Selected Alternative in the Final Environmental Impact Statement (signed in 1991). The Selected Alternative, Q, was chosen for its overall design qualities, including fewer lanes, advantages in functionality, fewer environmental impacts, improved safety, and aesthetics.

Summary of Alternatives Considered and Identification of the Selected Alternative

As a result of this comprehensive and inclusive process, the Selected Alternative, Q, modifies the previously considered Kirby Parkway alternatives. From Macon Road following Whitten Road to Mullins Station Road, the right-of-way will be 106 feet, with four 12-foot traffic lanes, a 14-foot center turn lane, 10-foot shoulders, and curb and gutter on either side of the roadway. This section also is to be constructed with five-foot sidewalks, one on either side. Mullins Station Road will be slightly modified to allow for better site distance at its intersection with Alternative Q. From Walnut Grove Road to Mullins Station Road, Kirby Parkway is to be constructed with a 220-foot right-of-way, four 12-foot traffic lanes (two in each direction), 12-foot outside shoulders (10-foot paved, two-foot grass), six-foot inside shoulders, and a variable-width, depressed median. A speed limit of 35 mph is proposed for the parkway; the road is designed for 40 mph. Additionally, the Selected Alternative includes a new grade-separated interchange with Walnut Grove Road (see Figure 2.2), approximately 1,900 feet east of the newly constructed Wolf River Bridge and 3,500 feet west of the existing signalized intersection of Walnut Grove and Farm Road. The trumpet design interchange required Walnut Grove Road to be relocated north of the existing roadway by 450 feet to provide for the loop ramp. Travel speeds associated with the interchange/ramp system will be 20 mph. This alternative provides Farm Road with right-in/right-out access to westbound Walnut Grove Road, while eliminating access to eastbound Walnut Grove Road; access to Walnut Grove Road will be accomplished via Kirby Parkway.

Summary of Environmental Impacts

Construction of Kirby Parkway may induce impacts of varying degrees to the human and natural environments. This document evaluates direct, indirect, and cumulative consequences to the area’s air and noise quality, aquatic ecosystems, wildlife, cultural resources, and socioeconomic setting.

The primary adverse environmental impacts of the proposed action include:

- the displacement of up to five residences;
- impacts to streams (320 feet estimate);
- impacts to biological ecosystems from the conversion of wetlands (1.7-acre estimate) to

highway right-of-way; and

- temporary impacts, such as dust and noise, and inconvenience, such as traffic delays at cross roads and equipment access points, during the construction period.

These items should be evaluated and mitigated to achieve the most beneficial response possible.

Beneficial effects of the proposed action include:

- improved regional travel safety and accident reduction;
- decreased travel times;
- improved local and regional accessibility;
- improved system connectivity;
- improved functionality and use of Shelby Farms through greater accessibility; and
- highlight natural beauty of Shelby Farms for the parkway user.

The proposed action will not use land protected by Section 106 of the National Historic Preservation Act or Section 6(f) of the Land and Water Conservation Act. In addition, this project will not affect archaeological or UST/Hazmat sites. Section 4(f) does not apply to this project because the joint-planning exception likely applies given past concurrent planning for a park and a north-south corridor along the current project's general proposed pathway. Furthermore, even if the joint-planning exception did not apply, Section 4(f) still does not apply because any impact to parkland appears to be *de minimis*." The project is not expected to impact the Memphis aquifer.

During the development of this project, a review of previous environmental studies was necessary to address segments of the project that have been altered since it began. Additional documentation was necessary to address changes in environmental laws and regulations that occurred during the life of the project.

Areas of Controversy and/or Unresolved Issues

No areas of controversy or unresolved issues have been identified or raised by agencies or the public.

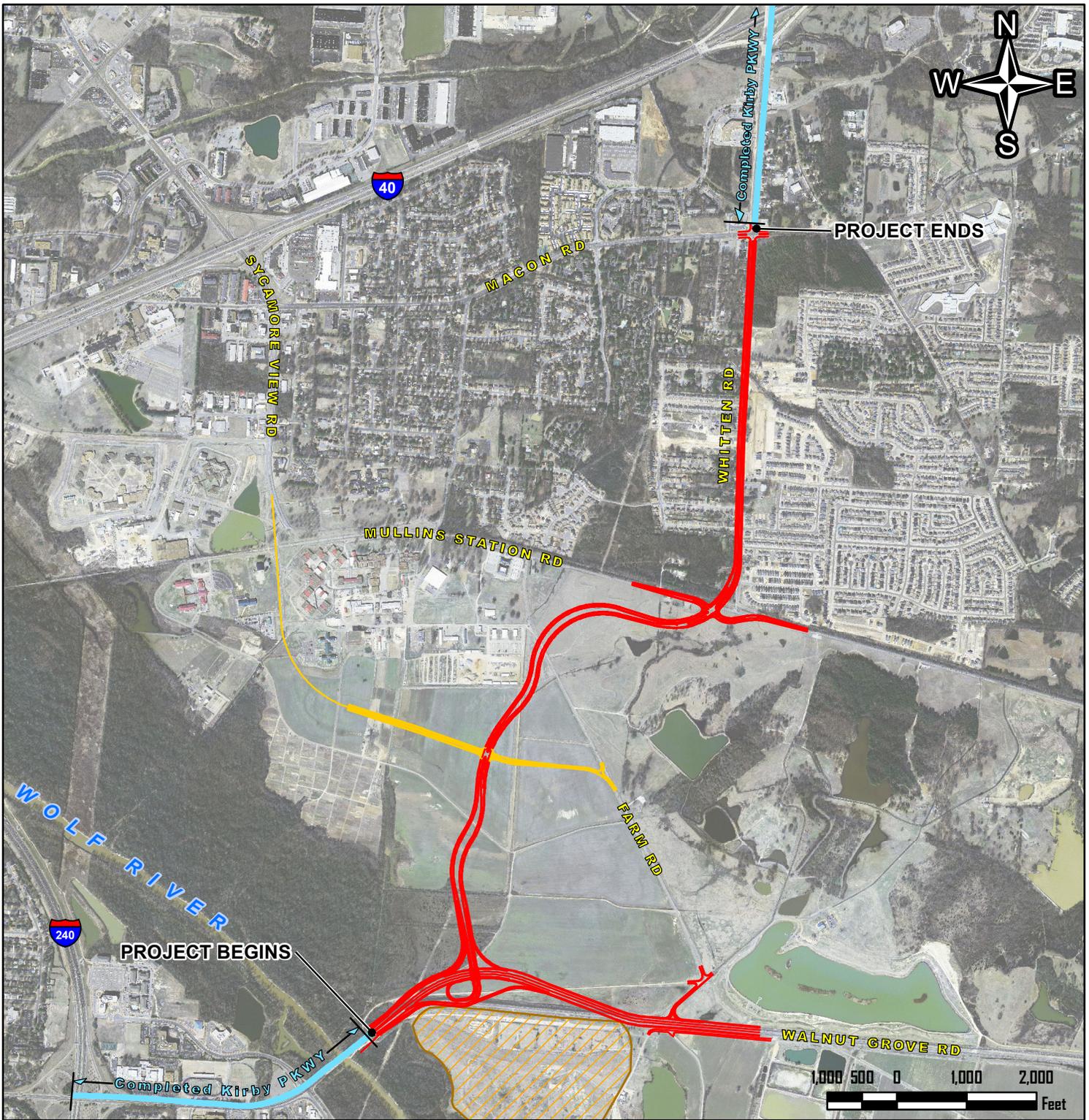
List of Other Federal Actions Required

U. S. Department of the Army, Corps of Engineers (USACE)

- Section 404 Permit
- Section 401 Water Quality Certification Permit

Summary of SAFETEA-LU Statute of Limitations

SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) establishes a 180-day Statute of Limitations for legal challenges to federal approvals of highway and transit projects, triggered by publication of a 23 USC 139(1) notice in the Federal Register. If a 23 USC 139(1) notice is not published, the Statute of Limitations extends for six years. This Statute of Limitations pertains to the FEIS and is as follows: "A Federal agency may publish a notice in the Federal Register, pursuant to 23 USC 139(1), indicating that one or more Federal agencies have taken final action on permits, licenses, or approvals for a transportation project. If such a notice is published, claims seeking judicial review of those Federal agency actions will be barred unless such claims are filed within 180 days after the date of publication of the notice, or within a shorter time period as is specified in the Federal laws pursuant to which judicial review of the Federal agency action is allowed. If no notice is published, then the periods of time that otherwise are provided by the Federal laws governing such claims will apply."

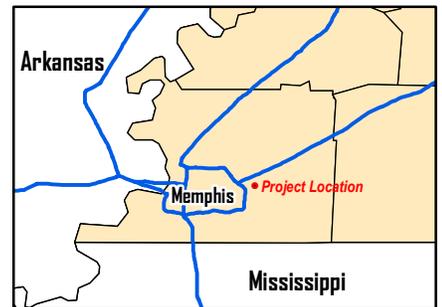


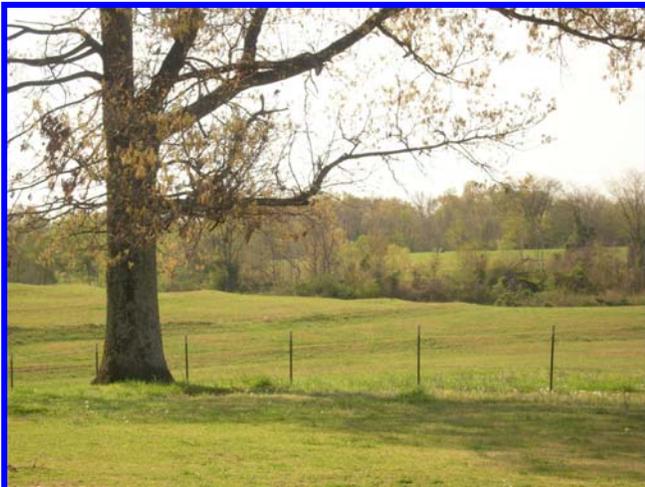
Proposed Kirby Parkway Vicinity Map

Memphis, Shelby County, Tennessee



- Landfill Boundary
- Proposed Parkway
- Sycamore View Road Extension (Future Project)





**Views of
Shelby
Farms**

ENVIRONMENTAL COMMITMENTS

Throughout the alternative development process, alternatives have been designed to avoid and minimize, to the extent practicable, impacts to environmental resources. Prior to and during construction, mitigation measures will be followed.

Wetlands, Streams, and Floodplains

The provisions of the *Tennessee Water Quality Control Act of 1977* (T.C.A. 69-3-101 et seq.) and the authorization by the United States Environmental Protection Agency (USEPA) under the *Federal Water Pollution Control Act*, as amended by the *Clean Water Act of 1977* (33 U.S.C. 1251, et seq.) and the *Water Quality Act of 1987*, P.L. 100-4 with the permits required prior to project initiation shall be fully enforced during construction to minimize adverse impacts to the water quality of surface streams and groundwater in the project corridor. If concurrence is needed, the Memphis District's Hydraulics and Hydrology Branch would need to review the road profiles and hydraulic model to provide a more detailed analysis of the expected effect on the flowlines or assess the likelihood of increased scour at the Walnut Grove Road Bridge as a result of this project. Water normally carried by the ditches and streams within the Shelby Farms area should be handled by a provision of culverts through the proposed parkway.

Executive Order 11990, *Protection of Wetlands*, provides guidelines to avoid wetlands where possible and minimize contact with them where total avoidance is not feasible. Federal resources management agencies (e.g., NRCS and USFWS) also recommend impact minimization measures as the Best Management Practices (BMP). Mitigation measures and BMP's are proposed during highway construction to avoid, minimize, or mitigate impacts to jurisdictional wetlands caused by any of the alternatives. These measures may include avoidance and minimization through roadway design modifications and mitigation through wetland banking. A combination of measures to mitigate for wetland losses and changes in functions and values will be employed. Selection of BMP's or mitigation measures is influenced primarily by functional values, wetland type, or objectives.

Detailed wetland studies and delineation will take place prior to the Section 404/401 permitting. For Department of Army (DA) permits, each crossing of a water of the U.S. is typically considered a single and complete project; therefore, each crossing/impact site should be specified as just part of a permit application. Mitigation monitoring plans will be approved by permitting agencies, and will be included with the wetland mitigation plan. If at all possible, avoidance of floodplains should take place. If this is not feasible, construction limits will be minimized and BMP will be utilized. During or following high precipitation, limited activity should occur; work near streams shall be conducted during low flow periods to minimize disturbance. Wetland, stream, and floodplain impacts are discussed in Section IV.C.

Aquifer

A breach, or paleochannel, has been identified in the Memphis aquifer, a prolific aquifer that provides water to people throughout the Tennessee-Mississippi-Arkansas region, north of the closed landfill at Shelby Farms. Additional information about the Memphis aquifer is located in Section IV.N and Appendix H. The commitments regarding the aquifer are summarized below.

A total-containment policy will be adopted for any spills of hazardous or chemical materials on the road crossing Shelby Farms. The use of an in-line oil and grit chamber should suffice to capture oil and grit that might otherwise find their way into the aquifer through the window. Prompt response to such an incident and thoroughly cleaning the spill site, including the soil, should result in no spill products

reaching the Memphis aquifer. An example of a total-containment method used along Interstate 65 near Mammoth Cave in Barren County, Kentucky, is featured in Appendix H. Mammoth Cave is an underground resource that feeds groundwater resources much like the Memphis aquifer. The city of Memphis has committed to including appropriate mitigation measures for managing the runoff from hazardous spill incidents as an element of the construction of the project and will maintain total-containment methods following construction.

No fill material will be removed from the Wolf River floodplain that would potentially expose the upper Memphis aquifer.

A monitoring program will be initiated to evaluate the down-gradient extent of a potential leachate plume, its direction of migration, and the impacts of decomposition and dilution on leachate contaminants. This would involve periodic sampling of the existing well network. This information should serve well to evaluate the potential for any spill contents to reach water supplies.

All discharge from the proposed road will be discharged as far downstream on the Wolf River as financially feasible. This would ensure any containment introduced into the Wolf River cannot make its way into the aquifer through the windows.

Erosion Controls and Construction Practices

Prior to construction, application for a National Pollutant Discharge Elimination System (NPDES) permit will be carried out to confirm a plan that will prevent silt from entering creeks and tributaries by the use of silt traps, sedimentation basins, silt checks, silt fences, temporary seeding, and, if necessary, temporary silt ditches properly located along the length of the embankment and in ephemeral ditches tributary to these features. This will assure that all runoff from construction is routed through these erosion control structures before reaching streams and that sediment control structures will be shown on the final parkway design. Construction and hazardous material releases, oil spills, fish/animal kills, and radiological incidents must be reported to Office of Emergency Services, the Western Region Office of TEMA. This contact should occur as soon as action has been taken to either contain/control the extent of the release, or protect persons, animals or fish from harm or further harm. Dust and other air pollutants must be controlled to the greatest extent. Any action taken on open burning during the construction phase will be in accordance with *Chapter IV, "Open Burning"*, of the *Tennessee Air Pollution Control Regulations*. Construction and Demolition (C&D) solid waste will be properly disposed in the appropriate solid waste facility. All roadway fills must be stabilized immediately upon placement; disturbed areas must be revegetated immediately following construction activities. Combination grass/asphalt shoulders and a landscaped median will be used where feasible to support erosion control and the natural setting. In addition, caution must be executed near the landfill at the southern end of the project area; landfill wells will be avoided.

Invasive Species

Executive Order 13112, issued in 1999, calls for the prevention and control of invasive species (non-native exotics). Since many invasive species can be found within the project area, the following mitigation measures will be employed to hinder spread of these species:

- grasses, shrubs, and trees planted for beautification purposes or to prevent erosion should be native species, and, if possible, naturally occurring at the project locale;
- all disturbed soil, whenever possible, should be seeded with non-invasive or temporary annual species; and
- careful consideration should be paid to the types and quality of plants at borrow areas.

Endangered Species

According to the United States Fish and Wildlife Service (USFWS), no records regarding proposed threatened and/or endangered species of plants and animals exist within the proposed project corridor. However, according to TDEC, seven state-listed rare species may be near the project area (see Section IV.D.1). If any of these are discovered in or near the project site, protection measures will be used to prevent or minimize impact to these species. With heightened potential for nesting site destruction of two state sensitive bird species, the ROW in the Shelby Farms will be cleared and grubbed between mid September to March prior to construction.

Cultural Historic Resources

If archaeological material is uncovered during construction, all construction will cease in that area and the Tennessee Division of Archaeology and the recognized Native American Tribes will be contacted to afford a representative the opportunity to examine and evaluate the materials found.

Pedestrians and Bicyclists

It was concluded at the August 18, 2005 Advisory Team meeting that the project should include bicycle facilities for commuters as well as recreational cyclists throughout the project area. The addition of multi-use paths and sidewalks/side paths are expected to maintain and/or increase continuity and connectivity of the current bicycle and pedestrian facilities. Pedestrian and bicycle facilities, as described in Section IV.K were developed in concurrence with the ideals expressed in the Shelby Farms Park Master Plan (see page xi and Figure 4.4 for proposed facilities; see Appendix A for Master Plan). Proposed trail segments "A", "B", "C", and "H" will be constructed as a part of the Kirby Parkway project through Shelby Farms. Segments "D", "F", "G", and "I" will be constructed when funding for the proposed Shelby Farms Bicycle, Pedestrian and Equine Trails Transportation Enhancement project is fulfilled. Additional trail segments "X" and "Y" will be constructed in conjunction with the expansion of Patriot Lake. Segments "J" and "K" have no funding in place at this time.

Landscaping

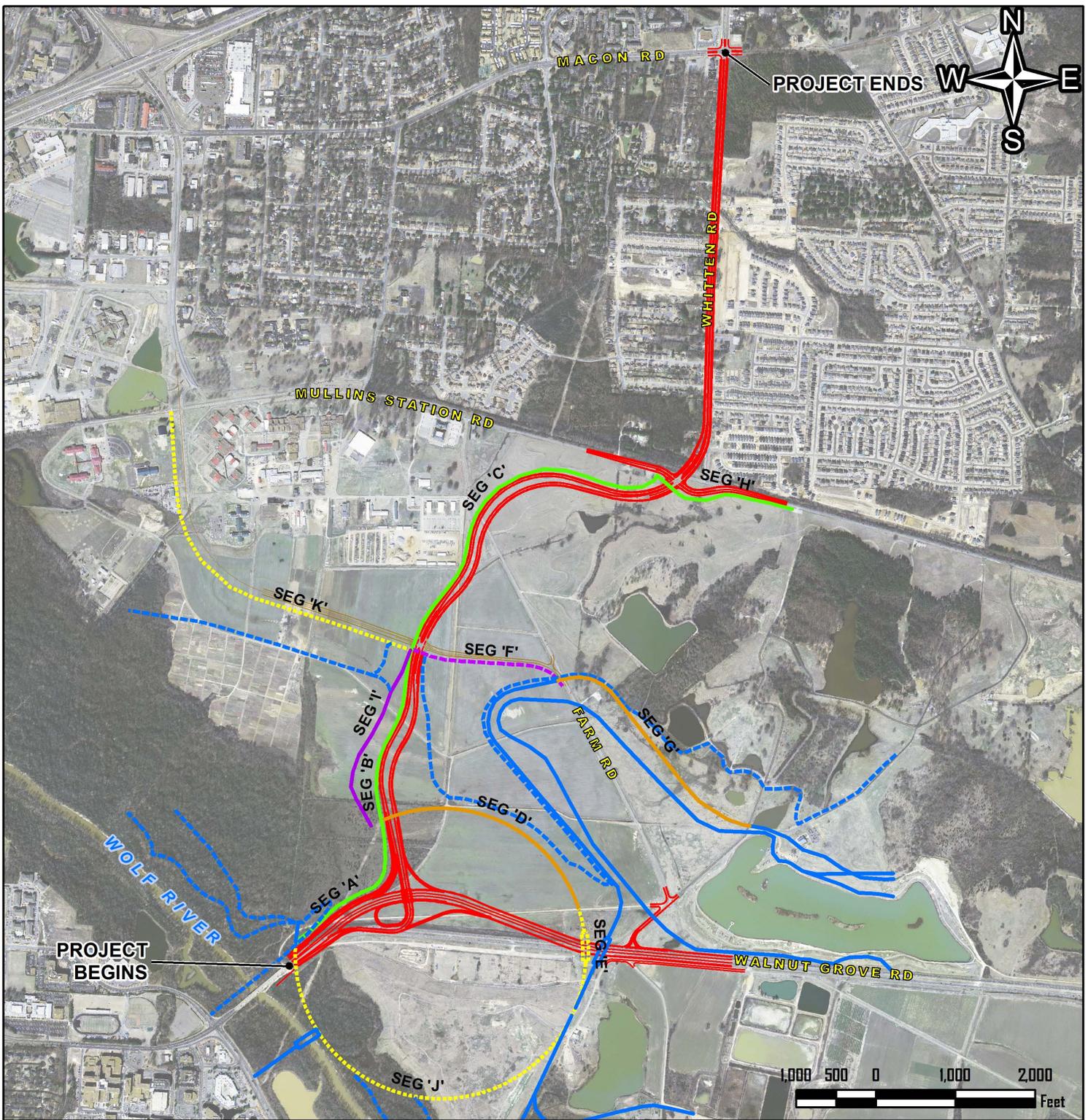
Landscaping and forestation of the parkway through Shelby Farms shall also utilize the ideas expressed in the Master Plan. A mix of nearly 2,600 understory and shade trees, millions of square feet of fescue and native grasses, and nearly 80,000 square feet of shrubs will be utilized to promote natural growth and succession. An initial estimate for landscaping improvements totals \$1.8 million.

ALTERNATIVE IMPACTS MATRIX

Category Impacts	Selected Alternative Alternative Q	Alternative L	Alternative M
Air Quality	Same or less than existing levels	Same or less than existing levels	Same or less than existing levels
Noise	1 receptor equaled NAC; 1 receptor increased 10 dBA over existing; 2 receptors increased 5 dBA or less over existing	1 receptor equaled NAC; 2 receptors increased 5 dBA or less over existing	1 receptor exceed NAC; 1 receptor increased 10 dBA over existing; 2 receptors increased 5 dBA or less over existing
Streams	320 linear feet	530 linear feet	410 linear feet
Wetlands	1.679 acres	1.346 acres	1.571 acres
Floodplains	13.60 acres	14.43 acres	12.14 acres
Threatened and Endangered Species	None	None	None
Historic Resources	None	None	None
Archaeological Resources	None	None	None
Environmental Justice	None	None	None
Relocations	5 Residential	5 Residential	5 Residential
Replacement Housing	Adequate available	Adequate available	Adequate available
Community Resources	More accessible	More accessible	More accessible
Land Use	Irreversible land use changes	Irreversible land use changes	Irreversible land use changes
Farmland Impacts	23 Acres of Prime and Unique	23 Acres of Prime and Unique	23 Acres of Prime and Unique
Pedestrian & Bicycle Facilities	Improved	Improved*	Improved*
UST/Hazardous Materials	None	Shelby County Landfill	Shelby County Landfill
Visual	Improved from Road and to Road	Improved from Road and to Road	Improved from Road and to Road
Section 4(f) and 6(f) Resources	Section 4(f) <i>de minimis</i> use of Shelby Farms Park	None**	None**

*Pedestrian and Bicycle Facilities were not developed for Alternatives L and M; however, based on the commitments set forth by the Advisory Team, if these Alternatives were to have been chosen, facilities would have been integrated into the roadway design based on the Shelby Farms Park Master Plan.

**Section 4(f) impacts were not determined for Alternatives L and M. A Section 4(f) alternatives analysis was not required for use of the land needed for this project because it appears the joint-planning exception applies, and, in any case, Alternative Q would involve a *de minimis* use of any Section 4(f) land. The joint-planning exception could also apply to Alternatives L and M. While Alternatives L and M, like Alternative Q, might also constitute a *de minimis* use even if the joint exception did not apply, they would likely have had more of an impact than Alternative Q. Alternatives L and M would have placed the interchange at Walnut Grove Road closer to the BMX track and featured median divides with greater separation, which would in turn have required additional land than is used for Alternative Q. See Figures 2.9-2.11.



Proposed Bicycle, Pedestrian, and Equestrian Trails

Memphis, Shelby County, Tennessee

Proposed Alternative

- Proposed Parkway
- Sycamore View Road Extension (Future Project)

Trail Type (Construction Funding)

- Proposed Master Plan Facility-Paved
- - - Proposed Master Plan Facility-Unpaved
- Equestrian (Trail Enhancement Grant Contract)
- - - Bicycle and Pedestrian (No Funding)
- Bicycle and Pedestrian (Parkway Project)
- Bicycle and Pedestrian (Trail Enhancement Grant Contract)
- - - Bicycle, Pedestrian, Equestrian (Trail Enhancement Grant Contract)



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I. PURPOSE OF AND NEED FOR ACTION

Since the late 1960s, the east Memphis community has expressed the need for greater accessibility. The purpose of and need for the proposed Kirby Parkway is to create a new north-south route in the east Memphis area of Shelby County, Tennessee. By providing improved access, the new roadway is expected to improve mobility of Bartlett and Germantown residents, as well as the Poplar Avenue employment and commercial corridor commuters, reduce congestion, and lessen travel time along existing routes in east Memphis. Also, it will result in a more efficient, safer roadway and provide for growth in east Memphis.

I.A. Project History

In 1969, the Memphis Urban Area Transportation Study emphasized the need for a Kirby Parkway in eastern Shelby County. In 1973, The East Memphis Urban Area Transportation Plan update evaluated this need for a continuous north-south arterial. The 1981 Major Road Plan Update projected the construction of Kirby Parkway by 1990. The Transportation Improvement Program (TIP) 1991-1995 for the Memphis Urbanized Area designated Kirby Parkway as the fourth priority project. The 1999 TIP also included Kirby Parkway connecting in the vicinity of Shelby Farms. Currently, the project is contained on page 61 in the TIP for Fiscal Years 2011-2014 for the Memphis Urbanized Area as project number STP-M-2006-10.

The FEIS was approved in August 1991 with an Environmental Reevaluation following in March 2001. The portion of Kirby Parkway from Macon Road south of I-40 to Stage Road north of I-40 was constructed and opened to traffic from 1991 to 1999 (see Figure 1.1). The Parkway area of study is from I-240 to I-40 encompassing all roads and projects connected to this project. Kirby Parkway also encompasses an area to the west of the proposed roadway, near Humphreys Boulevard which was completed in 2008 (see Proposed Kirby Parkway on page vi).

Preliminary design plans for the portion of Kirby Parkway from Humphreys Boulevard to Macon Road were prepared from 1991 to 1994. TDOT held a design Public Hearing in November 1994, whereby comments and concerns prompted Shelby County to modify the proposed parkway's design through Shelby Farms. This alternative included lane reductions from six lanes to four lanes and the addition of a landscaped median. The proposed interchange at Walnut Grove and Farm Road onto Kirby Parkway was shifted farther west.



Figure 1.1. Completed portion of Kirby Parkway from Macon Road to Stage Road (north of project)

In 2002, Governor Phil Bredesen and Tennessee Department of Transportation (TDOT) Commissioner Gerald Nicely requested a detailed study of 15 controversial transportation projects across the state by the University of Tennessee Center for Transportation Research. Governor Bredesen and Commissioner Nicely based their decision to target these 15 projects following comments received during the 2002 political campaign. After the review, TDOT decided to refer a proposal to relocate Walnut Grove Road in Shelby County back to local government officials for future planning in October 2003. The University of Tennessee report suggested that the City of Memphis and Shelby County, in consultation with interest groups and the general public, re-affirm support and interest in pursuing the project to completion before development occurs. It was assumed that if there was continued local government support, the appropriate local entities would work to select a preferred alternative and perform the necessary environmental, economic, and social impact studies. Due to the public nature of this project, Context Sensitive Solution (CSS) principles were deemed critical in planning/designing phase of the Parkway. CSS is defined as "a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist."

A Supplemental Draft Environmental Impact Statement was prepared and approved (October 2007) to address changes that have occurred since the approval of both the Final Environmental Impact Statement (August 1991) and the Environmental Reevaluation (March 2001). The purpose of the SDEIS was to evaluate three build alternatives, Q, L, and M, of Kirby Parkway from west of the intersection of Humphreys Boulevard and Walnut Grove Road through Shelby Farms to the south of Interstate 40 at Macon Road.

I.B. Project Purpose

The purpose of the project is to decrease travel time and improve travel convenience between Poplar Avenue (Germantown and Bartlett) and I-40 as well as reduce congestion and provide a safer and more efficient roadway. This proposed segment of Kirby Parkway will connect to other previously constructed segments.

I.C. Project Need

The need for the Kirby Parkway project was documented in several transportation studies. For more than three decades, Memphis regional transportation plans have included a north-south connection in the vicinity of Shelby Farms. These plans were part of an overall strategy for a coherent road pattern based on a one-mile grid system. According to plans, a road pattern consisting of a north-south element was missing from the desired grid. In 1983, Kirby Parkway was chosen as the north-south route between I-240 and Germantown Parkway. Since that time, the route has been redesigned to reflect opinions stated during several public meetings. Prior to 1983, the regional plans consisted of two major north-south roadway projects, the northern extension of Kirby Parkway and the proposal for a Riverdale Road. In 1983, development of the Agri-Center International center located in Shelby Farms decreased the possibility for Riverdale Road. The proposed Kirby Parkway extension northward to Whitten Road remained intact.

In 2010, the current roadway system is expected to have a combined Level of Service (LOS) below the desired level of "C"; four of the five road segments will be at a level of "E" by 2030. Typically, this traffic pattern quickly progresses to a LOS ("F") that represents the worst possible traffic conditions. These figures were projected from traffic conditions of the current roadway system. Therefore, measures are and will be needed to alleviate current and future traffic congestion on existing roads

and crossroads. Kirby Parkway will cross several east-west routes (see Figures 1.2 and 1.3). They are, from south to north, Walnut Grove Road, Mullins Station Road, and Macon Road.



Figure 1.2. Traffic at the intersection of Macon Road and Whitten Road



Figure 1.3. Traffic at the intersection of Whitten Road and Mullins Station Road

Kirby Parkway is needed to address the growing population base in Shelby County. Population in East Memphis increased 33.2 percent between 1990 and 2000. This pattern is expected to continue. In 2000, according to United States Census data, population in Shelby County reached 897,472. Similar population figures for 1990 equaled 826,330, an increase of approximately 8 percent.

In addition to population growth, Memphis is considered one of the top places in the country to relocate businesses; business growth in east Memphis has increased tremendously over the past 14 years since the FEIS.

The combination of population and economic growth has added to highway congestion in east Memphis along area routes, such as I-240, Germantown Parkway and even I-40. The addition of Kirby Parkway will provide an alternative route with the potential to reduce congestion impacts from adjacent residential areas and business/employment centers along Poplar Avenue. Poplar Avenue runs east to west from downtown Memphis, south of the project area. Poplar Avenue encompasses the commercial development centered on this major roadway leading into and out of the city. A 1.5-mile-long completed portion of Kirby Parkway connects Humphreys Boulevard and Poplar Avenue.

I.C.1. System Linkages

The current roadway system consists of a two-lane paved road (see Figure 1.3), characterized by poor geometrics, lack of shoulders, and lack of system connectivity. A continuous four-lane route providing south-north travel service would satisfy these constraints, enhancing accessibility and connectivity throughout the region. It would be expected to provide the safe and efficient access needed to reach local destinations of county governments, local businesses and services, as well as those in distant markets.

Memphis, the county seat of Shelby County, is the area's center of employment, public and government services, commerce and shopping, education, and health. Memphis offers many opportunities and basic social and economic services that are not found elsewhere in the region. The lack of an efficient connection from Walnut Grove Road to I-40 contributes to major congestion and decreased safety for users of this heavily traveled corridor. The Walnut Grove Road/Humphreys Boulevard intersection and Walnut Grove Road Bridge reconstruction over Wolf Creek were recently

completed; this junction and improvement are located west of the project's southern terminus and will accommodate traffic to/from Kirby Parkway. Access to Kirby Parkway from Humphreys Boulevard north onto Walnut Grove Road east will be maintained by a separate lane; through access will be maintained for this lane to continue on Walnut Grove Road east (see Figures 2.2 and 2.4). Walnut Grove Road traffic from west of Humphreys Boulevard will have both Kirby Parkway and through access. These two lanes, from Walnut Grove Road east and Humphreys Boulevard north onto Walnut Grove Road east, do not merge at the interchange location. They maintain separate travel lanes and do not require weaving of traffic. The project also connects with a future project, known now as the Sycamore View Road Extension, through Shelby Farms Park. It can be seen in Figures 1.7 and 1.8.

Connection with major highway systems is extremely important for the economy of the study area. The area is poorly connected to National Highway System (NHS) routes; although the Interstate Highway System (IHS) is nearby, there is no easy connection to these major routes. This proposed segment of Kirby Parkway would provide substantially improved regional connections to east Memphis and the IHS. This enhanced access would assist commerce and industry with shipping and on-time deliveries, and be expected to decrease travel time for employees. The Memphis International Airport is located south of Interstate 240. The proposed Kirby Parkway will provide another route of access from north of Shelby Farms to Interstates 40 and 240.



Figure 1.4. Overhead view of Farm Road and Study Area

I.C.2. Growth in East Memphis

According to 2000 United States Census information, the east Memphis area has experienced a surge in population since 1990. The project area is represented by census tracts 211.22, 211.23, and 212. Population rose from 14,073 to 21,355 between 1990 and 2000, an increase of 33.2 percent in these tracts. In addition, the overall population for Shelby County which includes Germantown and Bartlett increased approximately 8 percent from 826,330 to 897,472 during the same timeframe. The Shelby County Metropolitan Planning Commission projects that Shelby County will have a population of approximately 1,106,610 by 2020, up from 869,379 in 1999. This trend is expected to increase due to the attractiveness of the Memphis Metropolitan Statistical Area (MSA) and the opportunity for future expansion. Memphis MSA is slower in overall growth than Germantown or Bartlett.

The population along Whitten Road has steadily increased during the past 30 years. There are several new subdivisions, places of worship, and roads east and west of Whitten Road. Visible traffic congestion, particularly during peak daily travel times accompanies this growth. Redesigning the road will alleviate inaccessibility and traffic congestion.

The Shelby County Government owns Shelby Farms, a 4,500-acre former county penal farm. The property includes governmental uses, such as the Shelby County Corrections Center, Sheriff's Department, other county administration offices; dispersed recreational activities such as the Lucius Burch Jr. State Natural Area, the Visitors Center, Patriot Lake, the Arboretum, Plough Park, hiking trails, and other facilities. In the 1980s, the county established the Plough Development Board to oversee the area.



Figure 1.5. Current use of Shelby Farms multi-use trails

In transferring the administration of the farm property, Shelby County also reserved a 1,000-foot-wide corridor through Shelby Farms for the future construction of the Kirby Parkway. To accommodate increased population growth in the area, the Memphis Comprehensive Plan has included additional recreational opportunities in the vicinity of Shelby Farms. The public requested that the plan incorporate new and improved multi-use trails to compliment the current facilities (see Figure 1.5). The existing trails are not adequate to accommodate the expected increase of recreational uses in Shelby Farms.

Sustained commercial development along with population growth has accompanied increased development adjacent to Poplar Avenue, not to mention the Memphis metro area. Several magazines rank Memphis as one of the top ten best cities for company expansion or relocation. In a January 2004 study, Memphis ranked as the 16th least expensive city for corporate headquarters. This sustained economic development in the MSA has earned Memphis a reputation for advantageous relocation. Consequently, this growth has congested the existing north-south routes; therefore, in order for Memphis to continue its competitive attractiveness, an improved transportation system is needed to relieve pressures due to the area's past growth patterns and to accommodate/provide for future growth.

I.C.3. Safety

The City of Memphis Engineering Department, Traffic Division conducted a safety analysis of the current roadway system in August, 2006. In the previous five and a half years, the majority of crashes in the project area resulted in property damage and/or minor injury. Approximately sixty percent of all collisions took place at the intersection of Walnut Grove Road and Farm Road. The Selected Alternative will replace the existing signalized intersection at this location with an unsignalized trumpet interchange. Thus rear-end collisions will decrease by the elimination of this stopping point. This alternative provides Farm Road with right-in/right-out access to westbound Walnut Grove Road, while eliminating access to eastbound Walnut Grove Road. Thus, the construction of Kirby Parkway is expected to improve overall safety through this heavily traveled corridor. Table 1.1 summarizes collision data from January 1, 2001 to August 7, 2006. No fatal incidents occurred at any of the intersections.

Table 1.1. Proposed Kirby Parkway vicinity collision data (January 1, 2001-August 7, 2006)

Collision Type	Intersection Location				
	Walnut Grove Rd Farm Rd	Whitten Rd Macon Rd	Whitten Road Mullins Station Rd	Farm Rd Mullins Station Rd	Pine Lake Rd Farm Rd
Property Damage	312	126	66	33	4
Injury	76	16	9	2	2
Critical	1	0	0	0	0
Fatal	0	0	0	0	0
TOTAL	389	142	75	35	6

Source: City of Memphis Engineering Department, Traffic Division

Collision data for accidents along existing roadway segments were not provided. However, congestion and inattention are to blame for collisions at non-intersection locations. Since congestion and inattention are related to traffic conditions at intersections and uncontrolled access, the proposed Kirby Parkway from Walnut Grove Road to Macon Road will eliminate many of the existing intersections and the resulting stop-and-go conditions that lead to collisions through partially controlled access.

I.C.4. Highway Capacity

A LOS analysis for the intersections included in the study area was conducted using year 2010 build-year traffic information and projected traffic figures (2030) to represent completion of the Parkway. A No Build Scenario traffic capacity projection is also included. LOS is a qualitative measure of traffic flow. The Levels of Service range from A to F, with A being the best quality of flow, and F being the poorest. Table 1.2 and Figure 1.6 describe the general LOS situations. LOS is dependent upon Average Control Delay; this is the delay (in seconds) a vehicle experiences given the presence of a traffic signal and/or conflicting traffic. This includes time spent decelerating, idling, and accelerating. Figures 1.7-1.10 feature LOS diagrams of all four scenarios at different points in time, current, no build, and proposed traffic capacity.

Table 1.2. Description of LOS for Unsignalized Intersections

Level of Service	Description	Average Control Delay
A	Minimal Delay	≤10
B	Brief Delay	>10 and ≤15
C	Average Delay	>15 and ≤25
D	Significant Delay	>25 and ≤35
E	Long Delay	>35 and ≤50
F	Extreme Delay	>50

Source: *Highway Capacity Manual*, 1997 Update, TRB Special Report 209, Third Edition

Based on existing capacity figures, current traffic delays vary from average to long. If the no build alternative was selected and traffic increases as expected, the LOS for each road will remain at current conditions and/or decrease in quality. Overall, congestion issues are anticipated to hamper the area without construction of the Parkway. Table 1.3 outlines the above conditions. Figures 1.7-1.10 illustrate the 2010 No Build, 2030 No Build, 2010 Proposed, and 2030 Proposed Scenarios.

Table 1.3. Existing and Projected No Build Traffic Capacity Figures for Study Area

	2010 No Build Alternative		2030 No Build Alternative	
	ADT	LOS	ADT	LOS
Farm Road (including Pine Lake Road)	17,244	E	18,300	E
Mullins Station Road (Farm Road to Whitten Road)	13,164	E	19,200	E
Walnut Grove Road (Pine Lake Road to Humphreys Blvd)	56,202	D	69,100	E
Walnut Grove Road (east of Pine Lake Road)	46,358	C	51,400	C
Whitten Road (Macon Road to Mullins Station Road)	10,564	E	11,400	E

Average daily traffic numbers are expected to increase with the construction of Kirby Parkway. However, unlike the no build alternative, improvements in the project's overall level of service and efficiency are expected to accompany this increase in vehicles; traffic will face minimal to average delays. After Kirby Parkway is built, traffic conditions in the study area are expected to be improved, as outlined in Table 1.4.

Table 1.4. Projected Traffic Capacity Figures of Proposed Alternative

	2010 Proposed Alternative Build Year		2030 Proposed Alternative	
	ADT	LOS	ADT	LOS
Proposed Parkway (Sycamore View Road to Walnut Grove Road)	17,800	A	36,400	C
Proposed Parkway (Sycamore View Road to Mullins Station Road)	13,400	A	27,300	B
Walnut Grove Road (Proposed Parkway to Humphreys Blvd)	54,100	B	83,100	D
Walnut Grove Road (east of Pine Lake Road)	47,600	B	56,500	B
Whitten Road (Macon Road to Mullins Station Road)	10,600	A	15,100	A

Figure 1.6. General Level of Service



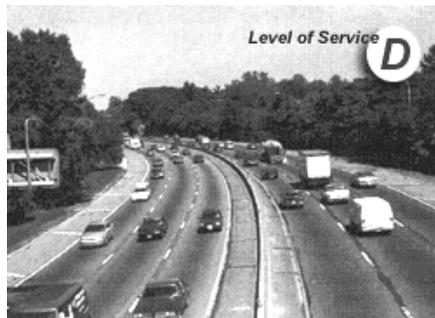
• **Level of Service A** - Represents the best operating conditions and is considered free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.



• **Level of Service B** - Represents reasonably free-flowing conditions but with some influence by others.



• **Level of Service C** - Represents a constrained constant flow below speed limits, with additional attention required by the drivers to maintain safe operations. Comfort and convenience levels of the driver decline noticeably.



• **Level of Service D** - Represents traffic operations approaching unstable flow with high passing demand and passing capacity near zero, characterized by drivers being severely restricted in maneuverability.

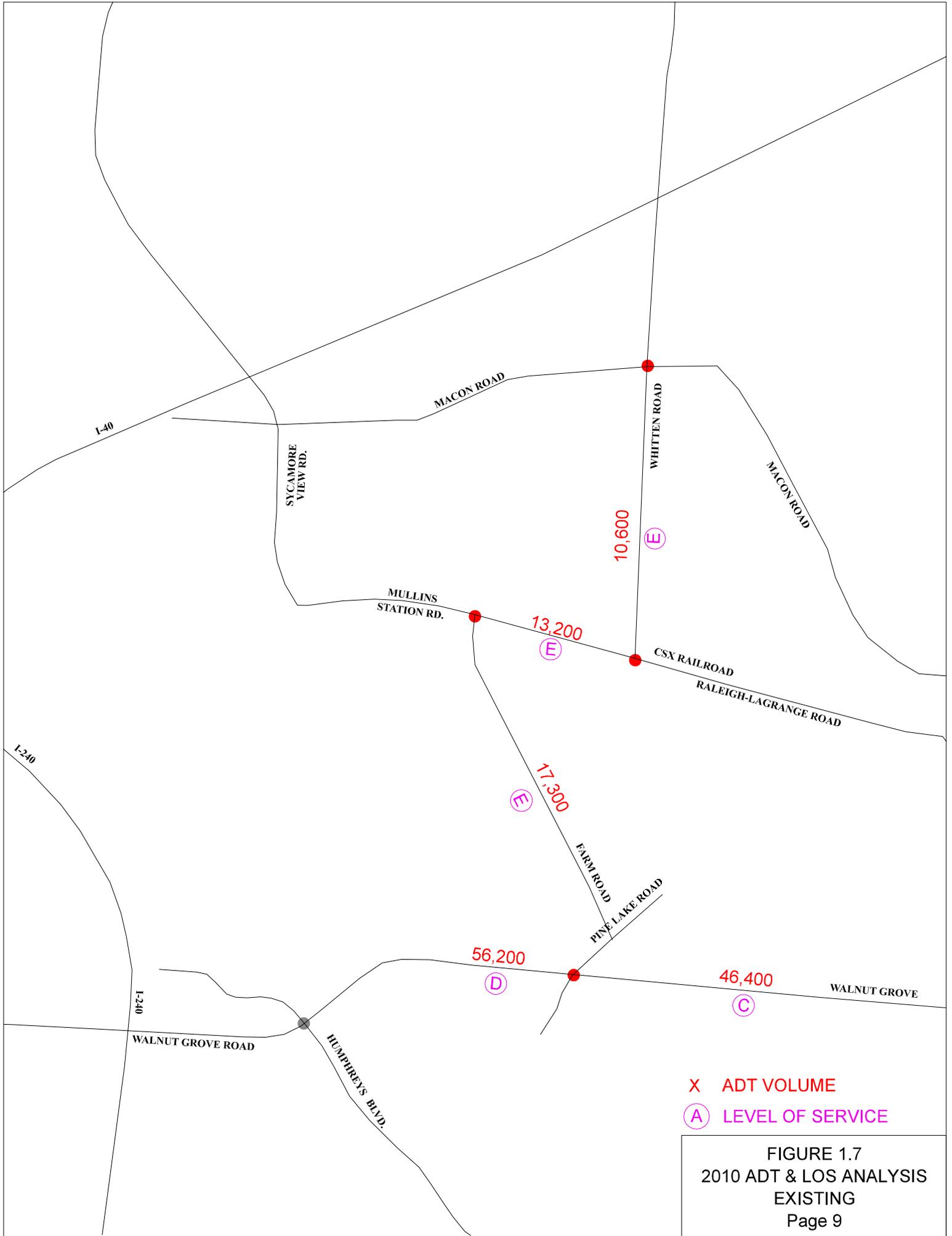


• **Level of Service E** - Represents unstable flow near capacity. LOS E often changes to LOS F very quickly because of disturbances (road conditions, accidents, etc.) in traffic flow.



• **Level of Service F** - Represents the worst conditions with heavily congested flow and traffic demand exceeding capacity, characterized by stop-and-go waves, poor travel time, low comfort, and convenience, and increased accident exposure.

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X ADT VOLUME
 (A) LEVEL OF SERVICE

FIGURE 1.7
 2010 ADT & LOS ANALYSIS
 EXISTING
 Page 9

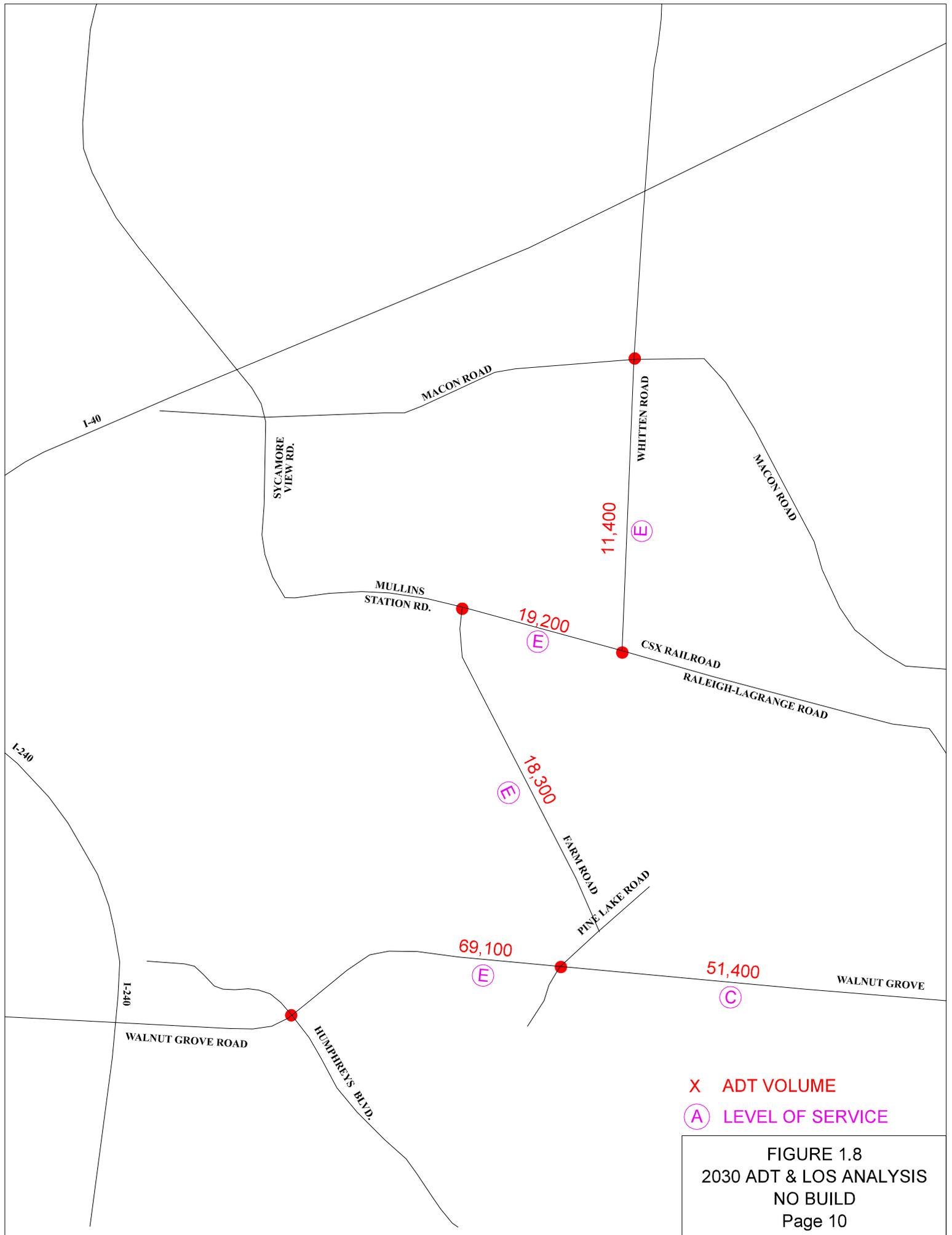
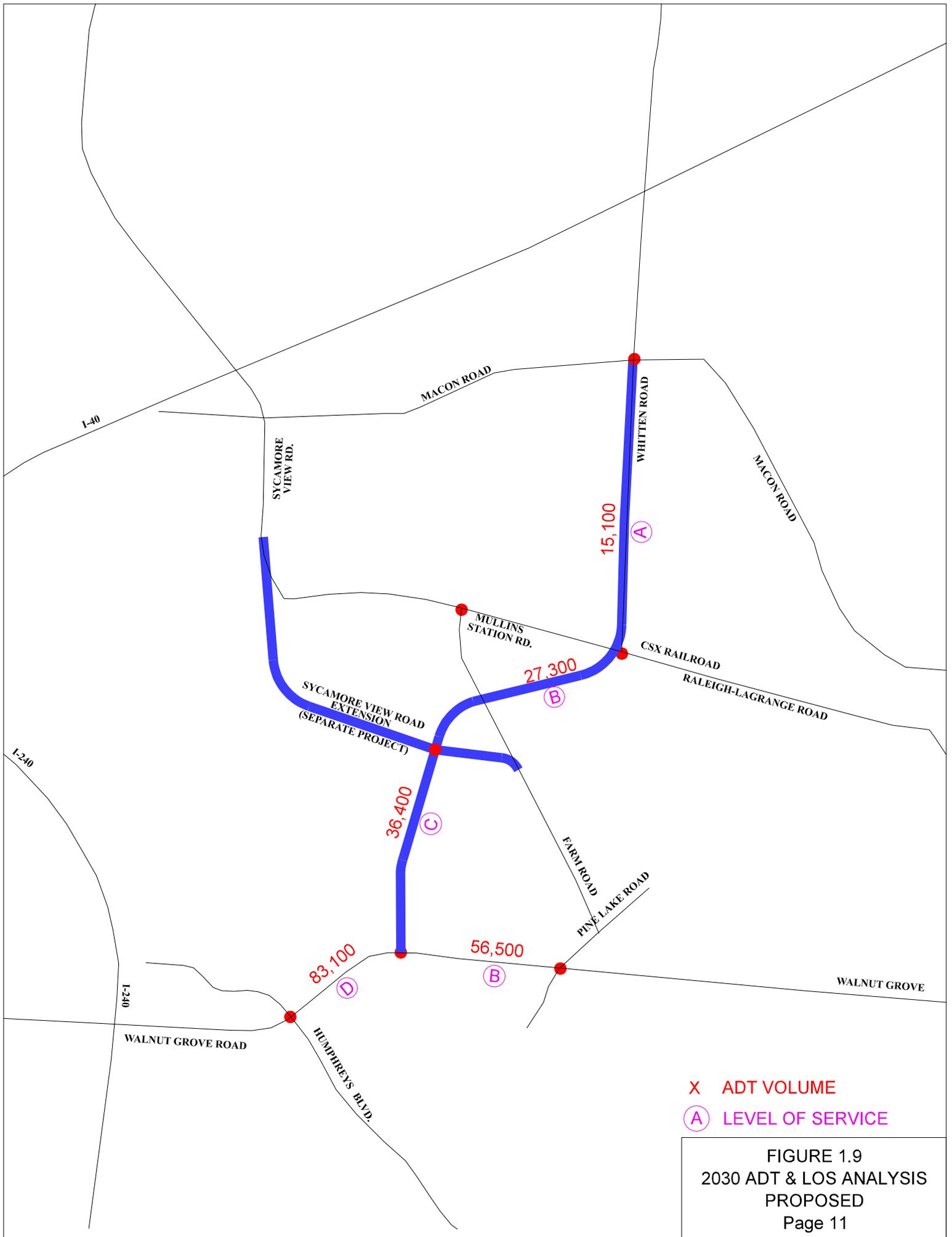
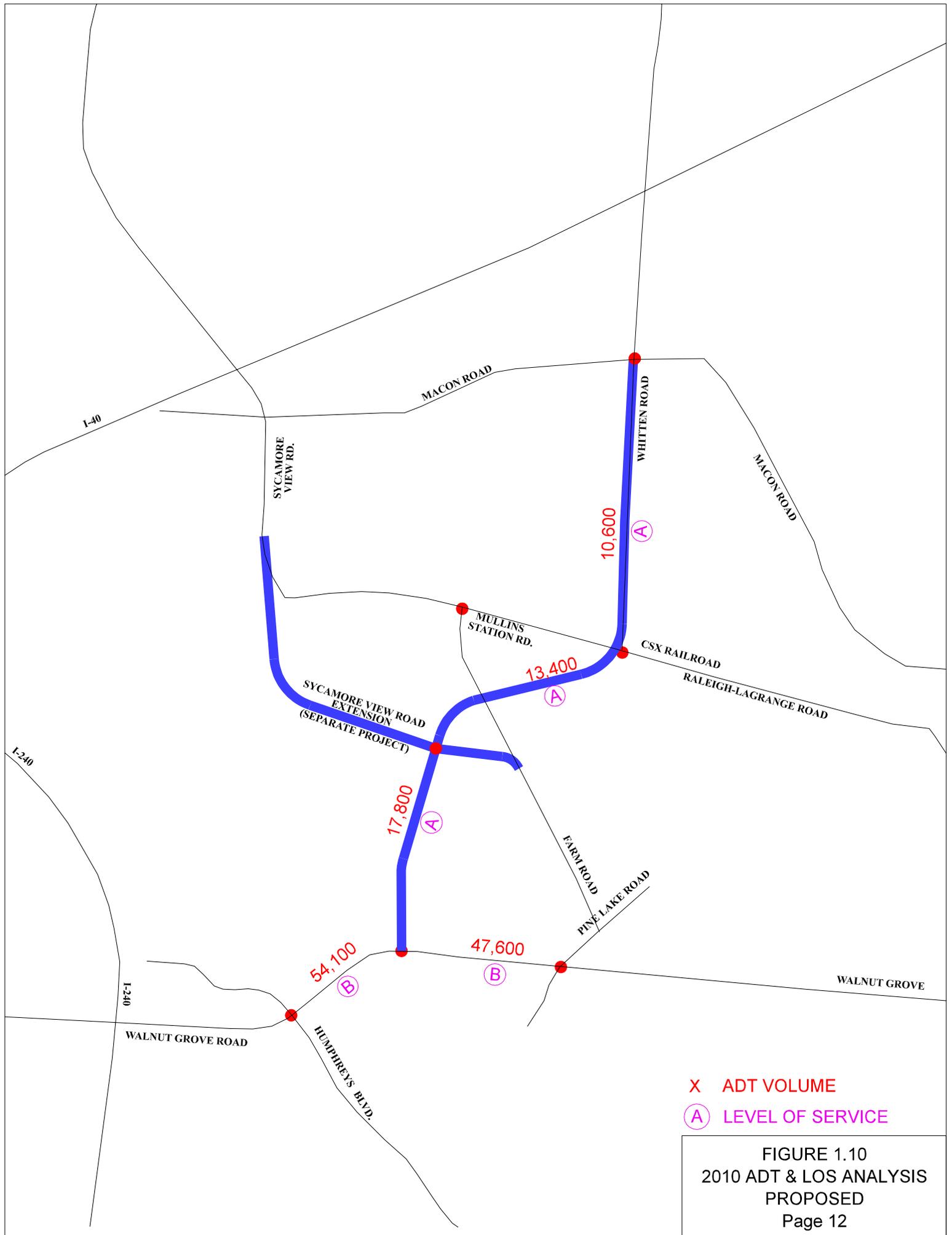


FIGURE 1.8
 2030 ADT & LOS ANALYSIS
 NO BUILD
 Page 10



X ADT VOLUME
 (A) LEVEL OF SERVICE

FIGURE 1.9
 2030 ADT & LOS ANALYSIS
 PROPOSED
 Page 11



X ADT VOLUME
 (A) LEVEL OF SERVICE

FIGURE 1.10
 2010 ADT & LOS ANALYSIS
 PROPOSED
 Page 12

I.C.5. Project Purpose and Need Summary

The Kirby Parkway project has been through thirty years of project reevaluations, studies, and public debates all the while maintaining its high priority status in the East Memphis area. The design has varied over the years to meet the needs of the project and to include the most environmentally, socially, and economically sound plans. The need for this north-south route has been proven time and again through various studies. The purpose and need of this project have been described in the four main objectives:

1. To improve system linkages by providing a new north-south connection;
2. To accommodate growth in east Memphis;
3. To improve or reduce travel time and delays on existing routes; and
4. To improve overall safety.

These purpose and need objectives have been validated and reconfirmed by the public and the Shelby Farms Parkway Advisory Team at numerous points during project development and public involvement activities (see Section V). In addition, the Shelby Farms Parkway Advisory Team reached a consensus on additional Partnership Goals to be pursued in conjunction with the project design criteria. These goals were also utilized in the consideration of alternatives:

<i>PARTNERSHIP GOALS</i>
<i>Create a road that enhances and embraces the park</i>
<i>Create a design concept that is socially, economically, and environmentally responsible</i>
<i>Create a safe and effective roadway design</i>
<i>Reduce corridor congestion</i>
<i>Produce an excellent design that enhances the quality of life in the community</i>
<i>Create the opportunity for non-vehicular traffic to enter and use the park</i>
<i>Create the opportunity for vehicular and non-vehicular crossing of the corridor including access for the physically challenged</i>

II. ALTERNATIVES

Since the approval of the Reevaluation in 2001, a considerable amount of changes have occurred to warrant additional study concerning the construction of Kirby Parkway through Shelby Farms. In 2005, a committee consisting of the general public, local officials, and state and federal agencies formed in order to establish the status of Kirby Parkway. In 2006, following the CSS process, this group developed and came to a consensus on the Parkway alternatives. For nearly one year, information about the project area, the needs and wants of the community, and the environmental constraints of the area were gathered to evolve several previously designed alternatives into three new alternatives as described in this SFEIS: L; M; and Q.

At the outset of the CSS process, the Advisory Team formulated an overall plan that included six 12-foot traffic lanes with a landscaped median, curbs, gutters, and a center turn lane. However, after review of traffic projections, the number of lanes was revised from six to four with a landscaped median. The Team agreed that access to Walnut Grove Road from Kirby Parkway required a grade-separated interchange to eliminate conditions caused by the intersection of Pine Lake Road and Walnut Grove Road. They also agreed that Kirby Parkway should not be designated as a through truck route. The Advisory Team then established a study corridor and some preliminary alignments by addressing the project area benefits and constraints. As environmental impacts or design information were received, the alternatives were retained for future study or dismissed from further consideration because they did not satisfy the purpose and need.

Each of the reasonable alternatives subjected to detailed examination and documented in the original FEIS (1991) were considered to accomplish the project purpose and need objectives to varying degrees and were considered candidates for selection; however, noteworthy changes to the alternatives examined since circulation of the original FEIS have occurred, hence the need for the SFEIS. The Selected Alternative has been altered after careful consideration of all reasonable alternatives, including the assessment of their potential environmental impacts (social, economic, and environmental), project costs, and the evaluation of public and agency comments stemming from the extensive project coordination and public involvement/public hearing process. The identification of the Selected Alternative, Q, and the basis for its selection follows.

II.A. Selected Alternative- Alternative Q

Alternative Q was recommended by the Shelby Farms Advisory Team as the preferred Alternative in 2006. Alternative Q was developed from the combination of Alternatives L and M, which are discussed in Sections II.B and II.C. The Advisory Team decided that Alternative L (the former preferred alternative) needed alignment modifications in order to: lower the speed limit from 45 to 35 mph; move the roadway curve south of Mullins Station further; move the roadway north out of the Shelby Farms area; and avoid a large wetland and an archaeological resource. Therefore, the bifurcated, independent roadway of Alternative M was integrated into the design, while simultaneously conveying the trumpet interchange of Alternative L to create the Selected Alternative, Q.

The Selected Alternative includes a four-lane, divided, partially-controlled access facility. Partially-controlled access gives preference to through traffic, but may provide at-grade or grade-separated access to selected public roads and streets. All other design criteria not specified below, will be in accordance with the currently approved *AASHTO Policy on Geometric Design of Highways and Streets*. The typical section dimensions are summarized in Table 2.1. The four-lane typical cross sections are shown in Figure 2.5.



Existing

Shelby Farms Parkway



Alternative "Q"

Figure 2.1. Alternative Q versus existing roadway, as viewed from Whitten Road

In addition, Alternative Q will include the construction of a new grade-separated interchange with Walnut Grove Road approximately 1,900 feet east of the newly constructed Wolf River Bridge (east of the Humphreys Boulevard intersection) and 2,500 feet west of the existing signalized intersection of Walnut Grove and Farm Road. The trumpet interchange (see Figures 2.2 and 2.3) is within the existing southern edge of the Walnut Grove Road right-of-way. This alternative provides Farm Road with right-in/right-out access to westbound Walnut Grove Road, while eliminating access to eastbound Walnut Grove Road. Travel speeds associated with the interchange/ramp system will be 20 mph. The interchange will have six-foot shoulders. The section from Walnut Grove Road to Mullins Station Road is to be constructed with a 220-foot right-of-way, four 12-foot traffic lanes (two in each direction), a 30-foot to 100-foot variable-width, depressed median, 12-foot outside shoulders (10-foot paved, two-foot grass), and six-foot paved inside shoulders. From Walnut Grove Road to Mullins Station Road, the Selected Alternative would use an independent roadway concept, wherein the grade and

alignment of the Parkway would vary to blend the roadway into the natural topography. From the Walnut Grove Road/Kirby Parkway interchange, Alternative Q will travel in a northerly direction while curving to the west and back to the east, intersecting the proposed Sycamore View Road Extension at a perpendicular angle. The Sycamore View Road intersection will be a signalized intersection to provide traffic movements in all directions. The Sycamore View Road Extension is a separate project proposed for the Shelby Farms area and is not covered in this SFEIS. The extension would provide better access to Sycamore View Road from Kirby Parkway. The Sycamore View Road area, located north of Walnut Grove Road, is bordered by commercial and industrial facilities. In addition, the extension will reach Farm Road and the Shelby Farms Visitor's Center, allowing for direct access from Sycamore View Road and from Kirby Parkway at a signalized intersection. The alignment continues north, curving east then west, crossing north of a gas regulator station located within Shelby Farms, then east again before crossing the relocated Mullins Station Road at a slight angle. The signalized Mullins Station Road intersection will be realigned to eliminate an existing angle and provide turn lanes on all approaches. Alternative Q will then continue north along the existing alignment of Whitten Road to Macon Road. Figure 2.1 is a visualization of existing conditions versus Alternative Q; the intersection at Mullins Station Road and Whitten Road is located in the foreground. From Mullins Station Road to Macon Road, the Alternative Q right-of-way will be 106 feet, with four 12-foot traffic lanes, a 14-foot center turn lane, 10-foot outside shoulders, and curb and gutter on either side of the roadway. This section also is to be constructed with five-foot sidewalks, one on each side of the roadway. A speed limit of 35 mph is proposed for Alternative Q; however, the road is designed for 40 mph.

Pedestrian and bicycle facilities, as described in Section IV.K were developed in concurrence with the ideals expressed in the Shelby Farms Park Master Plan (see Figure 4.4 for proposed facilities; see Appendix A for Master Plan). On August 25, 2010, Tennessee Governor Phil Bredesen and TDOT Commissioner Gerald Nicely announced that Shelby County received \$1,640,675 in federal Transportation Enhancement (TE) funds for the Shelby Farms Bicycle, Pedestrian, and Equine Trails. Proposed trail segments "A", "B", "C", and "H" will be constructed as a part of the Kirby Parkway project through Shelby Farms. Segments "D", "F", "G", and "I" will be constructed when funding for the proposed Shelby Farms Bicycle, Pedestrian and Equine Trails Transportation Enhancement

project is fulfilled. Additional trail segments "X" and "Y" will be constructed in conjunction with the expansion of Patriot Lake. Segments "J" and "K" have no funding in place at this time. Bicycle and pedestrian access to/from Shelby Farms will accompany the Humphreys Boulevard/Walnut Grove Road intersection reconstruction to the south and the Greater Memphis Greenmile to the north. The addition of multi-use paths and sidewalks/side paths are expected to maintain and/or increase continuity and connectivity of the current bicycle and pedestrian facilities. Landscaping and forestation of the parkway through Shelby Farms shall also utilize the ideas expressed in the Master Plan. A mix of nearly 2,600 understory and shade trees, millions of square feet of fescue and native grasses, and nearly 80,000 square feet of shrubs will be utilized to promote natural growth and succession. An initial estimate for landscaping improvements totals \$1.8 million.

From just east of the Wolf River to west of I-40, the Humphreys Boulevard/Walnut Grove Road intersection and Walnut Grove Road Bridge reconstruction were under construction as separate projects during the completion of this FEIS (see Figure 2.4). Now complete, a separate travel lane accommodates traffic turning east onto Walnut Grove Road from Humphreys Boulevard. This lane will provide access to Kirby Parkway and through access on Walnut Grove Road east. This road parallels and runs adjacent to the Walnut Grove Road entrance ramp onto Kirby Parkway. Walnut Grove Road traffic traveling to the east from the west of Humphreys Boulevard will have both Kirby Parkway and through access. These two lanes, from Walnut Grove Road east and Humphreys Boulevard north onto Walnut Grove Road east, do not merge at the interchange location. They maintain separate travel lanes and do not require weaving of traffic.

Access to Kirby Parkway will include a new grade-separated interchange at Walnut Grove Road. This trumpet interchange provides Farm Road with right-in/right-out access to westbound Walnut Grove Road and eliminates access to eastbound Walnut Grove Road while preserving the flow of traffic. The signalized Mullins Station Road intersection will be realigned to eliminate an existing skew and provide turn lanes on all approaches. Access will remain available to Whitten Road/Kirby Parkway north of Macon Road.

The decision of the Selected Alternative was made by Shelby County and the city of Memphis in consultation with TDOT. The decision was based on recommendations made by the Shelby Farms Parkway Advisory Team, following the Public Workshops that were held on March 24, 2005 and November 15, 2005. The Selected Alternative is considered to meet the project purpose and need objectives, fulfill the project decision determinants, and meet the Shelby Farms Advisory Team goals better than all other reasonable project alternatives considered.



Figure 2.2. Visualization of Walnut Grove Road's approach to trumpet interchange

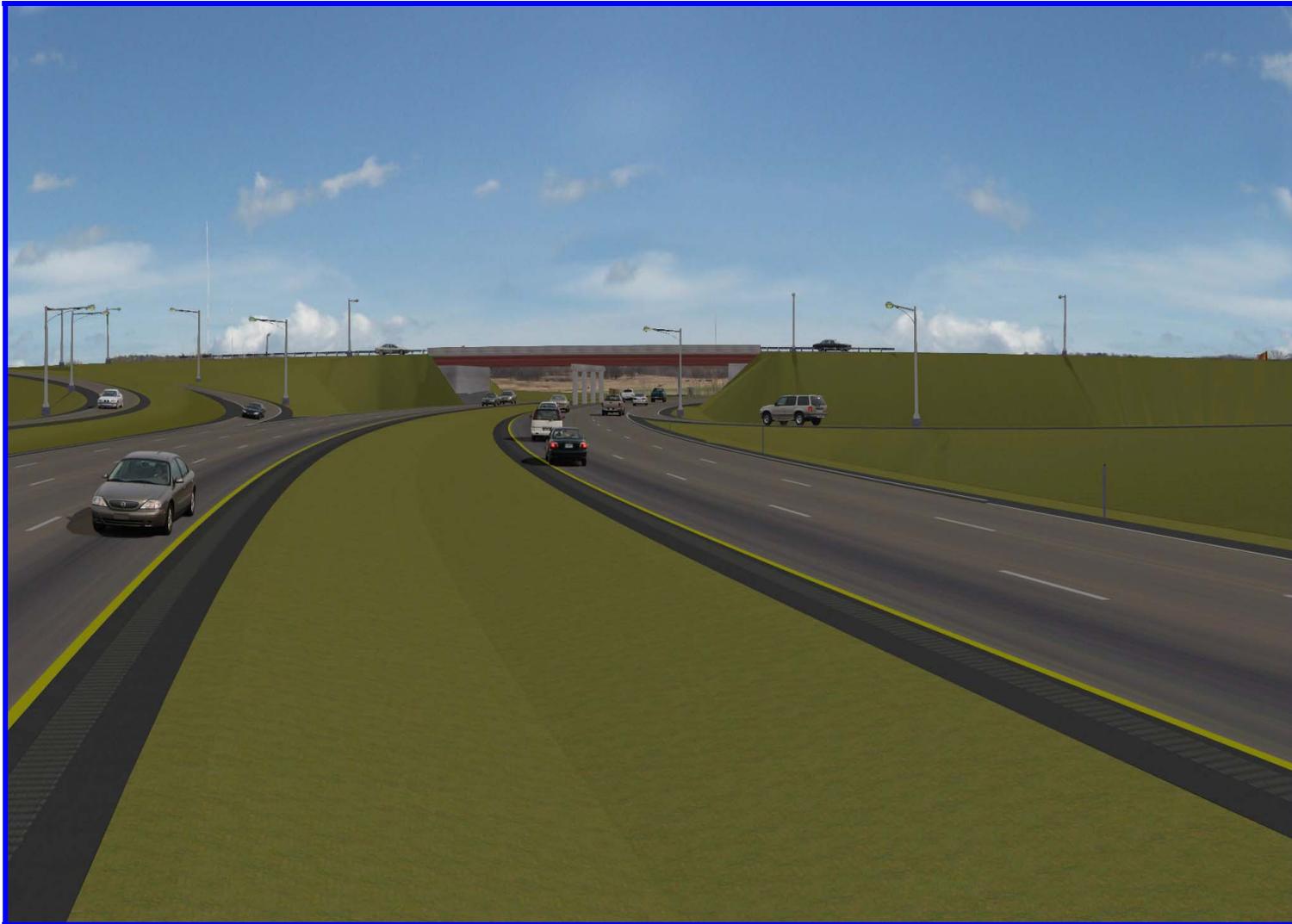


Figure 2.3. Visualization of grade-separated Kirby Parkway's approach to Walnut Grove Road from trumpet interchange



Figure 2.4. Looking east at Walnut Grove Road and the completed Walnut Grove Road Bridge (as of June 2008); Humphreys Boulevard/Walnut Grove Road intersection in background; project study area in foreground (source: www.walnutgroveroad.com)

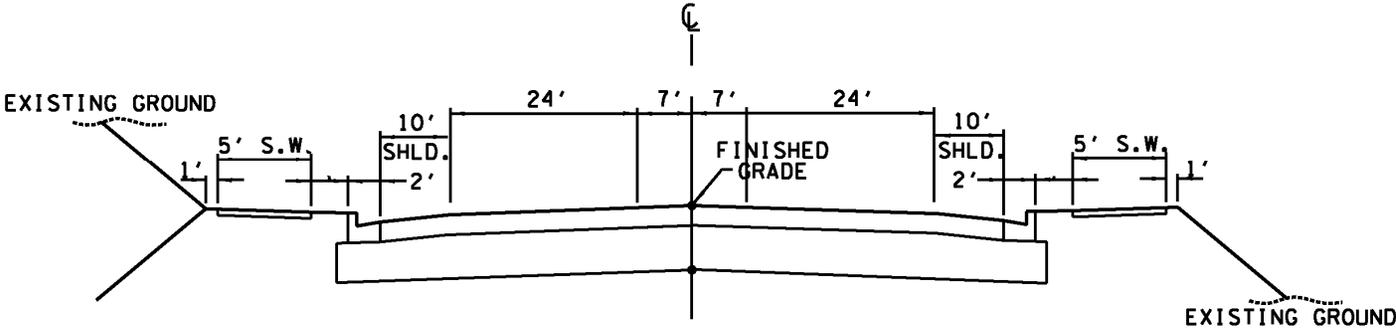
Table 2.1. Kirby Parkway Design Criteria for the Selected Alternative, Q

KIRBY PARKWAY DESIGN CRITERIA			
DESIGN ELEMENT	MULLINS STATION RD to MACON RD	WALNUT GROVE RD to MULLINS STATION RD	KIRBY PKWY INTERCHANGE w/ WALNUT GROVE RD
Classification	Urban Arterial	Urban Arterial	
Access	By Permit	Partial-Controlled	
Design Speed	40 mph	40 mph	20 mph
Posted Speed	35 mph	35 mph	20 mph
Minimum Curve Radius	955 ft	955 ft	135 ft
Maximum Grade	4%	4%	6%
ROW	106 ft	220 ft	
Number of Lanes	4	4	
Lane Width	12 ft	12 ft	
Center Turn Lane	14 ft		
Shoulder Width	10 ft (each side)	6 ft (inside) 12 ft (outside)	6 ft (each side)
Median	None	Variable	
Sidewalk	5 ft (each side)		
Minimum Stopping Sight Distance	300 ft	300 ft	

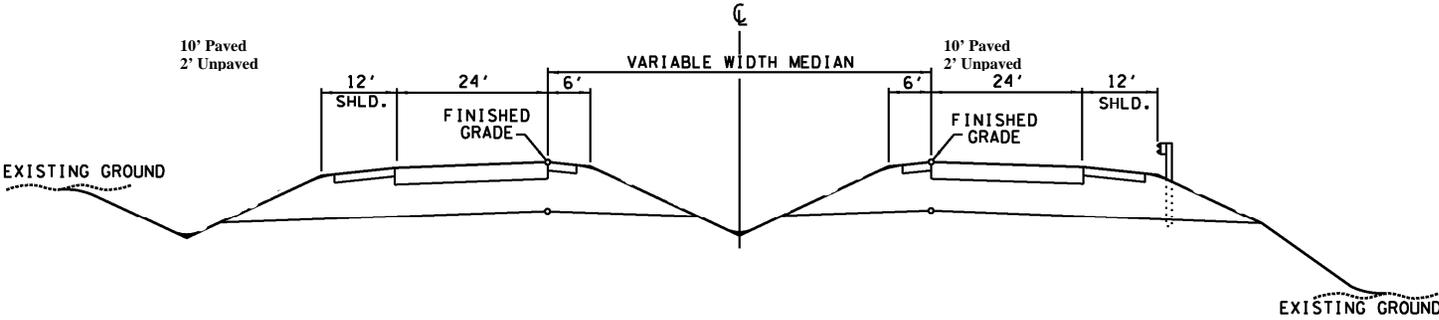
The Selected Alternative was considered by the Shelby Farms Advisory Team to best meet their project goals, receiving the highest recommendations and endorsement from them and from the project design team. The Selected Alternative would serve directly the local communities as well as a large regional population. It stands to provide the best access possible between I-40 and Poplar Avenue for residential (particularly subdivisions along Whitten Road), employment, and commercial areas, as well as provide new and improved access to Shelby Farms recreation areas for vehicular and non-vehicular traffic. The Selected Alternative will impact roughly the same level of streams and wetlands as the other explored alternatives. In summary, the Selected Alternative would not be expected to produce any significant long-term adverse social, economic, or environmental impacts for the project area.

Figure 2.5 shows the Selected Alternative typical section. Figure 2.6 shows profile for Alternative Q's trumpet interchange from Station 70+00 to Station 95+00. Proposed Kirby Parkway is 11 to 38 feet above existing elevation. Figure 2.7 presents the scope of the project's study area and land use map. See Figure 2.8 for a visual depiction of the Selected Alternative.

Mullins Station to Macon Rd



Walnut Grove to Mullins Station



4-Lane Section

Figure 2.5. Alternative Q typical section

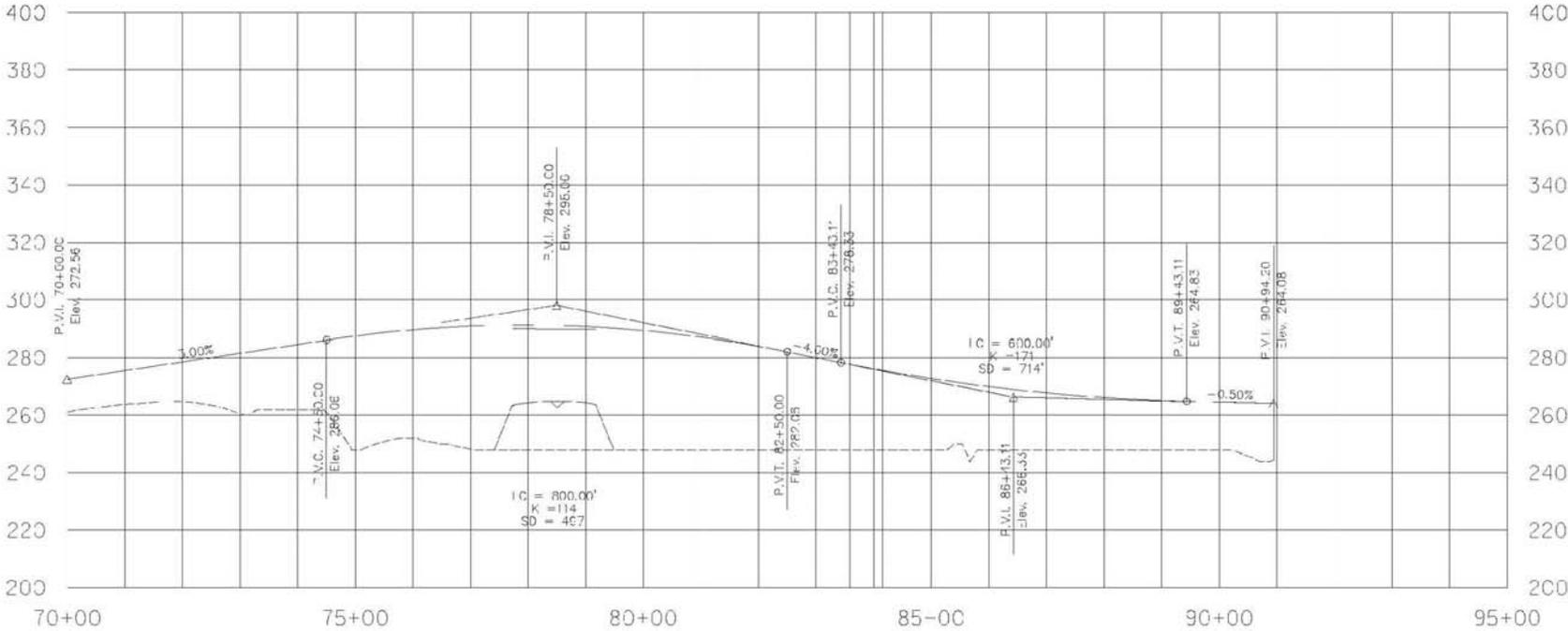


Figure 2.6. Alternative Q trumpet interchange profile from Sta. 70+00 to Sta. 95+00

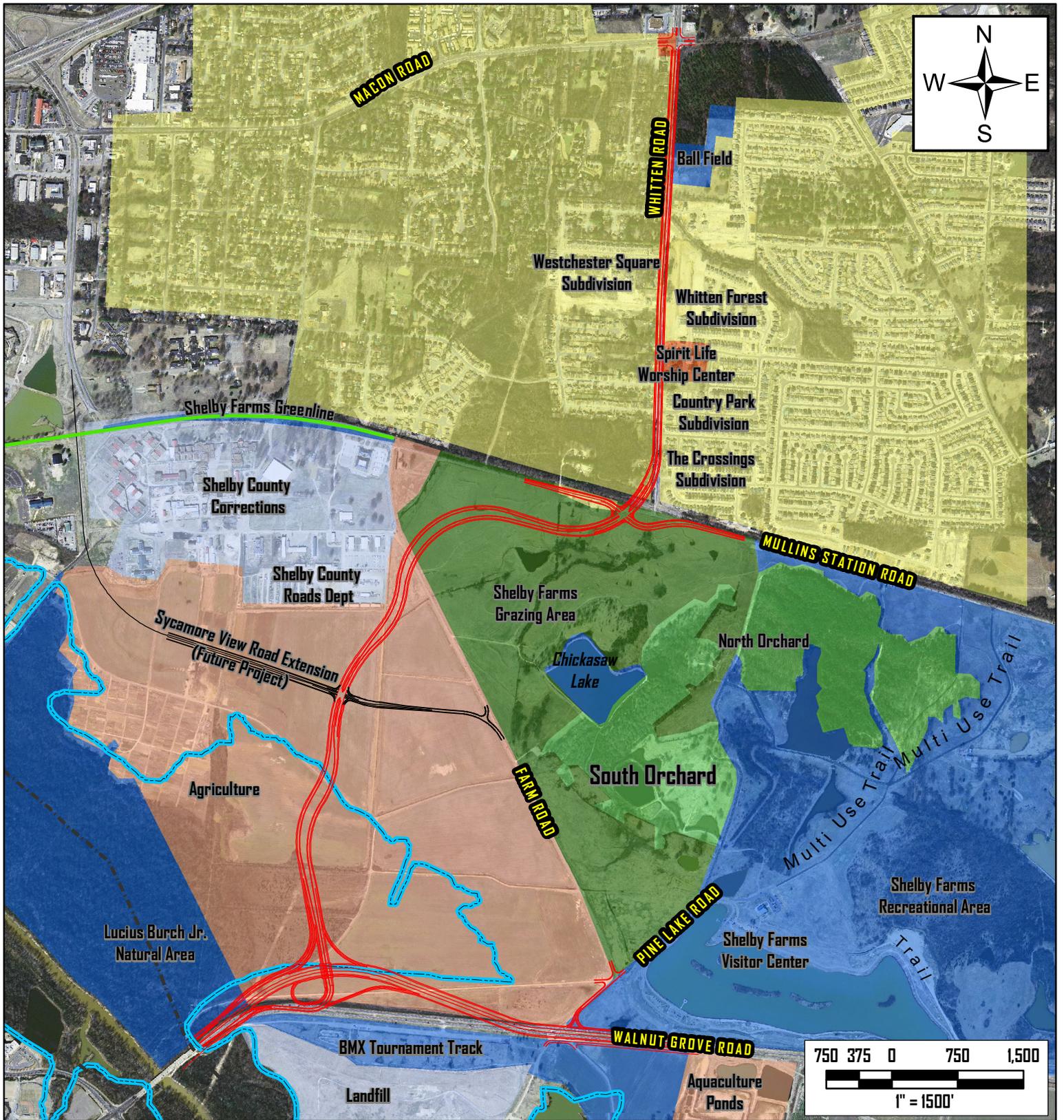
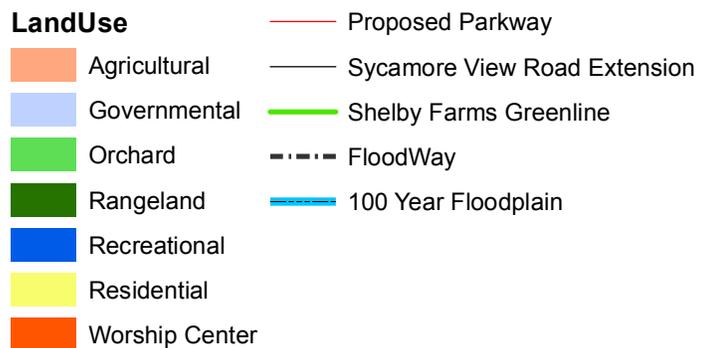


Figure 2.7
Proposed Kirby Parkway Area Land Use

Memphis, Shelby County, Tennessee



In response to public comment regarding use of land south of Walnut Grove Road, a landfill feasibility study was performed on the 130-acre Shelby County Landfill located at 6791 Walnut Grove Road. The objective was to assess the feasibility of constructing roadway elements, specifically ramps associated with the interchange, within the limits of the current landfill facility. The feasibility study is discussed in more detail in Section IV.M.2.

Three conceptual interchange alignments were under consideration, one of which (“Option 1”) was the original Alternative Q interchange as described in the SDEIS; it was previously thought to not encroach upon the landfill. The others included a base alignment wherein no construction elements were assumed to be located within the current facility footprint (“No Impact”) and an alignment that encroached upon the current facility footprint (“Option 2”) to a greater extent than Option 1 (see Figure 2.8).

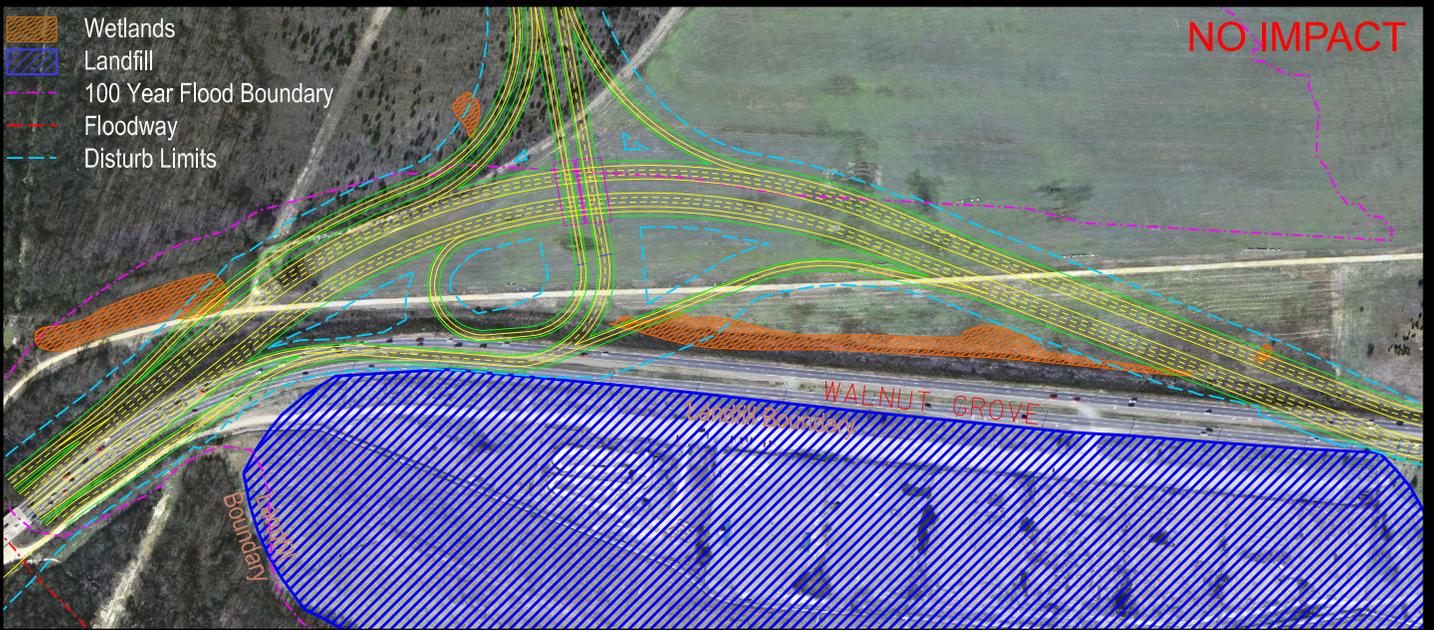
For Options 1 and 2, three approaches were considered:

- construction of roadway foundation elements bearing directly across waste materials (with or without conventional sub-grade improvements);
- construction of roadway foundation elements that penetrate waste materials (i.e., deep foundation elements); and
- removal of waste materials and replacement with suitable engineered fill.

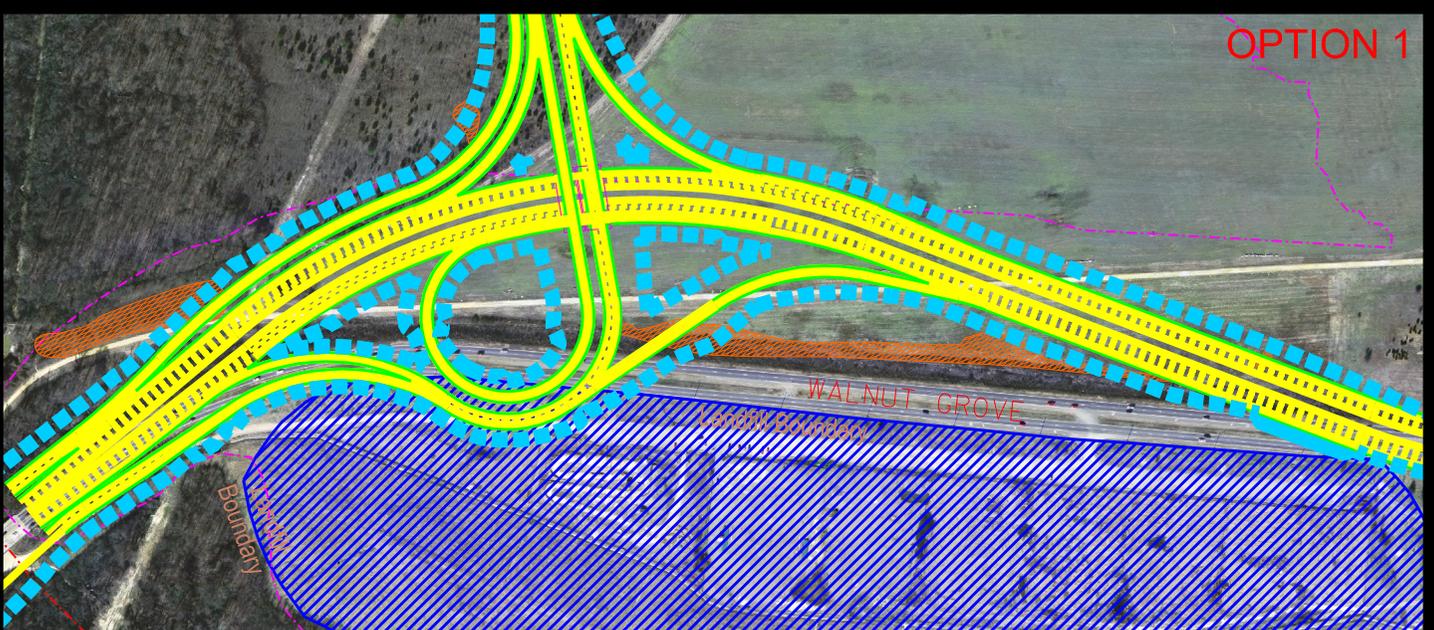
Based on the modeling approach used to assess the options presented above, it was estimated that 93,800 cubic yards of waste materials would be excavated for Option 1 and 651,600 cubic yards would be excavated for Option 2. The costs associated with these alternatives range from roughly \$6.4 million for Option 1 and \$33.4 million for Option 2. In a July 31, 2008 meeting, the Advisory Team accepted the study, and they decided to proceed without moving the interchange south of Walnut Grove Road into the landfill facility. Therefore, in order to eliminate the costs associated with Option 1 or 2, the Project Team elected to move the interchange ramp slightly north by keeping the southern edge of the future right-of-way within the existing right-of-way of Walnut Grove Road (“No Impact”; see Figure 2.8). As a result, the ramp design speed was reduced from 25 mph to 20 mph.

-  Wetlands
-  Landfill
-  100 Year Flood Boundary
-  Floodway
-  Disturb Limits

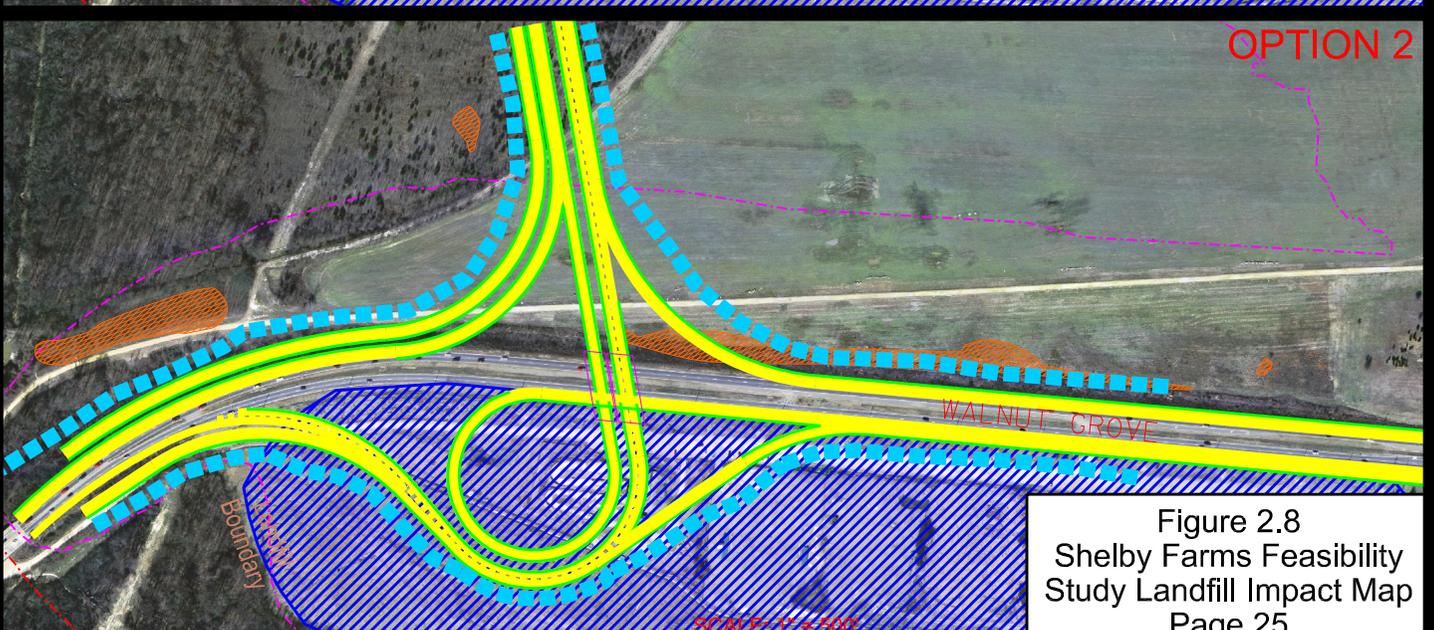
NO IMPACT



OPTION 1



OPTION 2



SCALE: 1" = 500'

Figure 2.8
Shelby Farms Feasibility
Study Landfill Impact Map
Page 25

II.B. Previously Considered Alternative – Alternative L

Alternative L, from Walnut Grove Road to Mullins Station Road, was to be constructed with a 220-foot right-of-way, four 12-foot traffic lanes (two in each direction), and curb and gutter on the inside with a 40-foot raised median. From Mullins Station Road to Macon Road, the right-of-way for Alternative L equaled 100-feet, with four 12-foot traffic lanes, a 14-foot center turn lane, 10-foot shoulders, and curb and gutter on either side of the roadway. This section was designed with a 5-foot sidewalk on each side of the roadway. A travel speed of 40 mph was proposed for Alternative L. Alternative L included the construction of a new grade-separated interchange with Walnut Grove Road approximately 1,900 feet east of the newly constructed Wolf River Bridge and 3,500 feet west of the existing signalized intersection of Walnut Grove and Farm Road. The trumpet interchange required the relocation of Walnut Grove Road 450 feet to the north to provide for the loop ramp. This alternative provided Farm Road with right-in/right-out access to westbound Walnut Grove Road, while eliminating access to eastbound Walnut Grove Road. Travel speeds associated with the interchange/ramp system ranged from 20 to 40 mph.

From the Walnut Grove Road interchange, Alternative L was to travel in a northerly direction while curving to the west and back to the east, intersecting the proposed Sycamore View Extension at a 90^o angle. In contrast to the Selected Alternative, the travel lanes of Alternative L will parallel one another from Walnut Grove Road to the location of Mullins Station Road. The newly signalized Sycamore View intersection was designed to provide for traffic movements in all directions. The alignment continued north, curving east then west, crossing north of a gas regulator station located within the farm area, then east again before crossing the relocated Mullins Station Road at a slight skew. The signalized Mullins Station Road intersection was realigned to eliminate an existing skew and provide turn lanes on all approaches. Alternative L was to continue north along the existing alignment of Whitten Road to Macon Road (see Figure 2.10).

While Alternative L satisfied many current roadway deficiencies, it was eliminated by the Kirby Parkway Advisory Team because it lacked the desired aesthetic characteristics. Therefore, the most desirable features of Alternative L, particularly the trumpet interchange, were combined with the best features of Alternative M, another previously considered alternative, to create Alternative Q.

II.C. Previously Considered Alternative – Alternative M

During the project planning stages, Alternative M was considered for parkway design. As determined by TDOT, accompanied by concerns from the Shelby Farms Parkway Advisory Team, Alternative M was determined inadequate. Alternative M was to include four 12-foot traffic lanes (two in each direction), a variable-width median, and a variable right-of-way that stretched from Walnut Grove to Mullins Station. This alternative would use an independent roadway concept, wherein the grade and alignment would vary to blend the roadway into the natural topography. From Mullins Station Road to Macon Road, the right-of-way for Alternative M would be 100-foot, consisting of four 12-foot traffic lanes and a 14-foot center turn lane, 10-foot shoulders, and a curb and gutter on either side of the road. A 5-foot sidewalk was proposed for each side of the roadway.

Alternative M would have included a new interchange with a fly-over for eastbound traffic that used the proposed road. This alternative included a signalized intersection for vehicles traveling south and turning east on Walnut Grove Road. The proposed interchange was located along Walnut Grove Road approximately 2,000 feet east of the newly constructed Wolf River Bridge and 2,200 feet west of the existing signalized intersection of Walnut Grove and Farm Road. The fly-over interchange required Walnut Grove Road to be relocated off the existing roadway. This alternative provided Farm Road with right-in/right-out access to westbound Walnut Grove Road and eliminated access to eastbound Walnut

Grove Road. Alternative M traveled in a northerly direction curving to the west and back to the east intersecting the proposed Sycamore View Extension at 90° angle. The Sycamore View intersection was a signalized intersection that provided traffic movements in all directions. The alignment continued north curving east, crossing south of a gas regulator station located within Shelby Farms, then returned east before crossing the relocated Mullins Station Road at a slight skew. The signalized Mullins Station Road intersection was realigned to eliminate an existing skew and provided room for turn lanes on all approaches. Alternative M continued north along the existing alignment of Whitten Road to Macon Road (see Figure 2.11).

While Alternative M satisfied many current roadway deficiencies, it was eliminated by the Kirby Parkway Advisory Team because fly-over interchange failed to eliminate the present intersection conditions. In addition, the fly-over interchange was not visually pleasing and was located closer to the Farms than Alternative L. Therefore, the most desirable features of Alternative M, particularly the typical section, were combined with the best features of Alternative L, another previously considered alternative, to create Alternative Q.

II.D. Alternative Considered – No Build

A No Build Alternative was also under consideration. The No Build Alternative would have left the existing road as it currently stands with only maintenance activities performed as necessary. However, selection of the No-Build alternative would leave the area with a deficient, poorly linked, and functionally obsolete transportation network. If the existing roadway were to remain, traffic conditions would be expected to decline according to projected traffic analysis figures for years 2010 and 2030. Residential development along Whitten Road and locations outside the project's study area may worsen the current conditions and, thus, not satisfy the purpose of and need for traffic improvements. The area's inaccessibility via foot or bicycle would not improve in its current state. Overall, the No Build Alternative does not satisfy the purpose and need.

DESIGN CRITERIA

DESIGN SPEED 40 MPH
4 LANE TYPICAL SECTION
VARIABLE MEDIAN WIDTH

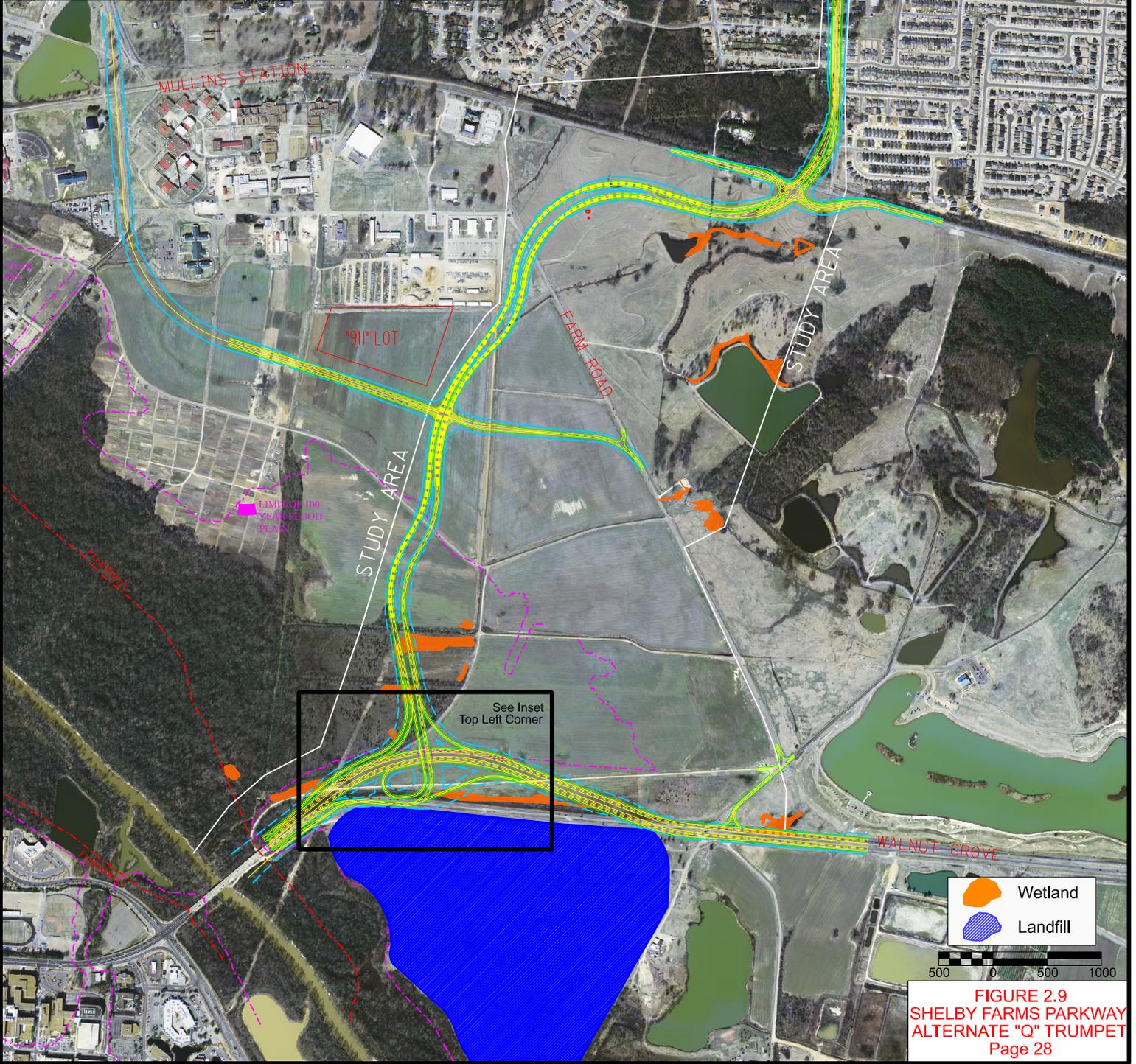
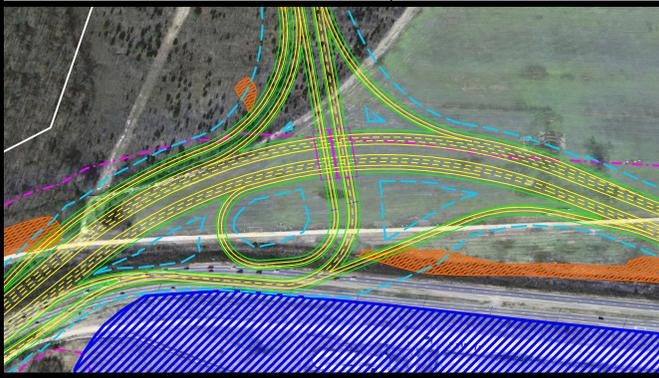
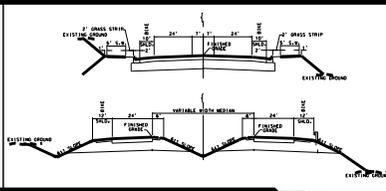
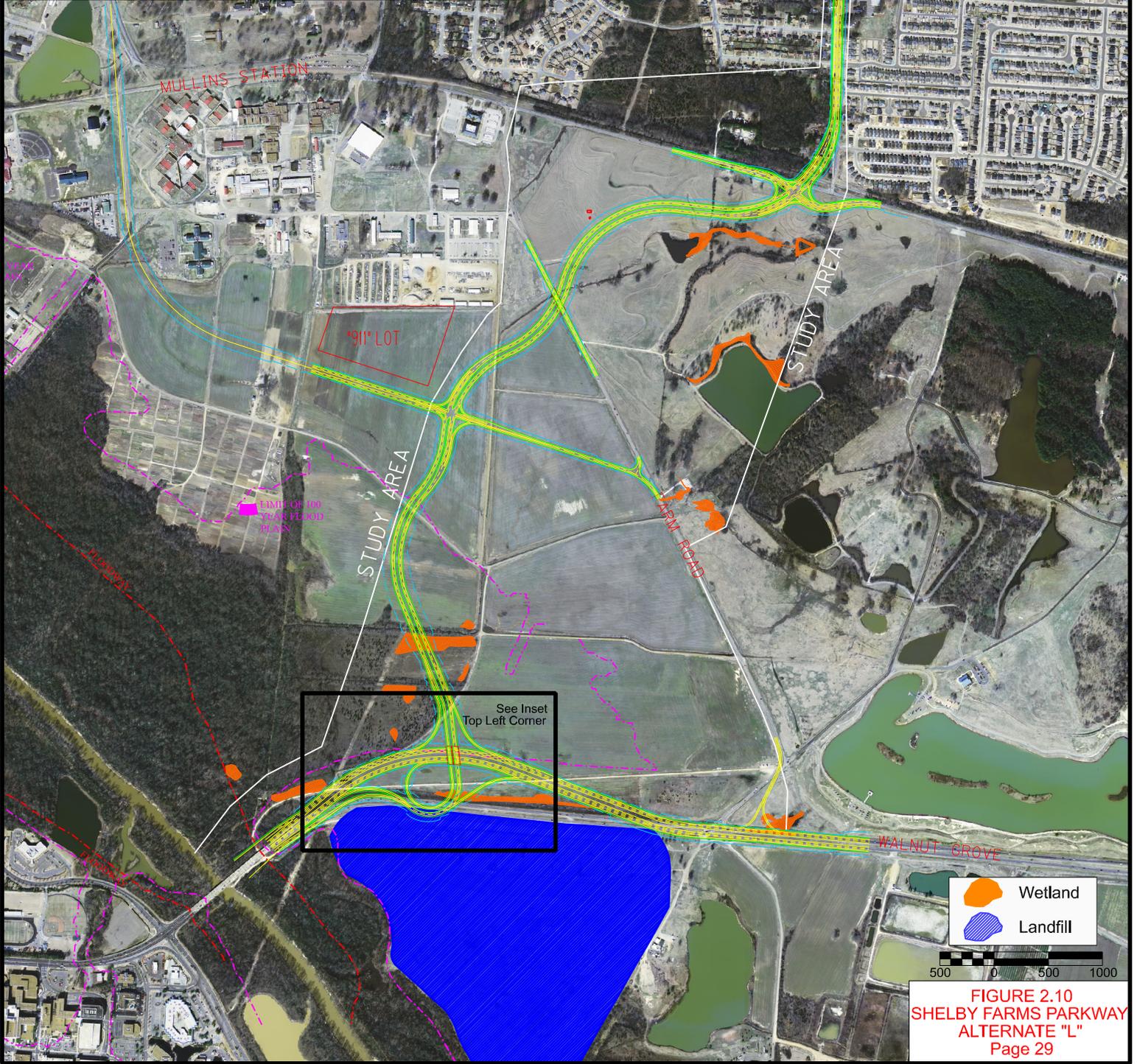
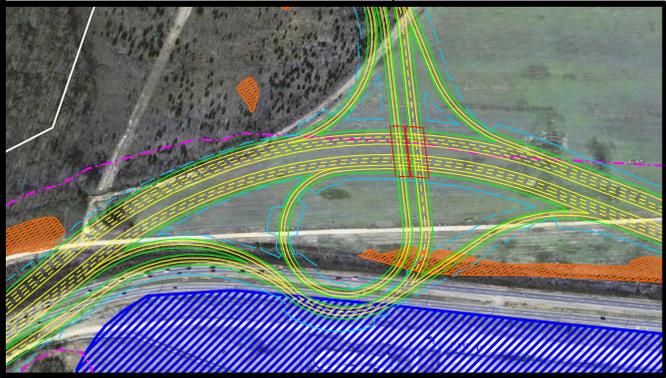
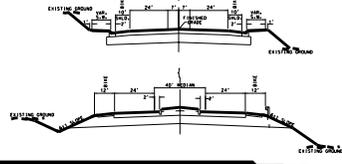


FIGURE 2.9
SHELBY FARMS PARKWAY
ALTERNATE "Q" TRUMPET
Page 28

DESIGN CRITERIA

DESIGN SPEED 40 MPH
4 LANE TYPICAL SECTION
40 FOOT MEDIAN WIDTH



See Inset
Top Left Corner

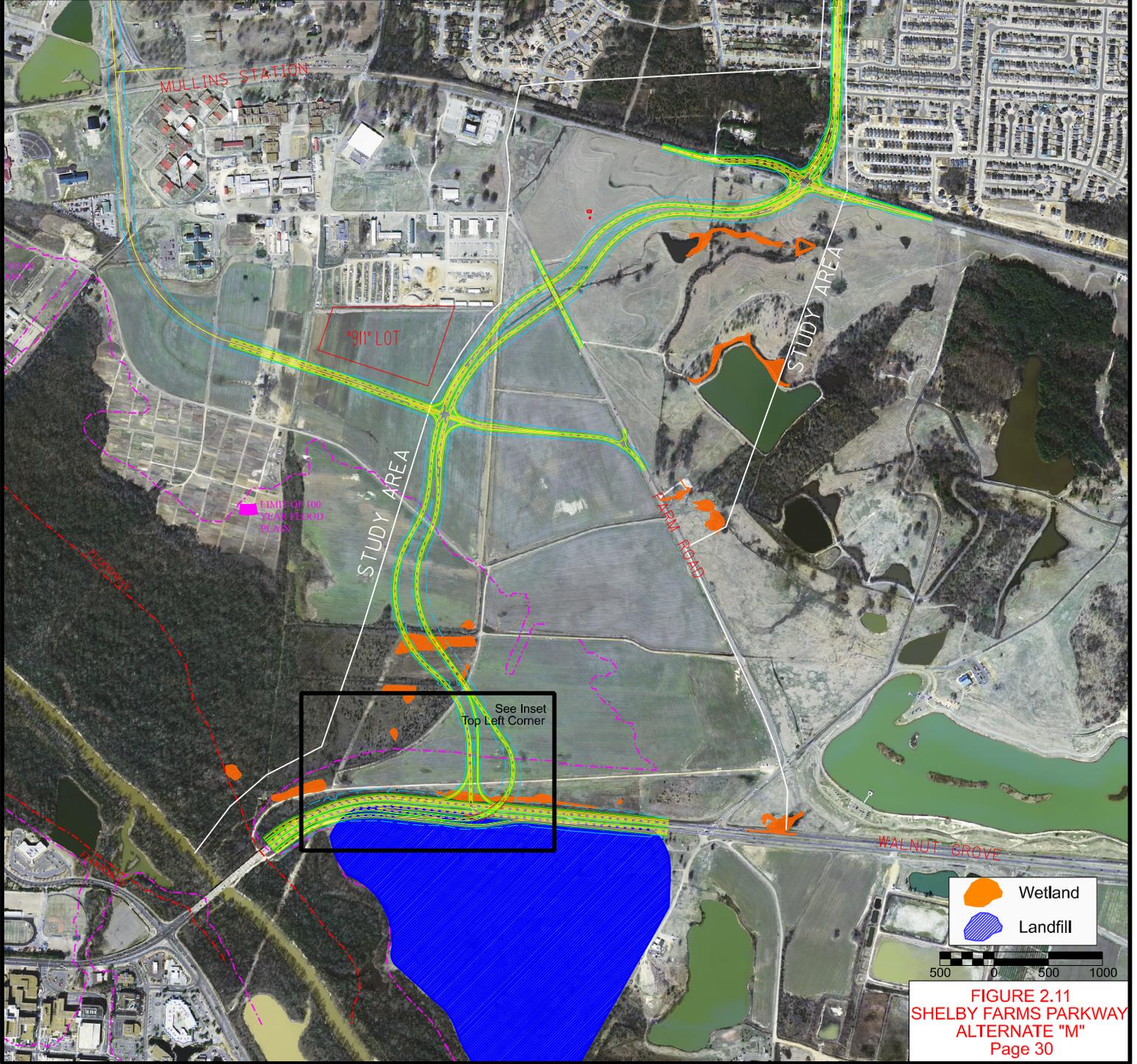
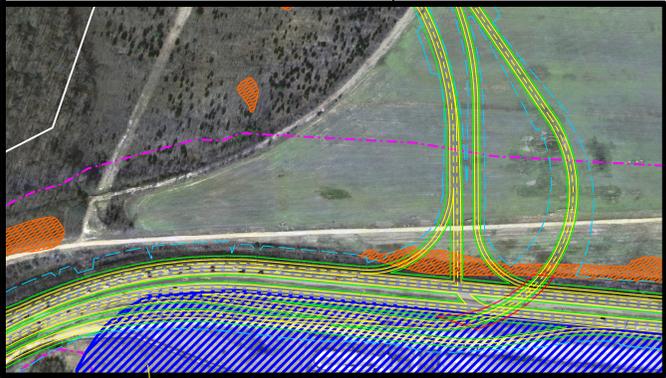
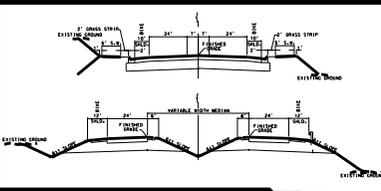
- Wetland
- Landfill



FIGURE 2.10
SHELBY FARMS PARKWAY
ALTERNATE "L"
Page 29

DESIGN CRITERIA

DESIGN SPEED 45 MPH
4 LANE TYPICAL SECTION
VARIABLE MEDIAN WIDTH



See Inset
Top Left Corner

- Wetland
- Landfill

FIGURE 2.11
SHELBY FARMS PARKWAY
ALTERNATE "M"
Page 30

III. AFFECTED ENVIRONMENT

This section provides a summary description of the social, economic, and physical environmental setting for the area affected by the alternatives. The project study area is situated in east Memphis, Tennessee. The description of the area is general in nature applying to the entire project area. Detailed study area data, which were utilized to prepare this section, are provided in the Technical Reports prepared for the project. Very few changes in the affected environment and setting of the project area have occurred since the FEIS and the FEIS Reevaluation were circulated.

During the development of this project over the past several decades, additional environmental studies, environmental reevaluations, and new or supplemental environmental documents were conducted. These studies and documents outlined the potential environmental impacts to the project area.

III.A. Socioeconomic Setting

III.A.1. Project Area Population

In 2000, the project area is represented by Census Tracts 211.22, 211.23, and 212 was 21,355 according to U.S. Census data. This figure increased 33.2% from 14,273 in 1990. Population figures for the study area labor market and Shelby County population projections are shown in Tables 3.1 and 3.2. In a little over twenty years, Shelby County is expected to grow 27%.

Table 3.1. State, local, and regional population figures, 1990 v. 2000

STATE, LOCAL and REGIONAL POPULATION		
	1990	2000
Shelby County	826,330	897,472
Census Tracts	14,273	21,355
Memphis MSA	N/A	650,100
Tennessee	4,877,185	5,689,283

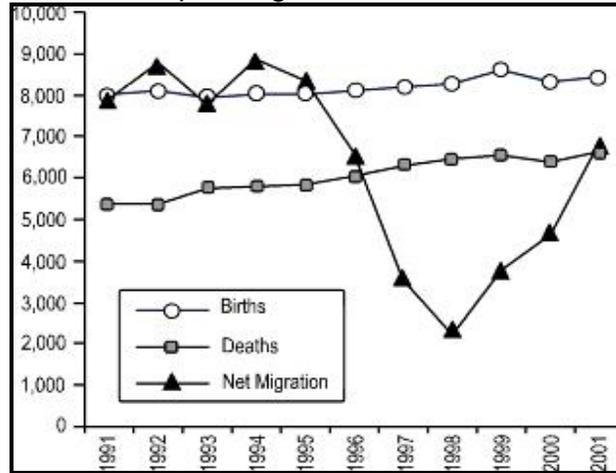
Table 3.2. Twenty-one year (1999-2020) population projections for study area labor market

POPULATION PROJECTIONS FOR SHELBY COUNTY		
Year	1999	2020
Population	869,379	1,106,610

Source: Shelby County Metropolitan Planning Commission (Tables 3.1 and 3.2)

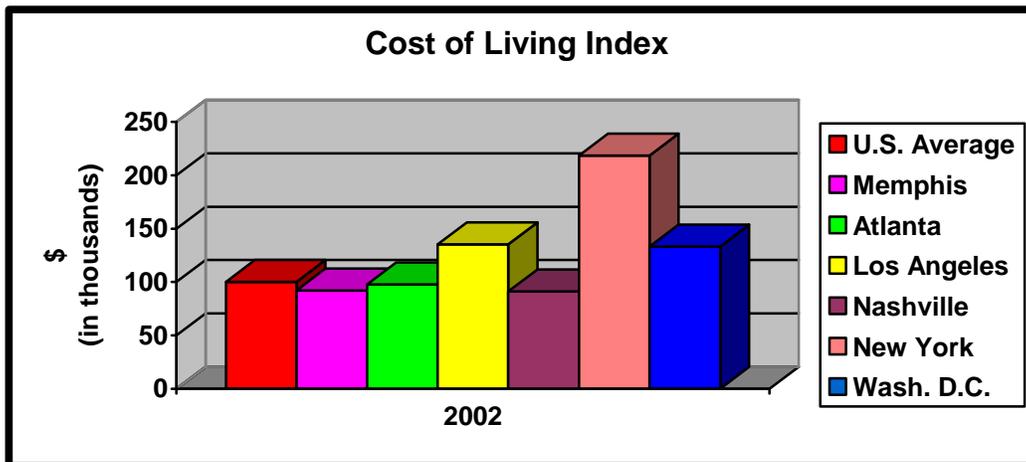
Growth or decline of a city's population can be determined by three factors, births, deaths, and migration. In Memphis, the number of births and deaths has been very stable and predictable over the past several years, yet the Memphis MSA has increased by 9,850 in size from 1992 to 1997. The number of people that have relocated to Memphis and Shelby County each year has fluctuated widely. Domestic in-migration (movement of families from some other part of the U.S.) was as low as 2,519 and as high as 15,159. Migration, and its rates of variation, is a direct function of the attractiveness of Memphis MSA and the perceived unattractiveness of the places people choose to leave (See Table 3.3). This trend is expected to continue to increase due to the attractiveness of the Memphis MSA and the opportunity for future expansion.

Table 3.3. Memphis migration tendencies, 1991-2001



Another factor in migration to the area is the cost of living index. Memphis' index is the second lowest in the compiled city data. Nashville, Tennessee has the lowest cost of living among six selected U.S. cities, while the cost of living in New York City, New York more than doubles that of Memphis (See Table 3.4).

Table 3.4. 2002 Memphis and other national cost of living indices



Expansion Management magazine's 2003 annual list of the "50 hottest cities" for relocating or expanding companies ranked Memphis 5th on this list in a January article. These rankings are based on a survey of consultants who assist businesses locate to new facilities. *Site Selection* magazine also ranked the Memphis MSA 5th for new and expanded facilities in 2002 behind Chicago, Detroit, Cincinnati, and New York. The same issue of *Site Selection* ranked Memphis 6th in investment behind Chicago, New York, Detroit, Washington, DC, and Cincinnati. Source: Conway Data Inc.'s New Plant Database, *Site Selection* magazine, January 2003. Memphis was ranked the 16th least expensive city for corporate headquarters in a January 2004 study. In this study, the Memphis economic development program is a positive factor fueling Memphis' reputation as a prime relocation area, naming it one of the most respected, forward-thinking programs in the country. *Site Selection* magazine ranked the Technicolor Home Entertainment Services expansion in Memphis the nation's 12th largest economic development deal of the year for job creation and the 17th largest for square footage.

III.A.2. Project Area Wages and Income Status

Memphis ranks higher in per capita income than the state of Tennessee and Census Tracts. Per capita personal income in Census Tracts increased 37.1 percent from \$13,243 in 1990 to \$21,064 in 2000. The state experienced an increase 32.5 percent and the U.S. had an increase in per capita of 33.2 percent during the same period. Household income had similar gains over the same period (See Tables 3.5 and 3.6). The city of Memphis more than doubled its household income and did so at a rate much faster than any other area investigated.

Table 3.5. Project area, state, and national per capita incomes, 1993 v. 2002

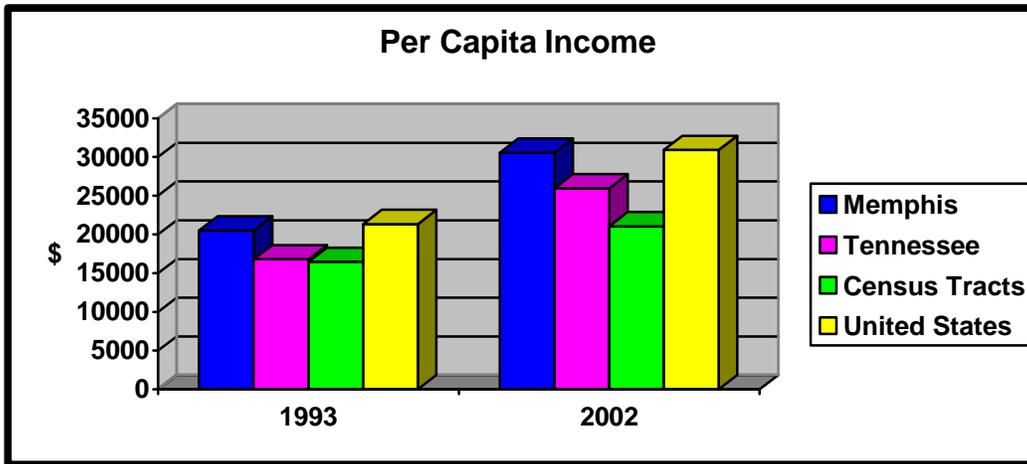
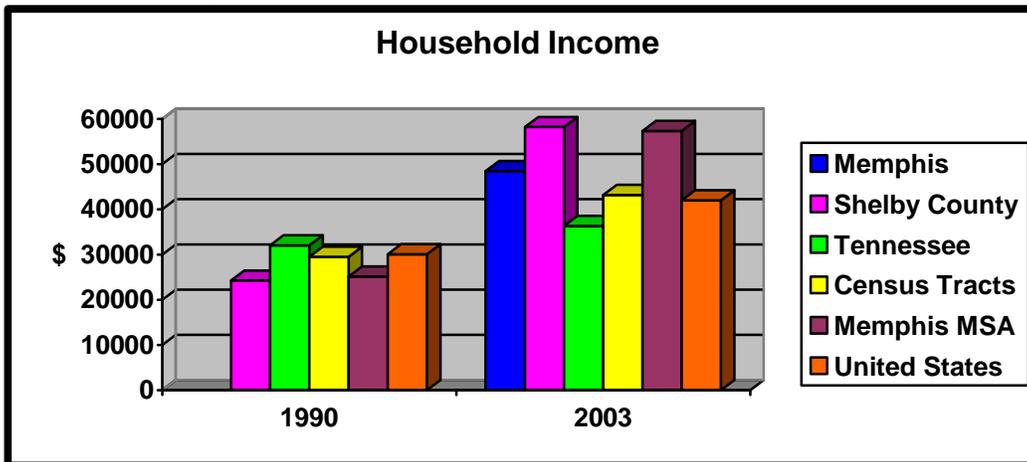
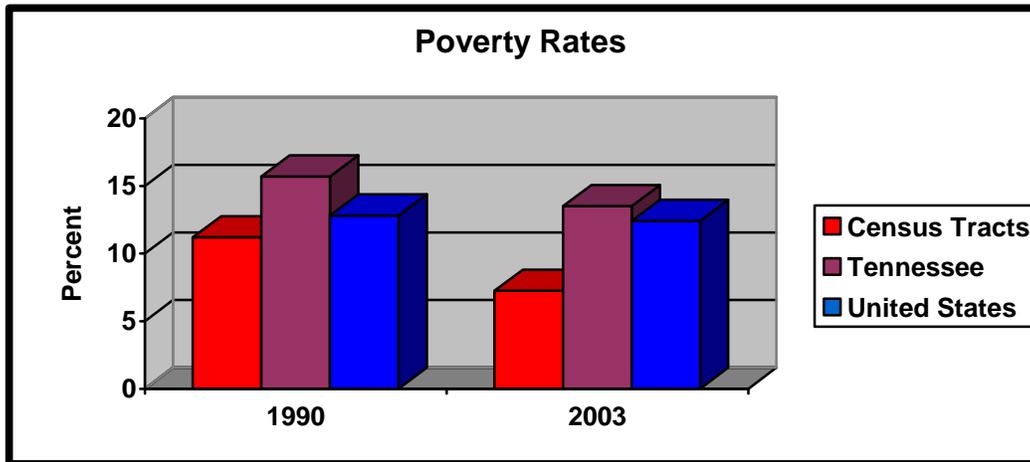


Table 3.6. Project area, state, and national household incomes, 1990 v. 2003



In 2000, Census data showed that 7.25 percent of individuals in the Census Tracts were below the poverty level (See Table 3.7). This represents the smallest percentage in the Memphis MSA, well below that of both Tennessee and United States levels. Poverty rates dropped in all areas considered for comparison.

Table 3.7. Project area, select Tennessee County, and national poverty rates, 1990 v. 2003



Most living in the Memphis MSA work away from the home and reach their employment destinations via personal vehicle. Roughly 72.7 percent of employees travel under thirty minutes and choose to drive alone 78.1 percent of the time. Combined, only 5.7 percent of workers utilize public transportation and/or walk. Table 3.8 outlines mean travel time for commuting to work in 2000.

Table 3.8. Percent method and length of travel to work in Memphis MSA

COMMUTING INFORMATION MEMPHIS MSA	
Method	Percentage
Drives alone	78.1%
Carpools	13.7%
Walks	2.9%
Public transportation	2.8%
Works at home	1.5%
Other	1.0%
Travel Time	Percentage
Under 10 minutes/home	15.9%
10 - 29 minutes	56.8%
30 - 59 minutes	19.9%
60 + minutes	2.5%
Average time:	21 minutes

Source: U.S. Bureau of the Census, 2000

III.A.3. Project Area Age Distribution

In 2003, the largest ten-year age group for the county was 35-44 years (15.1 percent) followed by 25-34 years (14.3 percent). The smallest age groups were the 85+ years with 1.2 percent of the population surveyed, followed by 3.6 percent in the 75-84 years age group. All other ten-year age groups fall between these percentages. Age groups were evenly dispersed with regard to gender (See Table 3.9).

Table 3.9. Percent population by age for Memphis, Shelby County, and Memphis MSA

PERCENT POPULATION BY AGE *			
	Memphis	Shelby County	Memphis MSA
Under 5 Years	7.6%	7.4%	7.4%
5 to 13 Years	13.7%	13.9%	13.9%
14 to 17 Years	6.0%	6.1%	6.1%
18 to 24 Years	10.9%	10.0%	9.9%
25 to 34 Years	14.9%	14.3%	14.0%
35 to 44 Years	14.2%	15.1%	15.2%
45 to 54 Years	13.1%	14.1%	14.1%
55 to 64 Years	8.6%	8.9%	9.1%
65 to 74 Years	5.6%	5.3%	5.5%
75 to 84 Years	4.0%	3.6%	3.5%
85 + Years	1.5%	1.2%	1.2%

Source: ACCRA Demographics Now

*based on 2003 estimates

III.A.4. Project Area Ethnic Composition

According to the 2000 U.S. Census, of the 20,355 people living in the project area Census Tracts, only 24.7 percent were of the Black race. This represents less than half (61.6 percent of the 2003 estimate*) of the Black race living in the City of Memphis. The consistent trend from the 2000 U.S. Census and the 2003 ACCRA estimate reveals more Blacks are migrating towards the city while Whites are migrating away from the city. The majority of the Black population lives in Memphis, more specifically, downtown Memphis, where a more diversified population exists (See Table 3.10). A more detailed account of individual race by percent of total population is presented in Table 3.11.

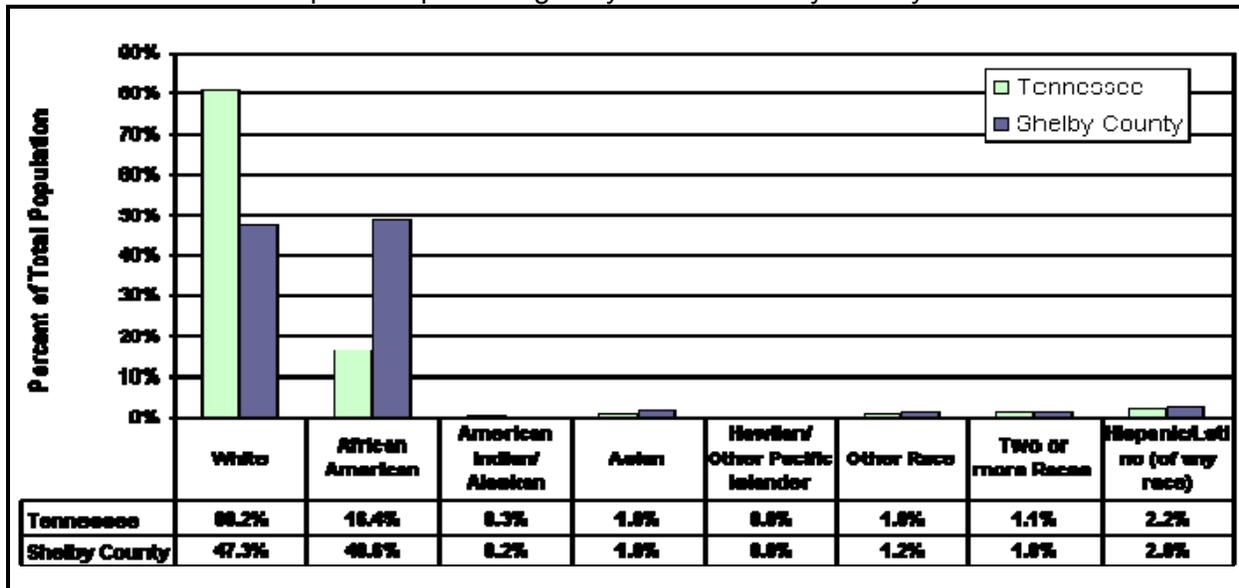
Table 3.10. Race by percent for Memphis, Shelby County, and Memphis MSA

RACE*			
	Memphis	Shelby County	Memphis MSA
White	34.2%	47.0%	53.1%
Black	61.6%	48.9%	43.2%
Asian	1.5%	1.7%	1.4%
Other	2.7%	2.4%	2.3%

Source: ACCRA Demographics Now

*based on 2003 estimates

Table 3.11. Population percentages by race for Shelby County and Tennessee

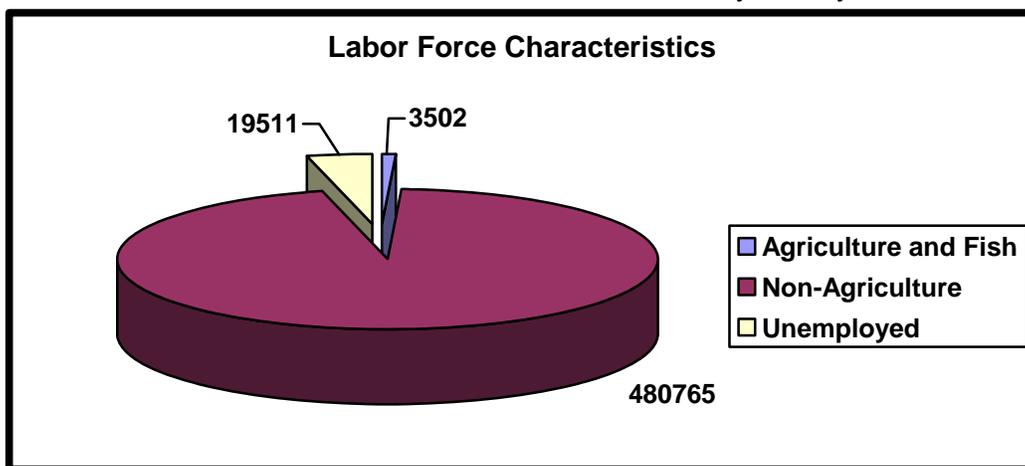


Source: The Tennessee Advisory Commission on Intergovernmental Relations, based on 2000 U.S. Census Data

III.A.5. Project Area Labor Characteristics

The 2000 civilian labor force in Shelby County was 500,276, with an average unemployment rate of 4.5% (December 2001). Rates for Shelby County were the same as the statewide average and lower than the national level of 4.7 percent. Characteristics of the Shelby County labor force are shown in Table 3.12.

Table 3.12. Labor force characteristics for Shelby County, 2000



In 2003, Shelby County's labor market area rate of unemployment was 6.2 percent, while Tennessee's was 5.8 percent (See Table 3.13). The economy in the labor market area is based on the incomes that local residents earn working outside the project area. The area shows a very strong employment status that may have benefited by the increasing migration into the region.

Table 3.13. Local, state, and National unemployment rates, 1996-2003

UNEMPLOYMENT RATES	1996	1997	1998	1999	2000	2001	2002	2003
Memphis MSA	4.4%	4.6%	3.8%	3.7%	3.8%	4.2%	5.2%	6.2%
Shelby County	4.4%	4.7%	3.8%	3.8%	3.9%	4.2%	5.3%	6.4%
Tennessee	5.2%	5.4%	4.2%	4.0%	3.9%	4.4%	5.1%	5.8%
United States	5.4%	4.9%	4.5%	4.2%	4.0%	4.7%	5.8%	6.0%

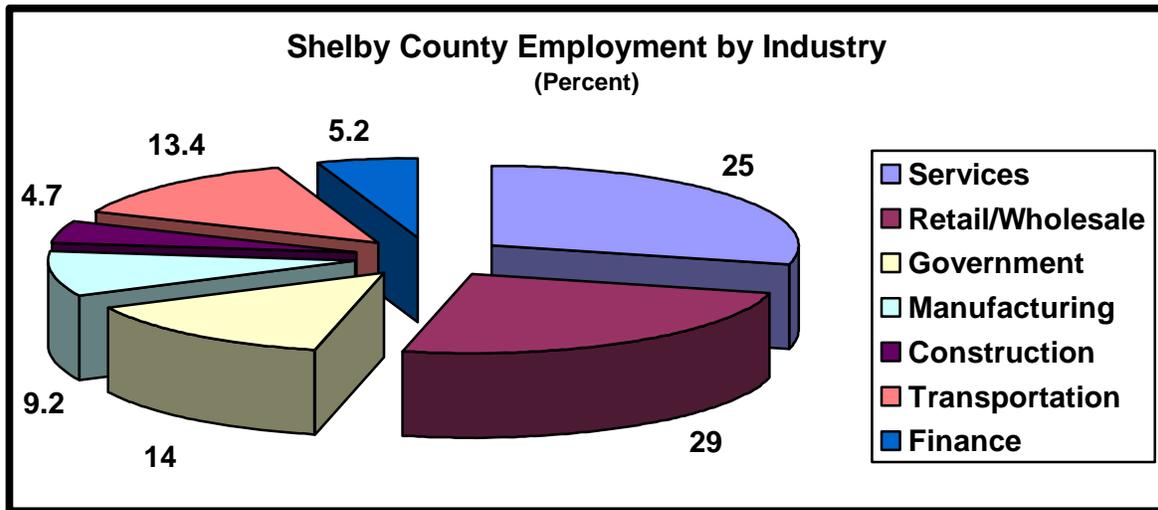
A diversified economy is credited for the stability of local employment and wages. Total county employment in 2000 was 500,276, including self-employed and agricultural workers, up 5 percent from the previous year. Tennessee and Shelby County nearly mirror one another's employment distribution by industry. As illustrated in Table 3.14, roughly 10 percent more individuals are employed in the manufacturing sector at the State level than Shelby County. However, Shelby County has double the transportation, communications, and utilities employment base as does the State of Tennessee.

Table 3.14. Shelby County and Tennessee percent employment by major industry, 2000

Employment by Major Industry	Tennessee	Shelby County
Agriculture, Forestry & Fishing	0.7%	0.7%
Mining	0.1%	0.0%
Construction	4.6%	4.4%
Manufacturing	19.6%	9.2%
Durable Goods	11.4%	4.1%
Non-durable Goods	7.6%	5.1%
Transportation, Communications & Utilities	6.6%	13.4%
Trade	23.4%	24.9%
Wholesale Trade	5.2%	7.5%
Retail Trade	18.2%	17.4%
Finance, Insurance & Real Estate	4.7%	5.2%
Services	25.4%	28.6%
Government	14.7%	13.4%
Federal	2.1%	3.2%
State	3.1%	1.9%
Local	9.6%	8.4%
Total Employment All Industry	2,563,629	500,276

A depiction of Shelby County's employment by industry is located in Table 3.15. Service and retail/wholesale industries make up the majority of private sector employment. Employment through government positions accounts for 14 percent of all of Shelby County opportunities.

Table 3.15. Shelby County percent employment by industry, 2000



III.A.6. Project Area Agriculture

Shelby County ranked 36th out of 95 in the State of Tennessee for total agricultural products sold with \$23,731,000. As of 2002, crop sales accounted for \$21,895,000 of sales, while livestock sales reached only \$1,835,000. Cash receipts shrank 21 percent from \$29,891,000 in 1997. Soybeans and cotton are the top crop items raised in Shelby County. Accompanying the decline in total sales, the number of farms and the County’s total farm acreage decreased, 21 percent and 18 percent respectively; however, the average farm size increased slightly from 157 acres to 162 acres. In the study area, corn is grown in addition to soybean and cotton.

III.A.7. Project Area Social and Economic Setting Summary

Since the Environmental Reevaluation of the FEIS was completed in 2001, several new subdivisions have been developed along Whitten Road, including The Crossings, Country Park, Whitten Forest, and Westchester Square. These newly built, single-family dwellings along Whitten Road start from the \$120,000’s. Although rapid residential development has occurred in this area, vacant properties and parcels are currently available for relocation.

Many employment opportunities exist within and adjacent to the study area. The Shelby County Corrections Office and Shelby County Roads Department have offices west of Farm Road. In this immediate vicinity, a future emergency call center has been planned for, while development has begun on the Shelby County Humane Society Headquarters. Many people work and/or volunteer at the Shelby Farms Visitors’ Center and its surrounding properties. Located west of the proposed parkway, on Walnut Grove Road, a school and a number of commercial buildings housing business offices will become more accessible and travel will become safer upon project completion. Within the next 15 years, the Shelby County Government has planned for an additional employment corridor near Nonconnah Creek, south of Germantown along TN 385.

Shelby Farms provides excellent recreational opportunities for nearby residents, the general public, and passers by. Guests from all walks of life, who make use of the Farms throughout the day, enjoy the approximately 4,500 acres of preserved forest and grasslands, multi-use trails, waters, and gardens. It is physically bounded by the Wolf River, Mullins Station Road, Raleigh LaGrange Road, and Germantown Parkway.



Figure 3.1. Shelby Farms Visitors' Center and one of the many paths available to guests as viewed from Farm Road

III.B. Existing Land Use and Land Cover

The study area contains a varied mix of land uses and land covers, which reflect the needs of the nearby communities. Individual land types are clustered in the study area (see Figure 2.4). Religious centers and residential subdivisions tend to border Whitten Road, north of Mullins Station Road. The majority of governmental and commercial uses can be found to the south of Mullins Station Road and west of Farm Road, while lands to the east of Farm Road are reserved for recreational uses.

In the study area, many of the former agricultural lands are now fallow grasslands or have been converted to other uses, such as recreational, commercial, and/or governmental. The biotic community of western Tennessee has been defined as a mixed oak-hickory forest characteristic of the upland southeast general region. This includes the earlier designation of mixed mesic and western mesic forests that defined for the area. By the mid nineteenth century, the forests were cut and cleared for cultivation with an emphasis on cotton. Within 100 years, the loess upland soils had become heavily eroded, and cotton cultivation became less successful. The marginal upland soils were abandoned for agriculture and left fallow or converted to pasture. The abandoned fields have started successive growth to a pine forest subclimax, and hardwood species are succeeding the pine forest.

The Friends of Shelby Farms organization officially began protecting Shelby Farms from large development in the early 1970s. Much of Shelby Farms is grassland and forest cover; recreational trails and activity sites, such as the Lucius E. Burch Natural Area and the Shelby Farms Park Visitors' Center, were added over the years, while bison and longhorn cattle can be seen grazing in nearby protected pasturelands. The study area has not been void of development. Currently, on the west side of Farm Road, an emergency call center has been planned for and development has begun on the Shelby County Humane Society Headquarters.

The Shelby County Government controls planning for all of Shelby County, including the City of Memphis and the study area. Zoning and planned development recommendations for the study area are made by the Memphis and Shelby County Land Use Control Board in cooperation with the Shelby County Board of Commissioners. In 1999, the Shelby County Government developed a 20-year plan for the County's rural and planned growth areas, particularly in east central Shelby County. In this

Plan, the Shelby County Government and the Metropolitan Planning Organization site the relevance of infrastructure to land use and development. Rapid, high-density development outside the study area, particularly in Bartlett and Germantown, increases the need for infrastructure planning and improvements through Shelby Farms and the residential area of Whitten Road. Within the next five years, many roads, known as “Priority One Roads”, adjacent to the study area will be constructed and/or improved per the Shelby County Growth Plan to absorb increases in commuting.

IV. ENVIRONMENTAL IMPACTS

IV.A. Air Quality

An air quality analysis was performed to determine if the proposed Shelby Farms Parkway in Memphis, Tennessee could contribute to decreased air quality within the project corridor by exceeding National Ambient Air Quality Standards (NAAQS). The level of air quality is determined by the concentrations of air pollutants in the atmosphere. An air pollutant is a contaminant in the air in a large enough concentration to have an adverse affect on public health or welfare. The U.S. Environmental Protection Agency (EPA) has identified seven air pollutants of national concern including carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}), sulfur oxides (SO_x), and lead (Pb). FHWA requires the development of an air quality technical base study and the modeling of CO to determine and compare calculated existing and future concentrations with the NAAQS.

Section 107 of the 1990 Clean Air Act Amendments requires the EPA to publish a list of all geographic areas in compliance with the NAAQS, as well as those not in attainment with the NAAQS. Areas not in compliance with the NAAQS are designated nonattainment areas. Areas with insufficient data to make a determination are designated as unclassified areas and are treated as being in attainment areas until proven otherwise. The designation of an area is made on a pollutant-by-pollutant basis. Shelby County, Tennessee is a part of the Metropolitan Memphis Interstate Air Quality Control Region. Currently, Shelby County is a marginal nonattainment area for the eight-hour ozone standard, being designated June 15, 2004; Memphis is a maintenance area for CO. For all other criteria pollutants listed above, Shelby County is designated as in attainment.

IV.A.1. Air Quality Results

For the Shelby Farms Parkway, a hot spot microscale analyses was performed for the Existing Alternative and the No-Build Alternative for the years 2010, 2026, and 2030 and Alternatives L and M for the same years. Alternative Q combines the trumpet interchange of Alternative L and the bifurcated mainline of Alternative M. The air quality conditions for both Alternative L and M were evaluated as separate instances. The combination of these results determines the air impacts for Alternative Q. Areas for analysis incorporate both the maximum traffic volumes and the presence of sensitive receptors, to model worst-case conditions in a free flow scenario. Within the project corridor, Walnut Grove Road in the vicinity of the future intersection with Alternatives L and M, was determined to meet the criteria for calculating maximum one-hour and eight-hour carbon monoxide concentrations. One-hour CO concentrations were obtained directly from the CAL3QHC model runs. Eight-hour CO concentrations were calculated by subtracting the one-hour background concentration of 4.7 ppm from the total one-hour concentrations calculated by the CAL3QHC model. The remainder was then multiplied by a persistence factor of 0.7. To this value, an eight-hour background concentration of 3.1 ppm was added to arrive at the eight-hour concentrations.

For the Existing Alternative, a maximum one-hour CO concentration of 9.9 ppm and a maximum eight-hour CO concentration of 6.8 ppm were calculated at Receptor 1 of Alternative L. For the No-Build Alternative, a maximum one-hour CO concentration of 9.2 ppm and a maximum eight-hour CO concentration of 6.3 ppm were calculated for Receptor 1 of Alternative L when analyzed for the year 2010. For Alternative L, the maximum one-hour and eight-hour CO concentrations of 5.5 ppm and 3.7 ppm, respectively, occur at Receptor 1 for the years 2010, 2026, and 2030. For Alternative M, the maximum one-hour and eight-hour CO concentrations of 6.0 ppm and 4.0 ppm, respectively, occur at Receptor 1 occur at Receptor 1 for the year 2030.

The calculated one-hour and eight-hour CO concentrations are listed in Table 4.1 and 4.2. The analysis shows that carbon monoxide levels for all alternatives in the hot spot analysis are below the one-hour standard of 35.0 ppm and the eight-hour standard of 9.0 ppm. Therefore, carbon monoxide levels within the remainder of the project corridor will also remain below both the one-hour and eight-hour standards.

Table 4.1. Alternative L, current and projected carbon monoxide concentrations

CARBON MONOXIDE CONCENTRATIONS, ppm										
RECEPTOR	2005 Existing		2010 / 2026 / 2030 (same response)		2010 No Build		2026 No Build		2030 No Build	
	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr
R1 Located on South ROW of Alt L; 46' and 76' south of Ramps B and B3, respectively	9.6	6.5	5.5	3.7	9.2	6.3	8.0	5.4	8.1	5.5

Table 4.2. Alternative M, current and projected carbon monoxide concentrations

CARBON MONOXIDE CONCENTRATIONS, ppm												
RECEPTOR	2005 Existing		2010 Build		2026 Build		2030 Build		2010 No Build		2026 / 2030 No Build (same response)	
	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr
R2 Located on South ROW of Alt M at Shelby Farms BMX Track; 34' of Humphreys Blvd to Walnut Grove Ramp	6.0	4.0	5.9	3.9	5.8	3.9	6.0	4.0	5.9	3.9	5.6	3.7
<i>Same as or Less than existing levels</i>												

According to the calculated existing microscale emissions of carbon monoxide, the maximum carbon monoxide concentrations in 2005 were 9.9 ppm for one-hour concentrations and 6.8 ppm for eight-hour concentrations. The maximum CO concentrations for 2026 are 8.0 ppm for one-hour concentrations and 5.4 ppm for eight-hour concentrations. The maximum CO concentrations for 2030 are 8.1 for one-hour concentrations and 5.5 ppm for eight-hour concentrations. The analysis shows that carbon monoxide concentrations for all receptors analyzed are below the one-hour standard of 35.0 ppm and the eight-hour standard of 9.0 ppm.

IV.A.2. Air Quality Maintenance

The proposed project is located in an air quality maintenance area effective August 31 1994, with respect to carbon monoxide and a nonattainment area effective June 15, 2004, with respect to ozone. A maintenance area is defined as one, which has been redesignated from a nonattainment area to one, which has attained the national primary ambient air standard for a specific pollutant. A revised State Implementation Plan (SIP) must provide for maintenance of this standard for at least ten years after the redesignation. The project is contained in the Transportation Improvement Program (TIP) Fiscal Years 2011 through 2014 for the Memphis Urbanized area on page 61 (project number STP-M-2006-10); and in the Memphis Metropolitan Area Long Range Transportation Plan (LRTP) for the Year 2030. The 2030 LRTP demonstrates air quality conformity as required by the 1990 Clean Air Act Amendments. As compared to existing conditions, fewer stop conditions and fewer VMT will exist; therefore, no impacts to air quality are expected.

Any increase in particulate matter in the air due to construction activities will be temporary and will not be detrimental to the health and welfare of local residents. Dust pollution during construction may be an unavoidable, minor nuisance and every feasible effort will be made to minimize this problem via

standard dust suppression methods (Tennessee Road and Bridge Construction Specifications). Exhaust from construction equipment will have an insignificant effect on the ambient air quality. Any open air burning will be done in compliance with Tennessee state regulations and local laws and ordinances. Care will be taken to insure burning is done only along the right-of-way at the greatest practicable distance from dwellings, highways, and airfields and not when atmospheric conditions are such as to create a hazard or nuisance to the public.

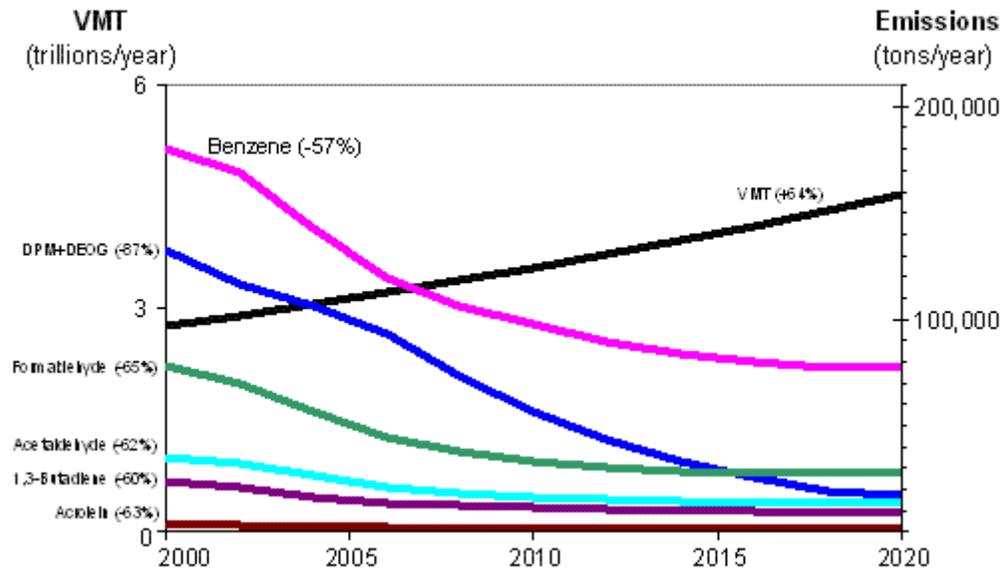
IV.A.3. Mobile Source Air Toxics

In addition to the criteria pollutants for which there are National Ambient Air Quality Standards (NAAQS), EPA also regulates air toxics. Most air toxics originate from human-made sources including on-road mobile sources, non-road mobile sources (e.g., airplanes), area source (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources, 66 FR 17229 (March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs: reformulated gasoline (RFG) program; national low emission vehicle (NLEV) standards; Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements; and the proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3 butadiene, and acetaldehyde by 57% to 65%, and reduce on-highway diesel PM emissions by 87%, as shown in the following graph. As a result, EPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. The agency is preparing another rule under authority of CAA Section 201(I) that will address these issues and could make adjustments to the full 21 and six primary MSATs.

U.S. Annual Vehicle Miles Traveled (VMT) vs. Mobile Source Air Toxics Emissions, 2000-2020



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

IV.A.3.a. Mobile Source Air Toxic (MSAT) Health Impacts

The construction of Kirby Parkway through Shelby Farms in Shelby County, Tennessee, includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the alternatives in the Kirby Parkway project. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Information that is Unavailable or Incomplete: Evaluating the environmental and health impacts from MSATs on a proposed highway would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- **Emissions:** The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to

predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE 6.2 for particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE 6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability of MOBILE 6.2 to estimate MSAT emissions. MOBILE 6.2 is an adequate tool for projecting emissions trends and performing relative analysis between alternatives for very large projects, but is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- **Dispersion:** The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The NCHRP is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.
- **Exposure Levels and Health Effects:** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupported assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this

information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATS:

Research into the health impacts of MSATs is ongoing. For different emissions types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposures to toxics have been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at <http://www.epa.gov/iris>. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen based on limited evidence in humans and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male or female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust (DE)** is likely to be carcinogenic to humans by inhalation from environmental exposures. **Diesel exhaust** as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary non-cancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of

mobile source pollutants, and other topics. The final summary of the studies is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes - - particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community:

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have “significant adverse impacts on the human environment”.

In this document, a qualitative assessment of MSAT emissions relative to the various alternatives and has acknowledged that the 2010 No-Build Alternative, 2026 No-Build Alternative, 2030 No-Build Alternative, 2010 Alternative Q Build Alternative, 2026 Alternative Q Build Alternative, and 2030 Alternative Q Build Alternative may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

IV.A.3.b. Qualitative Analysis

For the No-Build Alternative and the Alternative Q Build Alternative, the amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each of the listed alternatives. Because the VMT estimated for the 2010, 2026,, and 2030 No-Build Alternatives are lower than the 2010, 2026, and 2030 Alternative Q Build Alternatives, higher levels of regional MSATs are expected from the Alternative Q Build Alternatives compared to the No-Build Alternatives for the years 2010, 2026, and 2030, respectively, see Table 4.3.

Future emissions will likely be lower than present levels in the design year as a result of EPA’s national control programs that are projected to reduce MSAT emissions by 57 to 87 percent from 2000 to 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

Because of the specific characteristics of the project alternative [i.e. new connector roadways], localized areas in each alternative where VMT would increase may exist; whereas in other areas, VMT would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along the new roadway sections that would be built from north of Macon Road to the proposed Walnut Grove Road Interchange under the Alternative Q Build Alternative and along Macon Road, Whitten Road, and Walnut Grove Road. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

In the design year, it is expected that MSAT emissions associated with VMTs of the Alternative Q Build Alternative will increase in the immediate area relative to the No-Build Alternative; however, emissions are expected to decrease due to EPA's MSAT reduction programs. In comparing the project alternative with the No-Build Alternative, MSAT levels could be higher in some locations than others, but current tools and science are not adequate enough to quantify them. However on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will cause substantial reductions over time that in almost all cases will cause region-wide MSAT levels to be significantly lower than today.

Table 4.3. Average Daily Traffic (ADT) and project Vehicle Miles Traveled (Daily VMT)

Facility	2010 No-Build		2010 Build		2026 No-Build		2026 Build		2030 No-Build		2030 Build	
	ADT	VMT										
Macon Road	14,670- 20,510	12,220	15,150- 20,740	12,487	21,670- 31,950	18,814	24,550- 32,890	19,936	23,470- 34,810	20,463	23,900- 35,930	21,799
Whitten Road	10,560- 14,090	11,429	7,800- 14,250	8,786	10,600- 21,780	11,800	13,600- 22,440	15,215	10,610- 23,470	11,892	15,100- 24,490	16,875
Mullins Station Road	11,560- 13,650	17,014	11,720	15,442	15,670- 20,290	23,048	7,550- 17,650	17,868	16,180- 22,470	24,524	6,500- 19,140	18,474
Farm Road	17,244	24,854	17,244	24,599	18,080	26,058	18,080	25,791	18,290	26,360	18,290	26,091
Walnut Grove Road	46,360- 54,250	90,939	45,140- 54,100	89,860	50,380- 75,850	105,102	52,320- 77,300	111,557	51,840- 81,280	108,707	55,640- 83,100	118,942
Alternative Q Mainline			13,400- 17,800	13,044			24,500- 32,700	23,864			27,300- 36,400	26,588
Walnut Grove Road/ Alternative Q Interchange			690- 17,520	22,492			960- 18,220	27,100			1,070- 19,300	28,903
Total VMT		156,455		186,711		184,872		241,332		191,946		257,672

IV.A.3.c. MSAT Mitigation Strategies

Lessening the effects of mobile source air toxics should be considered for projects with substantial construction-related MSAT emissions that are likely to occur over an extended building period, and for post-construction scenarios where the NEPA analysis indicates potentially meaningful MSAT levels. Such mitigation efforts should be evaluated based on the circumstances associated with individual projects and they may not be appropriate in all cases. However, there are a number of mitigation strategies and solutions for countering the effects of MSAT emissions.

Mitigating for Construction MSAT Emissions: Construction activity may generate a temporary increase in MSAT emissions. Project-level assignments that render a decision to pursue construction emission mitigation will benefit from a number of technologies and operational practices that should help lower short-term MSATs. In addition, the SAFETEA-LU has emphasized a host of diesel retrofit technologies in the law's CMAQ provisions-technologies that are designed to lessen a number of MSATs.

Construction mitigation includes strategies that reduce engine activity or reduce emissions per unit of operating time. Operational agreements that reduce or redirect work or shift times to avoid community exposures can have positive benefits when sites are near vulnerable populations. For example, agreements that stress work activity outside normal hours of an adjacent school campus would be operations-oriented mitigation. Also on the construction emissions front, technological adjustments to equipment, such as off-road dump trucks and bulldozers, could be appropriate strategies. These technological fixes could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions. The use of clean fuels, such as ultra-low sulfur diesel, also can be a very cost beneficial strategy.

The EPA has listed a number of approved diesel retrofit technologies; many of these can be deployed as emissions mitigation measures for equipment used in construction. This listing can be found at: www.epa.gov/otaq/retrofit/retroverifiedlist.htm.

Post Construction Mitigation for Projects with Potentially Significant MSAT Levels: Longer-term MSAT emissions can be more difficult to control, as variables such as daily traffic and vehicle mix are elusive. Operational strategies that focus on speed limit enforcement or traffic management policies may help reduce MSAT emissions even beyond the benefits of fleet turnover. Well-traveled highways with high proportions of heavy-duty diesel truck activity may benefit from active Intelligent Transportation System programs such as traffic management centers or incident management systems. Similarly, anti-idling strategies, such as truck stop electrification can complement projects that focus on new or increased freight activity.

Planners also may want to consider the benefits of establishing buffer zones between new or expanded highway alignments and areas of vulnerable populations. Modifications of local zoning or the development of guidelines that are more protective also may be more useful in separating emissions and receptors.

The initial decision to pursue MSAT emissions mitigation should be the result of interagency consultation at the earliest juncture. Options available to project sponsors should be identified through careful information gathering and the required level of deliberation to assure an effective course of action.

IV.A.4. Climate Change

Climate change, also referred to as global warming, is an increase in the overall average atmospheric temperature of the earth due to the trapping of heat in the atmosphere by greenhouse gases. The

primary greenhouse gas emitted by human activities in the US is CO₂, which represents approximately 85 percent of total greenhouse gas emissions.

Transportation sources contribute to global warming through the burning of petroleum-based fuel. According to the FHWA, transportation sources are responsible for approximately one-quarter of the greenhouse gas emissions in the US. Automobiles and light-duty trucks account for almost two-thirds of emissions from the transportation sector and emissions have steadily grown since 1990.

Emissions from transportation sources depend on the number of trips or miles traveled by each type of vehicle each year, which are, in turn, influenced by larger economic trends and consumer behavior. Over the long term, changes in vehicle fuel efficiency, driving behavior, and fuel type will influence the level of emissions.

Under the Clean Air Act, EPA has the authority to establish motor vehicle emissions standards for CO₂ and other greenhouse gases although such standards have not yet been established.

FHWA is actively involved in efforts to initiate, collect, and disseminate climate-change-related research and to provide technical assistance to stakeholders. FHWA is also involved in climate change initiatives with the USDOT Center for Climate Change and Environmental Forecasting.

Climate change and related effects are complex and global in nature. As a result, the impacts of any single transportation project cannot be effectively estimated in terms of global warming effect. However, the emissions changes due to individual projects are very small compared to global emissions.

Once standards are established and guidance for assessing the potential greenhouse gas effects of transportation projects becomes available, a more in-depth assessment may be possible.

IV.A.5. Indirect and Cumulative Air Quality Impacts

Existing indirect impacts on residential, commercial, and recreational areas along and within the project corridor are expected to continue as future traffic volumes increase with or without the construction of the proposed project. Future indirect impacts are also associated with the construction of the proposed project. Traffic patterns are expected to improve allowing for better transportation and delivery of products from residential and commercial areas in the vicinity of Macon Road to the remainder of the Metropolitan Memphis area.

IV.B. Noise

Federal guidance for handling noise impacts and abatement are contained in 23 Code of Federal Regulations (CFR) Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." Activity Categories B (Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals) and C (exterior of commercial structures and developed lands not included in Category B) are applicable to the receptors on this project. For Category B, the Noise Abatement Criteria (NAC) is 67 dBA L_{eq}. For Category C, the Noise Abatement Criteria (NAC) is 72 dBA L_{eq}.

IV.B.1. Alternative Results

Alternative Q combines the trumpet interchange of Alternative L and the bifurcated mainline of Alternative M. The noise conditions for both Alternative L and M were evaluated as separate instances. The combination of these results determines the noise impacts for Alternative Q. For Alternative L, four noise sensitive receptors were selected for modeling. Of the four receptors selected, one receptor equaled the

NAC and one receptor experienced an increase of 5 dBA or less over existing noise levels. For Alternative M, four noise sensitive receptors were also selected for modeling. Of the four receptors selected, one receptor exceeded the NAC, one receptor experienced an increase of 10 dBA over existing levels, and two receptors experienced an increase of 5 dBA or less over existing noise levels.

IV.B.2. Noise Abatement

Because Site 4 experiences a traffic noise impact with the proposed alternatives, the following possible abatement measures will be addressed: traffic management (traffic control devices and exclusive lane designations); alteration of horizontal and vertical alignments; installation of noise barriers.

The proposed road will be a four-lane parkway creating a new north-south route, which will assist in improving mobility and reducing congestion on existing facilities within the project corridor. The alteration of horizontal and vertical alignment is another noise abatement feature. This option is not feasible as alterations north of Mullins Station Road could create impacts to residential areas while impacting the aesthetics of Shelby Farms Park to the south of Mullins Station Road.

Noise barriers were determined to be the only logical abatement measure to reduce noise levels for the impacted area. Per Sections 2.1 and 2.2 of the Tennessee Department of Transportation Policy on Highway Traffic Noise Abatement, noise barriers must be feasible, obtaining a minimum of 7 dBA with a barrier height generally 20 feet or less and reasonable, i.e. in locations where frequent human use occurs. Site 4, where traffic noise impacts are predicted for both Alternative L and Alternative M, is located at a sports field where exposure to traffic noise impacts will be brief. Additionally, the proposed project calls for the construction of multipurpose paths/sidewalks at this location. Therefore, pursuant to Section 2.2.2 of the TDOT Policy on Highway Traffic Noise Abatement, installation of noise barriers for either Alternative L or Alternative M are not considered reasonable and are not recommended for the project. A landscaped berm was considered for Kirby Parkway, primarily as a visual screen rather than for noise abatement. The Resource Team decided to not incorporate the landscaped berm to maintain the aesthetic qualities of Shelby Farms. Since Alternative Q is a combination of Alternative L and Alternative M, and since noise barriers are not recommended for either Alternative L or M, noise barriers are also not recommended for Alternative Q. The final decision on implementation of abatement measures, particularly consideration of input from the public involvement process, will be made during the project design phase.

Construction procedures shall be governed by the Standard Specifications for Road and Bridge Construction as issued by TDOT and as amended by the most recent applicable supplements. The contractor will be bound by Section 107.01 of the Standard Specifications to observe any noise ordinance in effect within the project limits. Detoured traffic shall be routed during construction so as to cause least practicable noise impacts upon residential and noise sensitive areas.

IV.B.3. Indirect and Cumulative Noise Impacts

Indirect noise impacts occur as a result of other noise producing activities, which may occur due to the construction of the proposed project. An example of this type of impact would be the land use change from a recreational or residential setting to one of commercial development in the immediate vicinity of the proposed signalized intersections of the Shelby Farms Parkway with the Sycamore View Extension and Mullins Station Road. As the effects of noise decrease quickly with distance, it is expected that the separation between adjacent land uses of different types will prevent indirect noise impacts. Cumulative impacts would result from additional construction either planned or on-going located along I-40 to the north of the project corridor. However, cumulative impacts from this source are not expected due to the distance between the construction area and the project corridor. Traffic volumes are predicted to increase within the project corridor whether or not the proposed project is constructed. These volumes

would need to double from predicted levels for the year 2030 in order to produce an increase of 3 dBA in noise levels, which is regarded as a threshold where most people are able to notice a difference in noise levels when heard sequentially for comparison. Therefore, cumulative impacts with respect to changes in future traffic volumes are not anticipated.

IV.C. Aquatic Ecosystems

IV.C.1. Water Quality and Stream Impacts

An ecological study was conducted for the Reevaluation. Field investigations conducted during summer 2005 found that water resources in the vicinity of the proposed Kirby Parkway were the Wolf River, several intermittent blueline streams, channelized wet weather conveyances, and small wetland area. During the water quality assessment, no fisheries were found in the intermittent blueline stream or the wet weather conveyances in the project area. Prior to construction an NPDES permit, a USACE Section 404 and a Water Quality Section 401 permits will be required; a jurisdictional determination of whether intermittent blueline streams and channelized wet weather conveyances are considered waters of the U.S. will be completed. As a part of the permit application, each crossing of a water of the U.S. requires that each impact site (wetland or stream crossing) be considered a single and complete project; this will determine the appropriate permit type. All water bodies, wetlands, and floodplains are displayed in Figure 2.7 and 2.8.

The project alternatives would impact Wolf River and intermittent blueline streams. The stream impacts for each alternative are shown in Table 4.4. Alternatives Q has the shortest length of stream impact, while Alternative L has the longest. Efforts to minimize stream impact were made during preliminary design which reduced impact from 530 linear feet and 410 linear feet (Alternatives L and M, respectively) to 320 linear feet (Alternative Q). Further efforts will be made to reduce stream impacts from Alternative Q during final design.

Table 4.4. Streams to be relocated

Alternative	Linear Feet of Impact
Q	320
L	530
M	410

Short-term, direct impacts to aquatic habitats would occur during clearing, site preparation and construction. Stream impacts are expected to be minimal due to relocation or culvert placement in the intermittent streams. Erosion protection and sediment control measures, if properly installed and monitored, will eliminate sedimentation during construction. There will likely be short-term impacts to stream fisheries along the Wolf River due to reduced water quality from physical disturbances, such as rechanneling, bridge pier placement, or other in-stream construction operations. Such disturbances often displace larger fish while increasing mortality and impairing reproduction in smaller fish. Larval and youngest fish would be the most adversely affected because of their lessened mobility and narrow range of tolerance to disturbance and pollution. Project construction impacts to fisheries would be less during the months of September through March, and would greatly increase between April and August due to spawning activities and larval fish growth. A long-term impact on the fishery streams would be the loss of habitat from rechanneling, bank clearing, and stream filling, if required for project completion.

If several similar actions were to occur along the Wolf River, cumulative impacts would ensue. Projects thought to not have a severe impact would add to impairment of the river, and create an undesirable habitat. Indirect impacts would occur from increase development in the adjacent areas due to greater accessibility. More impervious surfaces would be located in close proximity to the river and lead to degraded water quality.

In response to the early coordination for the DSEIS, TDEC Division of Solid Waste Management called attention to the ground water monitoring wells located around the landfill and asked that care be taken not to disturb them during construction.

IV.C.2. Wetlands

Various types of wetlands exist in the study area, particularly in and around the Shelby Farms Grazing Area. National Wetland Inventory maps were analyzed to determine the type and size of these wetlands (see Appendix B). Those present are of the *Palustrine Open Water Permanently Flooded-Diked/Impounded* (POWHh) variety. Also present are *Palustrine Emergent Persistent Temporarily Flooded* (PEM1A) and *Palustrine Scrub-Shrub Broad Leaved Deciduous Temporarily and Seasonally Flooded* (PSS1A and PSS1C) wetlands. Located just south of Mullins Station Road, a wetland area, approximately 60 feet by 80 feet in size (0.1 acre), is associated with an intermittent blueline stream that trends from east to west. In the Wolf River floodplain, there exist several *Palustrine Broad-Leaf Deciduous Temporarily Flooded, Seasonally Flooded, and Semipermanently Flooded* wetlands (PFO1A, PFO1C, and PFO1F). There are approximately four combined acres of *Palustrine Emergent Persistent-Semipermanently Flooded* (PEMIF) wetlands in the vicinity. Implementation of Alternative Q would require a Section 404 nationwide permit. The project area's wetlands can be viewed in the land use map (Figure 2.7). With respect to Alternative Q, the area's wetlands are shown on Figure 2.8.

Prior to the application for Section 404 and Section 401 permits, detailed wetland studies will be undertaken for the Selected Alternative. As a part of the permit application, each crossing of a water of the U.S. requires that each impact site (wetland or stream crossing) be considered a single and complete project; this will determine the appropriate type of permit. Wetland impacts will be difficult to avoid due to the large presence of wetlands in the project area. However, efforts were made to avoid wetlands by shifting the roadway, yet simultaneously examining the level of wetland impact relative to other environmental impacts; where impacts could not be avoided, prudent and feasible efforts were made to minimize wetland impacts. If avoidance or minimization of impacts to wetlands is not possible, then impacts to the area's wetlands will be mitigated. Impacts to wetlands will be mitigated through a wetland mitigation bank. If available, on-site wetland banks should be utilized; however, if an on-site area is not available, a wetland mitigation bank within the Wolf River watershed is capable of holding such an area.

Potential wetland impacts are summarized in Table 4.5. Efforts were made during design to reduce wetland impacts. Alternative Q has the potential to affect the largest number of acres of wetlands; however, by moving the southern boundary of the interchange to the north, wetland impacts were decreased by nearly 0.13 acres. Possible wetlands may exist throughout the project area, making total wetland avoidance difficult. The proposed alignment for the section of roadway between Mullins Station Road and Walnut Grove Road was moved to the north to avoid a known wetland. The Resource Team weighed all environmental impacts when deciding on the Selected Alternative. If wetland impacts were to decrease, other impacts (stream, floodplain, recreational) may increase to the same level, if not greater. For example, stream impacts for Alternative Q are least among alternatives; floodplain impacts for Alternative Q are less than those of Alternative L; Kirby Parkway through the Shelby Farms area was moved as far away from recreational resources to avoid impact. No practicable alternative is available that avoids impacts; however, the proposed action includes all practicable measures to minimize harm. During Final Design, wetland impacts may be further decreased through more detailed and comprehensive design.

Table 4.5. Wetland impacts

Alternative	Acres Affected
Q	1.7
L	1.3
M	1.6

IV.C.3. Floodplains

The project will affect the 100-year floodplain of the Wolf River; floodplain impacts will be minimized during alternative design and selection. The amount of floodplain involvement for Alternatives Q, L, and M is shown in Table 4.6. The Wolf River floodplain can be viewed in the land use map (Figure 2.7).

Table 4.6. Floodplain impacts

Alternative	Linear Feet of Floodplains Crossed	Acres of Floodplains Crossed
Q	2,200	13.6
L	2,450	14.4
M	2,200	12.1

No encroachments of the floodplain are anticipated that would result in a potential for interruption of a transportation facility which is needed for emergency vehicles or provides the community's only evacuation route; a significant risk, including property loss or hazard to life; or a significant adverse impact on the natural and beneficial floodplain values. Floodplain encroachment was avoided largely by designing the roadway as far away from the floodplain as possible while steering clear of the Shelby Farms recreational facilities located to the east; floodplain risk was minimized by designing the roadway at a higher elevation than ground-level (while maintaining at-grade). However, the new roadway location will increase the storm event run-off (creating impervious surfaces and loss of forested areas). Increased flow during storm events must be partially stored on the floodplains to prevent excessive damage to downstream, areas that may result in erosion, substrate scouring and aquatic habitat alterations. Since the Selected Alternative is designed for at-grade construction through Shelby Farms, direct floodplain impacts (short-term and long-term) may be greatly reduced by implementing drainage structures, where possible. The project will be completed in accordance with Executive Order 11988. Minimizing impacts to the Wolf River floodplain would be of particular importance to protect the natural area and the aquatic fauna. The Shelby County Forest Management Plan does not include the proposed construction of Kirby Parkway. Minimal clearing of trees and vegetation cover within the floodplains and zero-bank clearing at streams would reduce floodplain and water quality impacts.

If several similar actions were to occur along the Wolf River, cumulative impacts would ensue. Projects thought to not have a severe impact would add floodplain degradation, and create an unstable environment. Indirect impacts would occur from increase development in the adjacent areas due to greater accessibility.

Every action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains will be executed. However, regardless of the chosen alternative, floodplain impacts will occur.

IV.D. Wildlife

The project is not expected to result in any substantial impacts to wildlife. Alternatives Q, L, and M will use the existing Walnut Grove Crossing of Wolf River. Most new development will take place north of the River where the habitat is predominantly pasture and row crops. These areas generally do not provide

substantial cover or shelter for wildlife. As such, any impacts are likely to be minimal and temporary as there is abundant similar type habitat outside the project boundary.

IV.D.1. Endangered Species

For the DSEIS, the US Fish and Wildlife Service (USFWS) was contacted regarding federally listed plant and animal species. The USFWS responded that no records regarding proposed, threatened and/or endangered species of plants and animals exist within the proposed project corridor. (See Appendix C for USFWS letter). Tennessee Department of Environment and Conservation (TDEC) Division of Natural Heritage records indicated that seven state-listed rare species may be near the project site. The copper iris (*Iris fulva*), bulbous adder's-tongue (*Ophioglossum crotalophoroides*), blue scorpion-weed (*Phacelia ranunculacea*), lark sparrow (*Chondestes grammacus*), barking Treefrog (*Hyla gratiosa*), northern madtom (*Noturus stigmosus*), and common barn owl (*Tyto alba*) were all listed by TDEC with the potential to occur in the area. Preliminary habitat assessments on site visits determined that no state-listed threatened, endangered, or sensitive species were present.

On June 24, 2011, USFWS concurred with TDOT's determination of "not likely to adversely affect" for Indiana bat due to lack of suitable habitat within the project area. Therefore, based on the best information available, USFWS indicated that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. This letter is attached in Appendix C.

IV.D.2. Invasive Species

Executive Order 13112 (E.O.), issued in 1999, calls for the prevention and control of invasive species (non-native exotics). The E.O. directs federal agencies to expand and coordinate their efforts to combat the introduction and spread of plants and animals not native the United States. The purpose of the E.O. is to avert the spread of non-native species and prevent them from encroaching upon and altering plant and animal habitat; prevent further loss of our native species; avoid the loss of agricultural and recreational lands; and avoid other detrimental effects caused by these species.

Highways provide opportunities for the unimpeded movement of invasive species. Non-native plant species are of a great concern along roadways. These invasive species can be spread along roadways by automobile and animal traffic; mowing and spraying operations; the importing of dirt, gravel or sod; being planted for erosion control, landscape and wildflower projects; or by the inadvertent spread of their seeds. While some of these factors are beyond anthropogenic control, some measures can be taken to prevent the spread of these invasive species.

Table 4.7 lists Rank 1 species per Tennessee Exotic Pest Plant Council guidelines (Severe Threat: exotic plant species which possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation; includes species which are or could become widespread in Tennessee). Also found in the project area are Crown Vetch (*Coronilla varia*) and Mimosa (*Albizia julibrissin*), listed by Tennessee Exotic Pest Plant Council as a Rank 2 (Significant Threat: exotic plant species which possess some invasive characteristics, but have less impact on native plant communities; may have the capacity to invade natural communities along disturbance corridors, or to spread from stands in disturbed sites into undisturbed areas, but have fewer characteristics of invasive species than Rank 1).

The Tennessee Exotic Pest Plant Council lists White Poplar (*Populus alba*) and Wild Carrot (*Daucus carota*), as Rank 3 invasive species (Lesser Threat: exotic plant species which seem to principally spread and remain in disturbed area, but not readily invade natural areas). The effect that these and other non-native species may have on the proposed project area could be detrimental to native plant populations if

allowed to spread. Exotic pest plants can alter ecosystems by displacing native plant species, which may in turn impact native fauna survival.

Table 4.7. Rank One Invasive Species

<i>Ailanthus altissima</i>	Tree of heaven
<i>Albizia julibrissin</i>	Mimosa
<i>Alliaria petiolata</i>	Garlic mustard
<i>Celastrus orbiculata</i>	Asian bittersweet
<i>Dioscorea oppositifolia</i>	Air potato
<i>Elaeagnus umbellata</i>	Autumn olive
<i>Elaeagnus pungens</i>	Thorny olive
<i>Euonymus fortunei</i>	Winter creeper
<i>Hedera helix</i>	English ivy
<i>Lespedeza cuneata</i>	Sericea lespedeza
<i>Ligustrum sinense</i>	Chinese privet
<i>Ligustrum vulgare</i>	January jasmine
<i>Lonicera fragrantissima</i>	Japanese honeysuckle
<i>Lonicera japonica</i>	Amur bush honeysuckle
<i>Lonicera maackii</i>	Morrow's bush honeysuckle
<i>Lonicera morrowii</i>	Tartarian honeysuckle; twin sisters
<i>Lonicera tatarica</i>	Bush honeysuckle
<i>Lonicera x bella</i>	Purple loosestrife
<i>Lythrum salicaria</i>	Nepalgrass; Japanese grass
<i>Microstegium vimineum</i>	Eurasian water milfoil
<i>Myriophyllum spicatum</i>	Princess tree
<i>Paulownia tomentosa</i>	Common reed
<i>Phragmites australis</i>	Japanese knotweed; Japanese bamboo
<i>Ailanthus altissima</i>	Kudzu
<i>Albizia julibrissin</i>	Multiflora rose
<i>Alliaria petiolata</i>	Tropical soda apple
<i>Celastrus orbiculata</i>	Johnson grass
<i>Dioscorea oppositifolia</i>	Japanese spiraea

Alternatives Q, L, and M would be expected to have a minor amount of impact since prior disturbances have already allowed numerous exotics to be established. The following recommendations may help prevent the introduction and spread of invasive species:

- Grasses, shrubs, and trees planted for beautification purposes or to prevent erosion should be native species, and, if possible, naturally occurring at the project locale. Salvaging native plants and/or harvesting native plant seeds in the way of construction will aid in the re-establishment of the natural ecosystem. These native species are adapted to the regional conditions, promote biodiversity, provide food and shelter to native wildlife and, once fully established, will help prevent the introduction and spread of exotics. Other non-invasive species may be used in planting in the absence of native species.
- Fresh disturbances to soil are areas in which exotics tend to invade and establish rapidly. Whenever possible, all disturbed soil should be seeded with non-invasive or temporary annual species (wheat, oats, rye, etc.) to reduce the ability of exotics to become established and reduce erosion potential during rain events.

- Careful consideration should be given to the types and quality of plants at borrow sites where soil will be removed for use in the project area. Borrow material often contains viable plant parts and seeds of exotics that could thrive at new locations once introduced.

IV.D.3. Construction Impacts to Wildlife

The construction impacts and mitigation measures discussed in the FEIS remain valid for the alternatives discussed in this environmental document.

In response to the early coordination conducted for this environmental document, TDEC requested that the project design be developed in consultation with their department. This request was made to ensure that impacts to the natural area are minimal.

With heightened potential for nesting site destruction of two state-sensitive bird species, it was suggested that the ROW in the Shelby Farms area be cleared and grubbed between mid-September and March prior to construction.

IV.E. Cultural Resources

IV.E.1. Historic Resources

During the EIS process, a study was undertaken to identify properties listed in or eligible for listing in the National Register of Historic Places (NRHP) and to identify impacts to such resources pursuant to Section 106 of the National Historic Preservation Act (NHPA). The FEIS concluded that no properties in the project area were listed in the NRHP, nor had any been determined to be eligible for listing. Following the approval of the FEIS and the issuance of the Record of Decision, TDOT and FHWA evaluated the historical significance of the Shelby County Penal Farm as part of another road improvement project. In a letter dated May 27, 1998 (see Appendix D for letter and additional historical documentation), Herbert L. Harper, Deputy Tennessee State Historic Preservation Officer, determined that the Shelby County Penal Farm was not eligible for listing in the NRHP because it no longer retained sufficient integrity based on the interrelationship between the prison buildings, farm buildings, and the land. None of the buildings are good examples of a particular style of architecture; however, the Shelby County Hospital Complex retains integrity of design, workmanship, and materials. With additional information, it may be eligible under National Register Criterion A. Until then, it is a good example of classical architecture and meets National Register Criterion C.

The alternatives chosen for this project will have no indirect or cumulative negative impacts on this historical property. The project would not encroach upon land within the property's NRHP-eligible boundaries. The road improvement will visually be introduced into the setting outside the boundaries of the historical area. Modern buildings have been built within the Shelby Farms project area.

IV.E.2. Archaeological Resources

In March 2001 and again in October 2006, a Phase I Survey of the archaeological area of potential effect (APE) was conducted. These surveys were conducted in compliance with Section 106 of the National Historic Preservation Act of 1966 (Public Law 89-655), as amended, implementing regulations 36 CFR 800, and the National Environmental Policy Act of 1969 (Public Law 93-291). The purpose of the surveys was to identify archaeological sites in the APE that are listed in, determined eligible, or are considered potentially eligible for the National Register of Historic Places pursuant to criteria set forth in 36 CFR 60.4.

The FEIS, signed August 1991, concluded that there are no archaeological historic properties in the APE. At the time of the Reevaluation in 2001, no coordination was made with the State Historic Preservation Officer regarding the contents of the 2001 report. As a result, no SHPO letter was obtained, and the statements presented in the report were not verified. However, the 2001 report concluded that sites 40SY640 and 40SY641 were in the APE, but neither was eligible for National Register of Historic Places (NRHP). Sites 40SY548, 40SY642, and 40SY643 were not assessed because they are either outside the APE or are inside an alternative that is no longer under consideration.

Inadequacies in the 2001 report prompted additional research to further investigate Alternative Q in 2006. The additional research found that no sites are located in the APE of Alternative Q, the Selected Alternative (see Table 4.8 for resources identified in 2006). Based on these results, in a letter dated November 20, 2006 (see Appendix D), the State Historic Preservation Officer found that the project area contains no archaeological resources eligible for listing in the National Register of Historic Places. No additional work is recommended.

Table 4.8. Cultural resource locations identified

Site #	Components	NRHP Recommendation
40SY640	Late Woodland, Recent historic	Not eligible
40SY641	Early/Middle Woodland	Not eligible
40SY642	Early/Middle Woodland	Not assessed
40SY643	Historic	Not assessed
40SY548	Historic	Potentially eligible

In accordance with 36 CFR 800, the federally recognized tribes that may attach cultural and religious significance to properties in Shelby County were invited to be consulting parties on the project. On December 6, 2006, notices were sent to the Alabama-Quassarte Tribal Town, The Chickasaw Nation, the Choctaw Nation of Oklahoma, the Eastern Shawnee Tribe of Oklahoma, Kialegee Tribal Town, the Muscogee (Creek) Nation, the Quapaw Tribe of Oklahoma, the Shawnee Tribe, Thlophlocco Tribal Town and the United Keetoowah Band of Cherokee Indians. Tribes are allotted thirty days to respond. No responses were received.

If during any construction activity any previously unknown archaeological sites are discovered, the Tennessee Department of Environment and Conservation Division of Archaeology and the American Indian tribes will be contacted so that representatives can evaluate the material.

IV.F. Land Use

Minimal changes in land use and land cover are expected to accompany the project's construction. Currently, agriculture and grassland, county governmental uses, recreational lands, religious centers, and residential subdivisions occupy the project area landscape. Direct land use changes will be attributed to the conversion of non-highway uses to highway right-of-way.

Mitigation measures were taken to preserve the area's most valuable lands and to avoid unnecessary impacts. The Selected Alternative, Alternative Q, is located through the Shelby Farms property, and conversion of land use and land cover is expected to provide improved access to the recreational land uses within Shelby Farms.

The Shelby Farms area falls within a zoned jurisdiction; planning is carried out by the Shelby County Government and the Shelby County Land Use Control Board. The Shelby Farms Park Conservancy protect land use within their property limits and actively contribute to planning initiatives that may affect the Farms. The Shelby Farms Park Master Plan Report, which incorporates Kirby Parkway, was

released in 2008. The Master Plan documents the future land use strategies within the 4,500-acre Shelby Farms property. A main deficiency or challenge of Shelby Farms, as the Plan describes, is the lack of good access and poor connectivity to other land uses—in Shelby Farms and in adjacent areas. To improve accessibility and increase use of the facility, various land use/land cover changes are proposed by the Master Plan, including the addition of the Parkway. “The new Shelby Farms Parkway will replace the over-burdened Farm Road and connect traffic using Walnut Grove Road to the neighborhoods to the north by connecting the east-west thoroughfare to the north-south Whitten-Kirby Road” (p. 64). Additional roadways within the facility, which may allow more logical access to recreational facilities, will build upon the presence the Parkway.

Shelby County is growing, particularly in the communities of Bartlett and Germantown. With time, the Shelby Farms area and the environmental resources unique to its landscape may absorb some of the impacts imposed by these growing trends. Increased development surrounding Shelby Farms may result in the conversion of land uses and the increased use of the recreational facilities at Shelby Farms. Shelby Farms has accommodated past growth with its current facilities. However, as annual visitation to the area increase, Shelby Farms may exceed its capacity. Kirby Parkway will provide for better access through the area, exposing the area’s recreational and natural amenities. As more people discover these unique qualities, cumulative impact may accrue. Therefore, as a foreseeable occurrence, the Shelby Farms Park Master Plan has been developed to offset any indirect and/or cumulative impacts

IV.G. Community

Communities—their demographic make up, economic vitality, and resources—are discussed in Section 3.0. Several local communities and neighborhoods will be directly impacted during construction. Five relocations are expected. Adequate housing is available near their existing residences; therefore, little to no long-term community impacts, including cohesion, are expected. Commuting delays, particularly from detours, should be expected that will alter the adjacent community’s daily traffic patterns. Short-term effects from these expected detours may indirectly affect non-users of the Parkway through the rerouting of traffic.

Currently, no major established businesses exist in the project corridor. Although traffic conditions are expected to improve, the traffic load increase may lead to greater service needs in the area. Therefore, businesses to the west of the project area along Walnut Grove Road and north of the project along Macon Road may be required to fulfill a greater demand. Community members have been encouraged to voice their opinions and concerns about the project and will be considered before, during, and after the project’s completion. Two neighborhood groups were represented on the Advisory Team (Table 5.2). Study area communities could experience indirect and cumulative impacts from increases in daily traffic. The project will not impair access to community services, particularly schools and health care facilities. Also, the mobility of fire/safety vehicles will be maintained. Currently, mass transit is not feasible or reasonable in the study area considering demand, but increases in traffic through the corridor or users of Shelby Farms Park may warrant mass transit service.

IV.H. Relocations and Displacements

Relocation figures were obtained from 2006 project design team information. Five residential relocations along Whitten Road and partial frontal property removals are anticipated with the construction of Kirby Parkway (same for Q, L, and M). The residences are located west of Whitten Road and within one-quarter mile of the intersection of Mullins Station Road and Whitten Road. It appears that family size is approximately two to four people; the majority of area residents are middle class and own their properties. Figures 4.1 and 4.2 show examples of residences in the study area.



Figure 4.1. Sample residences along west side of Whitten Road

Sufficient, safe, decent, and sanitary replacement housing appears to be available within the financial means of the residents to be displaced; this was confirmed through multiple windshield surveys, home buying guide consultation, and census data research. During an April 2006 field survey, several homes along the Whitten Road corridor built in the 1960's to the present were noted that appear to be in the same price range as the displaced residences. Additional subdivisions were under construction. Housing costs in the project area typically start in the \$120,000s.



Acquisition and relocation for this project would be conducted in accordance with the *Uniform Relocation Assistance & Real Property Acquisition Act of 1970* as amended and *Title VI of the Civil Rights Act of 1964* wherein "no person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." Relocation resources are available to all residents without discrimination. The process would be conducted in accordance with TDOT's relocation process.

Figure 4.2. Sample housing stock

For those displaced, indirect impacts may include the need to familiarize oneself with new surroundings or a change in daily habits. Cumulative impacts in the area may occur if additional relocations are necessary in the future for an unrelated project.

IV.I. Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (dated February 11, 1994) requires Federal agencies to address environmental justice concerns. This involves the identification of disproportionately high and adverse human health and environmental effects, including the interrelated social and economic effects of their programs, policies, and activities on minority populations and low-income populations.

A review of Census information (Tables 4.9 and 4.10), accompanied by numerous site visits, revealed no concentrations of low income and/or minority population in the project area. Since the Reevaluation completion in 2001, little change concerning the socioeconomic makeup of the project has occurred. The neighborhoods surrounding the Shelby Farms property are moderate- to upper-middle income, with primarily non-minority residents. Conversations with local planners and Shelby County and Memphis officials confirm the social configuration of the neighborhoods in the area. There are no community,

medical, or education facilities that are exclusive providers of necessary services to low-income or minority populations.

Five residential relocations are expected as a result of the construction of Kirby Parkway; three of the five households were interviewed during January 2-4, 2008. Multiple attempts were made to contact the remaining households. Of the three who were interviewed, none were of a minority race. In addition, an income category was included on the questionnaire that was completed during the interviews. Of the three households that were interviewed, two were willing to share income information for their household. These respondents were not below the poverty level for their respective household sizes.

Table 4.9. Race information for Memphis, Shelby County, affected Census Tracts, and affected Census Tract Block Groups

RACE	Census Tract 211.22	Census Tract 211.22 Block Group 4	Census Tract 211.23	Census Tract 211.23 Block Group 1	Census Tract 212	Census Tract 212 Block Group 1	Memphis	Shelby County
White	77.4%	80.2%	84.9%	82.6%	24.8%	100%	34.2%	47.0%
Black	13.0%	14.1%	9.2%	12.3%	73.9%	0.0%	61.6%	48.9%
Asian	4.8%	3.1%	3.6%	3.4%	0.3%	0.0%	1.7%	1.7%
Other	4.8%	2.6%	2.3%	1.7%	1.0%	0.0%	2.4%	2.4%

Table 4.10. Poverty information for Memphis, Shelby County, affected Census Tracts, and affected Census Tract Block Groups

	Census Tract 211.22	Census Tract 211.22 Block Group 4	Census Tract 211.23	Census Tract 211.23 Block Group 1	Census Tract 212	Census Tract 212 Block Group 1	Memphis	Shelby County
Percent Poverty	5.3%	4.9%	3.6%	2.8%	0.0%	0.0%	20.6%	16.0%

The Shelby County Division of Corrections facility, located at 1045 Mullins Station Road, falls in Census Tract 212, Block Group 2. The proposed parkway bisects Census Tract 212, Block Group 1. According to 2000 U.S. Census information, 4,790 individuals and zero housing units were accounted for in Census Tract 212 (the 2000 U.S. Census recorded inmates according to their place of incarceration rather than a personal residence). Therefore, the large number of individuals in Census Tract 212 is made of inmates over 18 years of age and will not be affected by the proposed parkway

Given that the majority of the population in Census Tract 212 are inmates at the Shelby County Division of Corrections facility, their poverty status is not factored into the above table. In 1999, poverty status was determined for all people except institutionalized people, people in college dormitories, or unrelated individuals under 15 years old. These groups of people are considered neither poor nor unpoor.

The recreational facilities in Shelby Farms are available to and used by all populations of residents through Shelby County and beyond. The implementation of the proposed project would not have a disproportionately high and/or adverse impact on any particular population.

Following the approval of this environmental document, all populations will be afforded the opportunity to comment on its contents. Previously, no affected minority and/or low-income population or communities have been identified in the vicinity of the study area based on the fact that no individual appeals were made to representatives of minority and/or low-income populations in Shelby County.

IV.J. Recreational Resources

Shelby Farms Park-a publicly owned, 4,500-acre parcel devoted to recreational purpose containing several land areas not devoted to recreational purposes-lies within the project area. As the proposed project nears Shelby Farms Park, the Lucius E. Burch State Natural Area is located outside the project boundaries to the northeast, and a BMX competition track and soccer fields are located south of the project boundaries. Wilderness Trail runs the length of the Lucius E. Burch State Natural Area. The project continues east along Walnut Grove Road, but does not impact any of the contributing recreational resources inside Shelby Farms Park. A trumpet interchange allows the proposed project to head north through agricultural property. The proposed project is located east of Area 10, a non-recreational complex of governmental offices, and west of the Shelby Farms Park Visitors Center and other recreational land uses, such as Chickasaw Trail, Plough Park, and Patriot Lake. As the project exits Shelby Farms Park, it follows Whitten Road until its terminus at Macon Road. The contributing Section 4(f) elements of Shelby Farms Park can be seen on the attached map in Appendix E.

In order to determine the location of Section 4(f) resources (of the *US Department of Transportation Act* of 1966) in relation to the proposed project, separate Section 4(f) documentation was completed and is located in Appendix E. Section 4(f) does not apply to this project because the joint-planning exception likely applies given past concurrent planning for a park and a north-south corridor along the current project's general proposed pathway. Furthermore, even if the joint-planning exception did not apply, Section 4(f) still does not apply because any impact to parkland appears to be *de minimis*.

IV.K. Pedestrian and Bicycle Facilities

On August 18, 2005, the Advisory Team recommended that the project should include bicycle facilities for commuter and recreational cyclists throughout the project area. As a result, a commitment was made in the Draft document to include pedestrian and bicycle facilities within the Parkway design. The addition of multi-use paths and sidewalks/side paths is expected to maintain and/or increase continuity and connectivity of the current bicycle and pedestrian facilities which are primarily located in Shelby Farms. At that time, it was decided that the development of these recreational facilities would concur with the ideals expressed in the Shelby Farms Park Master Plan. As dictated by the Advisory Team and the CSS process, these facilities are crucial to provide accessibility to non-vehicular traffic. Indirectly, the construction of Kirby Parkway will necessitate more opportunities for recreation in the Shelby Farms area due to increased use via increased accessibility.

Throughout the course of the CSS process, the public and Advisory Team made known their concern for the inclusion of pedestrian and bicycle facilities together with information about circulation, overpasses/underpasses, bridges, and access into the Parkway design. With the release of the Shelby Farms Park Master Plan in July 2008, a more concurrent plan could be established. At the July 31, 2008 Advisory Team meeting, Project Team members presented to the Advisory Team a depiction of potential pedestrian and bicycle facilities, as laid out in the Master Plan (see Appendix A). In order to be considered for inclusion in the project, those facilities located outside the project study area were amended to fall within the boundaries of the proposed project.

On August 25, 2010, Tennessee Governor Phil Bredesen and TDOT Commissioner Gerald Nicely announced that Shelby County received \$1,640,675 in federal Transportation Enhancement (TE) funds for the Shelby Farms Bicycle, Pedestrian, and Equine Trails. Eleven segments were proposed in the TE application (see Appendix A) which requested \$1,933,732 in federal funds. Proposed trail segments "A", "B", "C", and "H" will be constructed as a part of the Kirby Parkway project through Shelby Farms. Segments "D", "F", "G", and "I" will be constructed when funding for the proposed Shelby Farms Bicycle, Pedestrian and Equine Trails Transportation Enhancement project is fulfilled. Additional trail segments "X" and "Y" will be constructed in conjunction with the expansion of Patriot Lake. Segments "J" and "K"

have no funding in place at this time. Thirteen-foot meandering, shared-use paths, striped with eight-foot bicycle lanes and five-foot pedestrian lanes, are proposed. Although a 10-foot shared-use path is the minimum required, the anticipated volume of pedestrians and bicyclists led to the proposal for a wider path. Bicycle path standards provided by TDOT will be used to develop a typical cross section. Equestrian paths are planned to be 10 feet wide and will not be hard surfaced. A general typical cross section is provided in Figure 4.3. Additional paths were proposed in the Shelby Farms Park Master Plan; they are shown in blue in Figure 4.4. These were not included in the TE application. These trails are not scheduled to be funded.

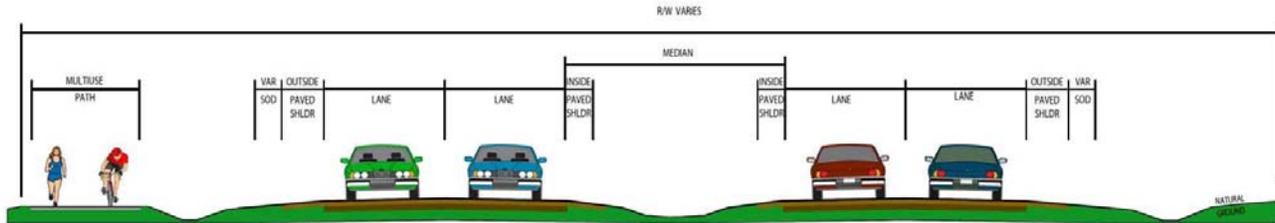


Figure 4.3. General typical cross section for Kirby Parkway through Shelby Farms Park

The Advisory Team is aware of issues surrounding the interconnectedness of current and proposed trails; however, no negative indirect or cumulative impacts are expected to develop at the interface of such systems. The system will be better served once adjoining segments outside the project area are designed and completed. As of October 23, 2006, plans were made to improve accessibility to the Kirby Parkway project area. The team for the Walnut Grove Road improvement project, located adjacent to the west of the proposed Kirby Parkway's southern terminus, developed a selected alternative for bicycle and pedestrian facilities with guidance from the Memphis Area Metropolitan Planning Organization's (MPO) Bicycle and Pedestrian Advisory committee (BPAC). In the plans,

"[a]s a part of a separate project, the City of Memphis intends to construct a multi-use path that will connect to the eastern end of the path along the westbound-to-northbound ramp at the interchange of Walnut Grove Road and Humphreys Boulevard and to a location in Shelby Farms. However, funding for this project has not yet been obtained, and the design of the path has not yet begun".

This plan is one of the latest implementations of the MPO's 2005 Bicycle and Pedestrian Plan (no updates to the plan since that time). An effort to increase bicycle/pedestrian accessibility to the north of the Kirby Parkway project area began in 2004 will progress as funds become available. The Greater Memphis Greenline (GMG) is a proposed 13-mile, multi-use, urban park/trail on former CSX railroad right-of-way from the intersection of Poplar/Walnut Grove/Union in Midtown Memphis to near Houston Levee in the suburbs of Shelby County. Seven miles of the trail have been constructed from Midtown Memphis to Farm Road. It can be viewed in Figure 4.4.

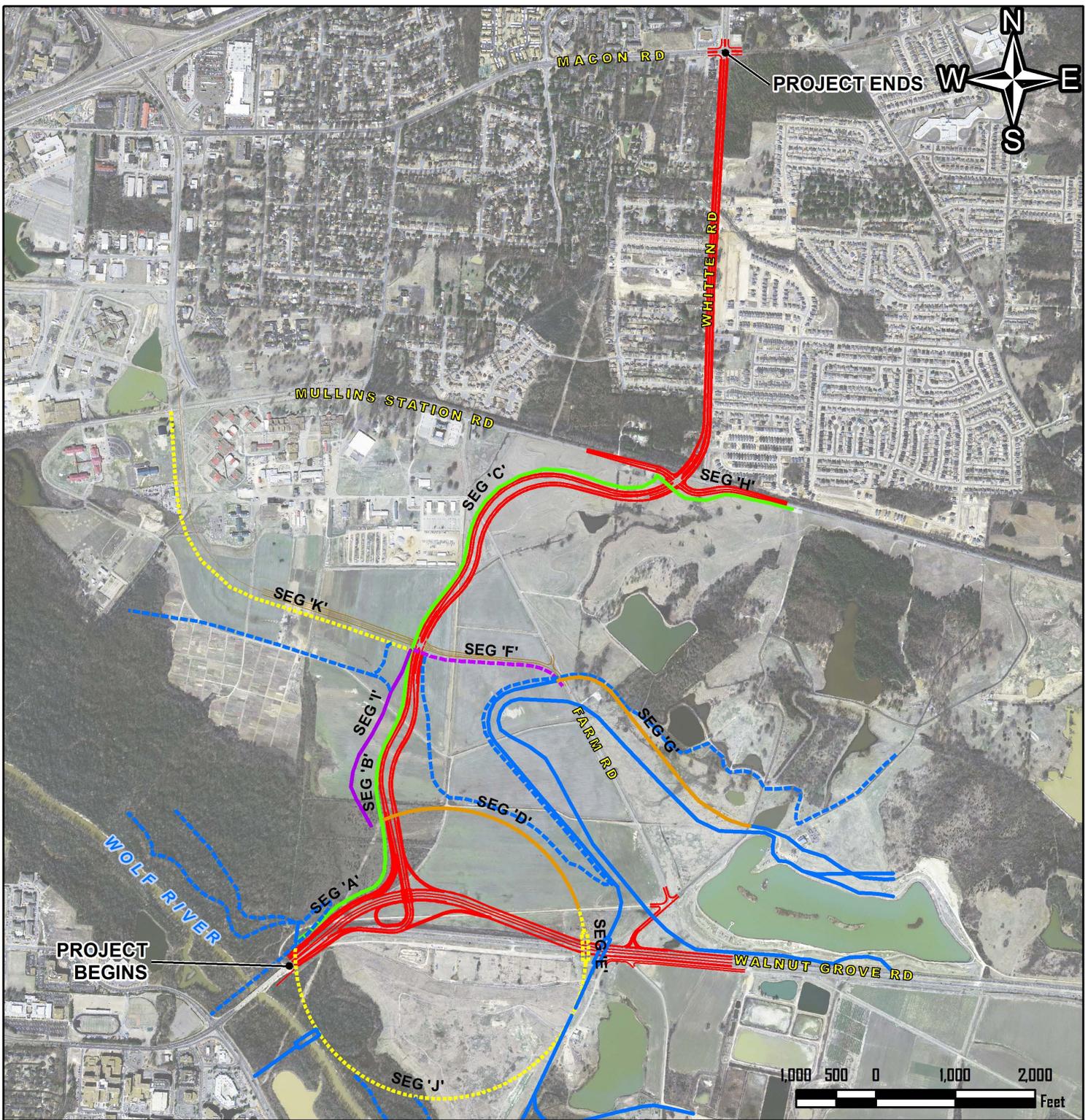


Figure 4.4 - Proposed Bicycle, Pedestrian, and Equestrian Trails

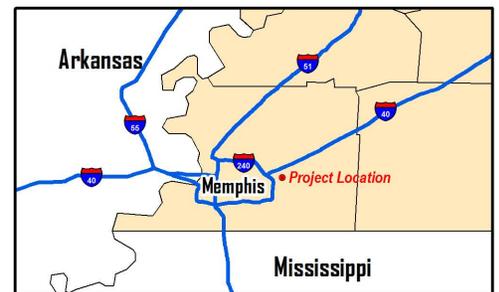
Memphis, Shelby County, Tennessee

Proposed Alternative

- Proposed Parkway
- Sycamore View Road Extension (Future Project)

Trail Type (Construction Funding)

- Proposed Master Plan Facility-Paved
- Proposed Master Plan Facility-Unpaved
- Equestrian (Trail Enhancement Grant Contract)
- Bicycle and Pedestrian (No Funding)
- Bicycle and Pedestrian (Parkway Project)
- Bicycle and Pedestrian (Trail Enhancement Grant Contract)
- Bicycle, Pedestrian, and Equestrian (Trail Enhancement Grant Contract)



IV.L. Farmland

Formal consultation with the U.S. Department of Agriculture, Jackson Division Office of the Natural Resources Conservation Service (USDA, NRCS) for compliance with the *Farmland Protection Policy Act of 1981* (FPPA) was completed (see Appendix F). This consultation utilizes the Farmland Conversion Impact Rating process (Form AD-1006) to establish a numerical impact rating for farmland effects. Under this process, total point ratings above 160 indicate that farmland impacts may accrue and could warrant avoidance and mitigation considerations.

Of the 74 acres to be converted to highway right-of-way for Alternative Q, approximately 23 acres are prime farmland. This equated to a rating of 130 out of a possible 260 points. Sites with the highest combined scores above 160 points are regarded as most suitable for protection under these criteria and sites with the lowest scores, as least suitable for protection. No sites have a combined score above 160 points.

Indirectly, Shelby County may gain economic benefits from the conversion of land use from farmland to right-of-way. This may generate additional jobs and commerce in adjacent areas. At the same time, area not previously used as farmland may be converted for agricultural purposes.

In 2002, Shelby County ranked 36th in total agricultural projects sold. Cumulatively, individually minor changes of farmland into other land uses across the county may deplete total available farmland acres.

IV.M. Hazardous Materials Impacts

IV.M.1. Hazardous Materials Findings

A review of potential environmental issues associated with the proposed project was conducted. The review included an environmental database report from Environmental Data Resources, Inc. (EDR); interviews; regulatory file reviews; site visits; a feasibility report; and findings, conclusions, environmental professional opinions, and recommendations. A map of the sites of environmental interest mentioned in this section can be located in Appendix G.

Fourteen sites were found to occur within the search radius for the databases in which they were listed and were of environmental interest in connection with the proposed project. These sites are listed in Table 4.11. Of particular interest is the former Shelby County Penal Farm Landfill (ID# SNL 79000028) which is located on property adjoining the proposed Kirby Parkway route, south of Walnut Grove Road. The landfill is closed and capped, and monitoring of wells within the site is ongoing as a part of the landfill closure plan.

Files were reviewed at the Division of Underground Storage Tanks (DUST) in the Memphis EFO for the sites listed in Table 4.11. In addition, files for the Stuckey's Travelers Inn (aka JMK Gas and Fuel Mart, ID# 9-790678) and the Shelby County Landfill Convenience Center (ID# CCC 790001522) were reviewed at TDEC's Division of Solid Waste Management (DSWM).

If the proposed routing of the project remains within the existing right-of-way and north of Walnut Grove Road, the risk of environmental impact to the project is low. In addition, no cumulative or indirect impacts are expected to occur.

Table 4.11. Summary of Sites With Potential Environmental Issues

Map ID	Site Name	Issue(s)	Location	Findings	Conclusion
2	Fleet Services	UST/ Historic UST	within 0.25 mi W of ROW	closure letter dated 10/27/99	not likely to impact the project based on closure letter and expected direction of groundwater flow being away from the project
A3 A4 A5 A6	Corrections Center Service Station	Historic UST/ LUST SQG	within 0.7 mi W of ROW	no closure letter; site is in monitoring status; RCRA violations in 1991 & 1993	Not likely to impact the project due to distance and expected direction of groundwater flow being away from the project
B14 B15	Mark Luttrell Reception Center	UST/ Historic UST	possibly adjoining the ROW to the W at 6000 State Rd	closure letter dated 03/24/99	not likely to impact the project based on closure letter and the expected direction of groundwater flow being away from the project
D22 D23	Federal Correction Institution	Historic UST, RCRA SQG	within 0.25 mi. W of ROW at 1101 John Dennie Rd	closure letter dated 09/01/93; RCRA violations in 1985 & 1987	not likely to impact the project based on closure letter; site outside applicable radius for RSCA issues
26	James J. Campbell Co.	Historic UST	within 0.25 mile N of ROW at 6012 Resources Rd	closure letter dated 06/23/92	not likely to impact the project based on closure letter
7	Shelby Co. Health Care Center	LUST	within 0.5 mi. NW of ROW	closure letter dated 12/16/98	not likely to impact the project based on closure letter and expected direction of groundwater flow being away from the project
8	Kroger Fuel Center	LUST	within 0.25 mi. W of ROW	same site as Fleet Services, Map ID 2; closure letter dated 10/27/99	not likely to impact the project based on closure letter and expected direction of groundwater flow being away from the project
9	Palmer Iron Works	RCRA SQG	adjoins ROW at 1157 Whitten Rd	residential site with shed at rear of property; file review indicated TDEC listing of this site as a HW generator was in error	no impact to the project is expected
10	Memphis Police Heliport	LUST	possibly adjoining the ROW to the N at 999 Dovecrest Rd	closure letter dated 02/25/02	not likely to impact the project based on closure letter
11	Shelby County Fire Dept. – Generator House	UST/ Historic UST	possibly adjoining the ROW to the N at 1115 Sycamore View Dr	TDEC file indicated the site had a discrepancy on the tank material of manufacture	no violations; appears to be a UST records inconsistency; unlikely to impact the project
H37 H38	Shelby County Penal Farm Landfill	Solid waste landfill	adjoins ROW to S of Walnut Grove Rd	site is closed with active monitoring wells; proposed plans do not call for disturbance of landfill cap	landfill boundaries are well-defined; landfill is not likely to be encountered during proposed construction activities
I39	McLemore Market #6	LUST	within 0.25 mi. E of ROW at 6882 Macon Rd	closure letter dated 02/21/01	not likely to impact the project based on closure letter
35	Shelby County Convenience Center	Recycling Center	within 0.5 mi. W of the ROW at 1075 Mullins Station Rd	no violations; registered in 2005; facility recycles household wastes	site is outside applicable radius for RCRA
M53 M54	Stuckey's Travelers Inn, now JMK Gas and Food Mart	LUST, UST, Historic UST	within 0.25 mile of N terminus of project at 6790 Raleigh-Lagrange Rd	TDEC closure email dated 07/22/02 for two former USTs at Stuckey's; TDEC Order of Non-Issuance of New UST Certificate dated 02/28/07 remains in effect for the owner of JMK Gas and Food Mart; cause was failure to submit application and fees for a new UST certificate; facility is closed	not likely to impact the project based on closure letter

IV.M.2 Landfill Feasibility Study

As a result of opinions expressed during public involvement activities regarding the potential use of the landfill south of Walnut Grove Road for highway right-of-way, a landfill feasibility study was performed and completed in June 2008. While the base roadway alignment is not assumed to extend into the footprint of the Shelby County (Walnut Grove Road) Landfill, alternative alignments that were under consideration, specifically ramps associated with the interchange, were located within portions of the facility.

The Shelby County Landfill, located at 6791 Walnut Grove Road, is a closed facility owned by the county. The current landfill facility footprint is assumed to be approximately 130 acres with embankment outcrops constructed at a maximum of 5(H):1(V) to an approximate peak elevation of 288 feet. Based on available records, it is understood that the site served as an open dump until June 1972, at which time it was converted to a sanitary landfill facility. Permitted disposal was reportedly limited to domestic and municipal wastes; hazardous wastes were prohibited. In September 1981, the County received permission from the Tennessee Department of Health and Environment—Division of Solid Waste Management for expansion south of Walnut Grove road to support continued waste disposal operations. As part of a further planned expansion north of Walnut Grove Road, several explorations that were conducted in 1986 revealed that the confining layer which typically separates the shallow alluvial aquifer from the deeper Memphis Sands aquifer was primarily absent. It is noted that the Memphis Sands aquifer is a principal drinking water source for the city and several adjacent communities.

Because of the above environmental considerations, the northern expansion was denied by the Division of Solid Waste. Subsequent studies revealed possible leachate impacts to the Memphis Sands aquifer, thereby resulting in a Commissioner's order to complete final cover construction across the facility in 1988; waste disposal operations ceased in October 1988. Associated closure and post-closure activities included construction of the final cover and surface drainage systems along with installation of the gas collection system. The facility is currently in long-term (minimum 30 years), post-closure monitoring status.

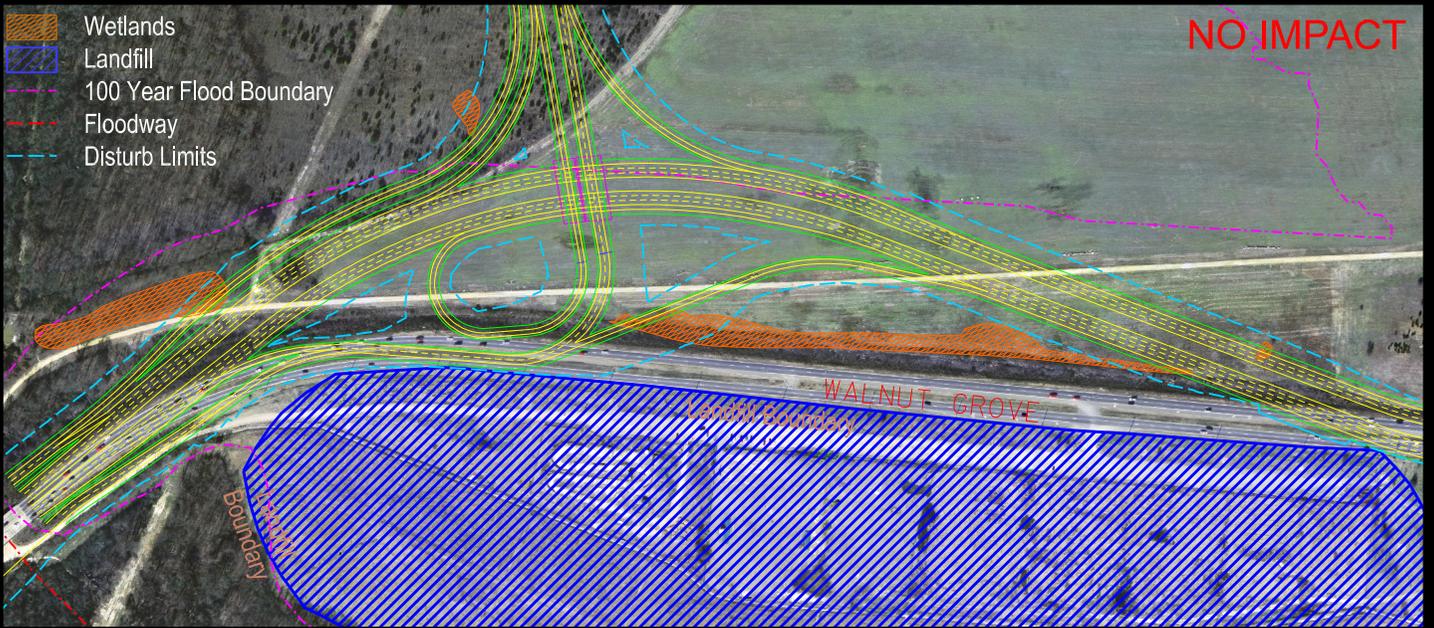
A base alignment, wherein no construction elements are assumed to be located within the current facility footprint, and two alternative alignments (herein referred to as Options 1 and 2) that encroach upon the facility to varying degrees, were examined in the feasibility study. The feasibility study was performed as an initial assessment of potential roadway construction associated with the alternative alignments. Three fundamental approaches were considered for this assessment:

- construction of roadway foundation elements bearing directly across waste materials (with or without conventional subgrade improvements);
- construction of roadway foundation elements that penetrate waste materials (i.e., deep foundation elements); and
- removal of waste materials and replacement with suitable engineered fill.

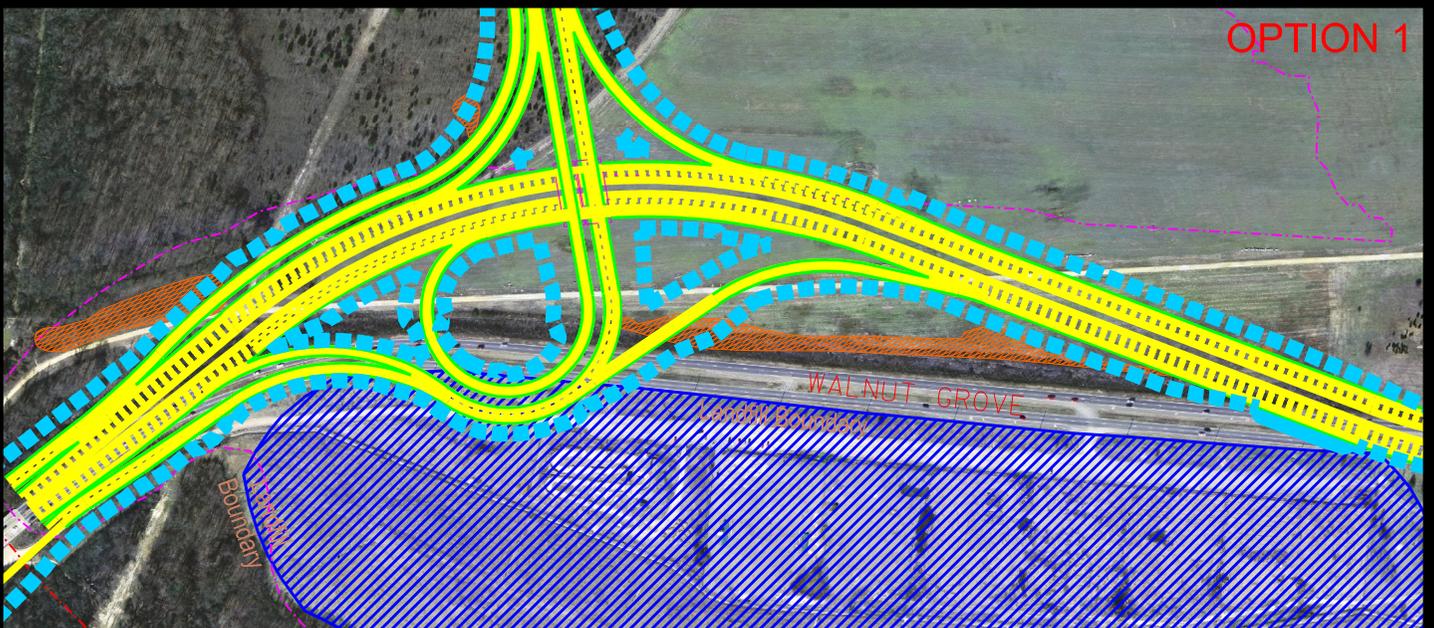
Construction across domestic and municipal embankments typically results in unpredictable amounts of non-uniform settlement. This is largely attributable to the various composition and biodegradable nature of the materials within a landfill. As a result, compaction occurs at various rates. Because the transportation project objectives are anticipated to include stable foundation conditions characterized by predictable (or manageable) settlement over the design life, it is judged that construction of roadway foundation elements bearing directly across waste materials is not feasible. It is further judged that conventional sub-grade improvements (e.g., additional compactive efforts, construction of a bridging soil or rock layer, or installation of a geosynthetic equivalent) will not effectively mitigate the primary causes of these damaging settlements.

-  Wetlands
-  Landfill
-  100 Year Flood Boundary
-  Floodway
-  Disturb Limits

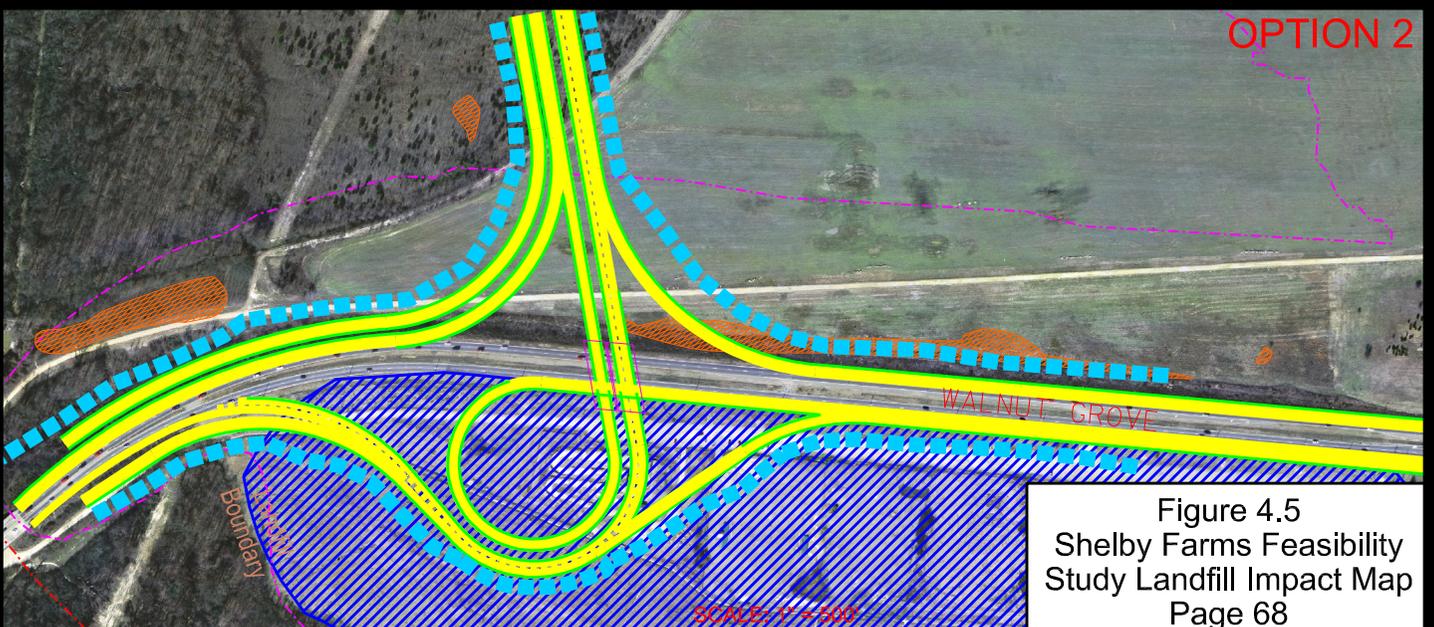
NO IMPACT



OPTION 1



OPTION 2



SCALE: 1" = 500'

Figure 4.5
Shelby Farms Feasibility
Study Landfill Impact Map
Page 68

An alternative construction approach may include the installation of deep foundation elements which transmit loads to suitable underlying foundation soils (e.g., piles, drilled shafts). While this approach may be structurally feasible, it may also provide a direct conduit for additional groundwater impacts, thereby affecting the current post-closure status of the landfill facility. In order to address both structural and environmental considerations, it is judged that removal of the waste materials and replacement with suitable engineered fill provides a more feasible path for construction.

Based on the modeling approach presented herein, it is estimated that 93,800 cubic yards (or 63,315 tons using a conversion factor of 0.675 tons per cubic yard based on an assumed unit weight of 50 pounds per cubic foot) of waste materials will be excavated for Option 1 and 651,600 cubic yards (or 439,763 tons) for Option 2. Furthermore, it is estimated that 13,400 cubic yards of final cover soil materials will be required for Option 1 and 48,000 cubic yards for Option 2. Results of the preliminary cost opinion indicate that the primary mitigation approach for both alternative roadway alignments will range from approximately \$6.4 million for Option 1 and \$33.4 million for Option 2.

The landfill feasibility study was presented to the Advisory Team at the July 31, 2008 Advisory Team meeting. The landfill limit was shown to be along Walnut Grove Road; therefore, the alternative recommended by the Team, particularly roadway elements associated with the interchange, would have some small impact to the landfill not previously anticipated. The following options were presented to the Team:

- No Impact (reduces loop ramp design speed from 25 mph to 20 mph);
- Option 1 (Team Recommended Alternative); and
- Option 2 (Walnut Grove Road to remain in current location with 25 mph ramp shifted to the south over landfill).

Based on the findings of the Landfill Feasibility Study, a recommendation was made by the nine Advisory Team members in attendance: The no impact option with the reduced speed was selected with the understanding that strong consideration would be made to incorporate trails, underpasses, and address bicyclists and pedestrians in the Shelby Farms Parkway design in an effort to achieve a multimodal community.

IV.N. Memphis Aquifer Impacts

According to the United States Geological Survey, an aquifer “is a formation, group of formations, or part of a formation that contains saturated, permeable material to yield significant quantities of water to wells and springs.” The Memphis aquifer, a prolific aquifer that provides water to people throughout the Tennessee-Mississippi-Arkansas region, is located within the Mississippi embayment in the south-central portion of the United States, as shown in Figure 4.6. The Mississippi embayment is a shallow Cretaceous-Tertiary basin underlain by a series of alternating sand aquifers and clay, silt, and sand confining units. Overlying much of the Memphis Sand is the Upper Claiborne confining unit. Sand and gravel deposits, which cover the Upper Claiborne unit, form a regional shallow aquifer with the overlying loess providing partial confinement.

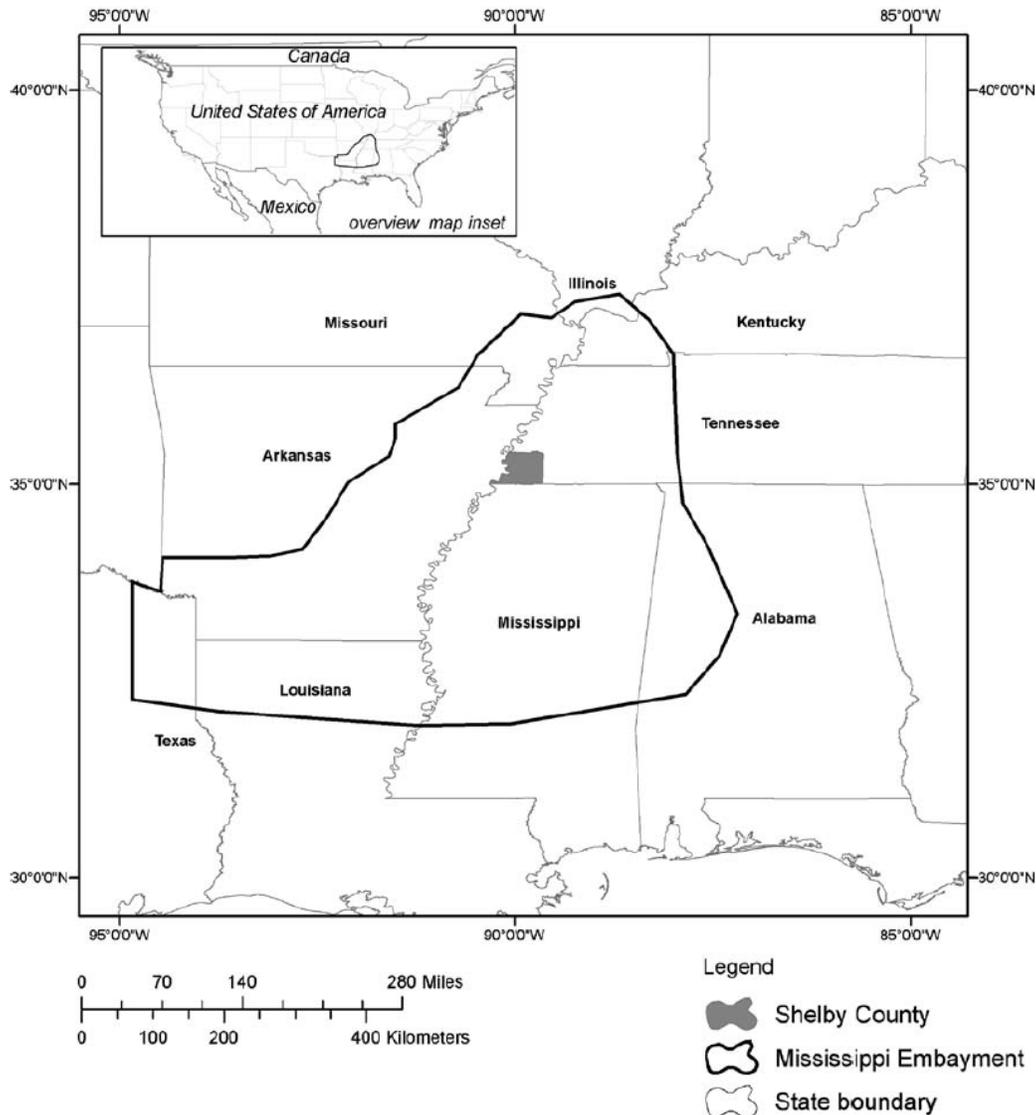


Figure 4.6. Location of Mississippi Embayment (Waldron et al. 2009)

The Memphis aquifer has been the subject of many investigational studies, many of which have involved the construction of monitoring wells. A large breach has been mapped south of Walnut Grove Road (see Figure 4.7). Waldron et al. (2009) has indicated that a depression or a lowering in the water table within the aquifer exists north of the now-closed Shelby County landfill near well Sh:Q-151. This paleochannel, as shown in orange in Figure 4.7, is located in an area where the Upper Claiborne confining unit is absent. Approximately three to five meters of loess overlie the shallow aquifer, which ranges from 14 to 17 meters thick. The Upper Claiborne confining unit underlies the shallow aquifer and ranges in thickness from zero to 18 meters. Kirby Parkway through Shelby Farms is located through the area of the suspected breach.

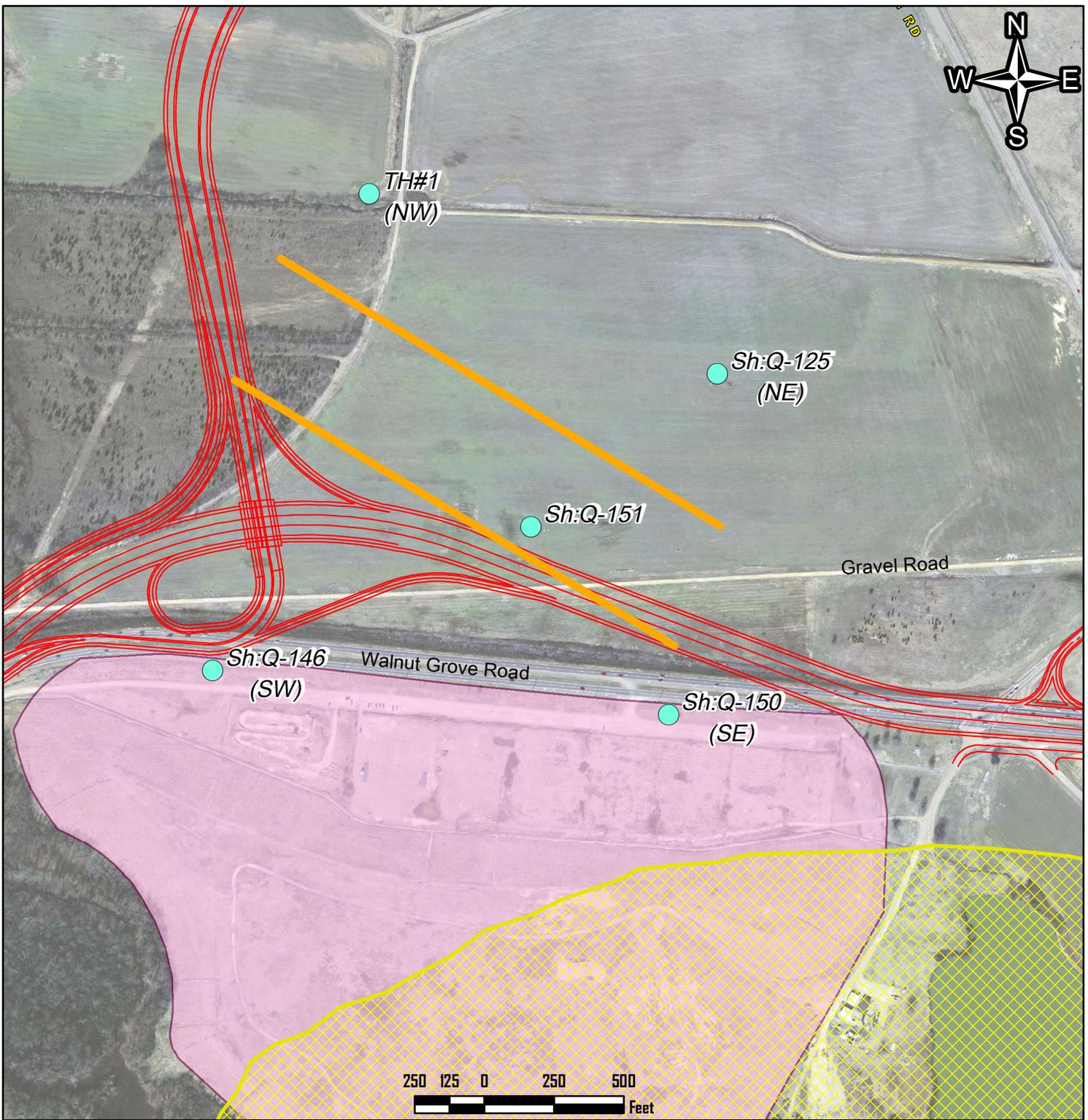


Figure 4.7 - Location of Memphis Aquifer Paleochannel and Breach
 Memphis, Shelby County, Tennessee

Legend

- Boreholes (Waldron, 2009)
- Paleochannel (Waldron, 2009)
- Breach (Parks, 1990)
- Landfill
- Proposed Kirby Parkway



According to Dr. Jerry Lee Anderson of the University of Memphis Ground Water Institute, “the extents, i.e., width, depths, and length, are not well defined...Any infiltration of contaminants proximal to the breach north of the Shelby County landfill and within the cone of depression will eventually find their way into the Memphis aquifer” (see letter dated September 9, 2009 in Appendix H). As a result, four recommendations with respect to the construction and operation of Kirby Parkway through Shelby Farms were made by Dr. Anderson in his September 9, 2009 letter. Mr. Jerry R. Collins, Jr., of Memphis Light, Gas and Water Division, outlined these recommendations, which have been recognized by the city of Memphis, and Final Design will make accommodations for:

- 1) A total-containment policy will be adopted for any spills of hazardous or chemical materials on the road crossing Shelby Farms. The use of an in-line oil and grit chamber should suffice to capture oil and grit that might otherwise find their way into the aquifer through the window. Prompt response to such an incident and thoroughly cleaning the spill site including the soil should result in no spill products reaching the Memphis aquifer. (An example of containment is also provided in Appendix H.)
- 2) No fill materials will be removed from the Wolf River floodplain that would potentially expose the upper Memphis aquifer.
- 3) A monitoring program will be initiated to evaluate the down gradient extent of the leachate plume, its direction of migration, and the impacts of decomposition and dilution on leachate contaminants. This will involve periodic sampling of the existing well network for specific constituents. This information should serve well to evaluate the potential for any spill contents to reach water supplies.
- 4) All drainage from the proposed road will be discharged as far downstream on the Wolf River as financially feasible. This would ensure any containment introduced into the Wolf River cannot make its way into the aquifer through the windows.

Additional or more specific mitigation measures should be considered for construction and maintenance and operations of Kirby Parkway through Shelby Farms. Examples of such mitigation, as used for other states' projects, include:

- Provisions for access of emergency vehicles to containment areas should be considered as plans are developed.
- Grass channels with flat grades, 150-foot minimum length, if practicable, should be provided to trap silt prior to discharge.
- Dual drainage ditch systems should be strongly considered if more than 100 feet in width of water flows into the highway drainage system. Interceptor ditches should be used to prevent large volumes of off-site water from adding to the volume of run-off being carried by the swales.
- Detention/containment basins may be implemented to temporarily impound the run-off from the swales before it is discharged from the right-of-way. These basins shall have a minimum volume of 10,000 gallons upstream from each final discharge point. This volume may be attained by constructing basins in a series. Detention basins shall be designed to maximize the flow length between the entrance and exit.
- If and when these swales and/or basins are cleaned out, they shall be restored.

With the application of the aforementioned commitments and other mitigation measures, it is not expected that the construction or maintenance and operations of Kirby Parkway through Shelby Farms will negatively impact the Memphis aquifer or its water quality. According to Dr. Anderson, reports have indicated that the groundwater supply most susceptible to contamination is the Sheahan well field, which is five miles away and downgradient of Shelby Farms. Using an estimated groundwater velocity of 0.5 to 1.5 feet per day in the Memphis aquifer, it has been calculated that it will take from 50 to 150 years for the ground water to travel from Shelby Farms to the Sheahan well field. Given the time and distance of ground water transport, any contaminants in the ground water would not likely persist to reach the Sheahan well field because of the effects of various physical, chemical, and biological processes, including dilution and adsorption.

Geophysical methods, which can be very effective in the search for groundwater resources, could be used to better determine the location of the paleochannel and other aquifer features in relation to the proposed roadway. By increasing the understanding of local geology prior to drilling, these methods can optimize well placement, if needed. If monitoring wells are encountered during construction of the project, they will be properly plugged and abandoned by a Tennessee licensed well contractor in accordance with TDEC criteria.

IV.O. Visual Impacts

The Shelby Farms area is a mixed-use land resource. It is influenced by commercial, agricultural, recreational, and transportation land uses. From the roadway, one can view grasslands, forest land, water resources, and residential communities.

Visual impacts will occur from the perspective of the roadway user and the non-user. Currently, the existing roadway is not visually pleasing; the FEIS described two areas where visual impacts of the project would be most pronounced. Areas along Whitten Road from Mullins Station to I-40 and though Shelby Farms will experience changes to visual quality. The expected impacts reiterate those mentioned in the FEIS; however, the main roadway and the interchange have been redesigned to be more aesthetically pleasing. The roadway will flow the topography of the land. The medians will be divided and landscaped. Minimal impacts to the visual quality of the State Natural Area and Shelby Farms are expected. Even though Whitten Road is proposed to be widened and some yards with large trees will be affected, the majority of the vegetation along the roadway will remain. Locations facing construction will be re-vegetated. Landscaping and forestation of the parkway through Shelby Farms shall also utilize the ideas expressed in the Master Plan. A mix of nearly 2,600 understory and shade trees, millions of square feet of fescue and native grasses, and nearly 80,000 square feet of shrubs will be utilized to promote natural growth and succession. An initial estimate for landscaping improvements totals \$1.8 million. Figure 4.8 depicts landscaping and revegetation of Shelby Farms.

Not only is Kirby Parkway designed to move traffic more efficiently, it is also designed to benefit the recreational users of the area. No longer will those using the trails and recreational facilities of Shelby Farms be exposed to congestion and busy intersections, but instead, they may view the area's current facilities differently, potentially inducing positive growth on the surrounding area and of the use of Shelby Farms.

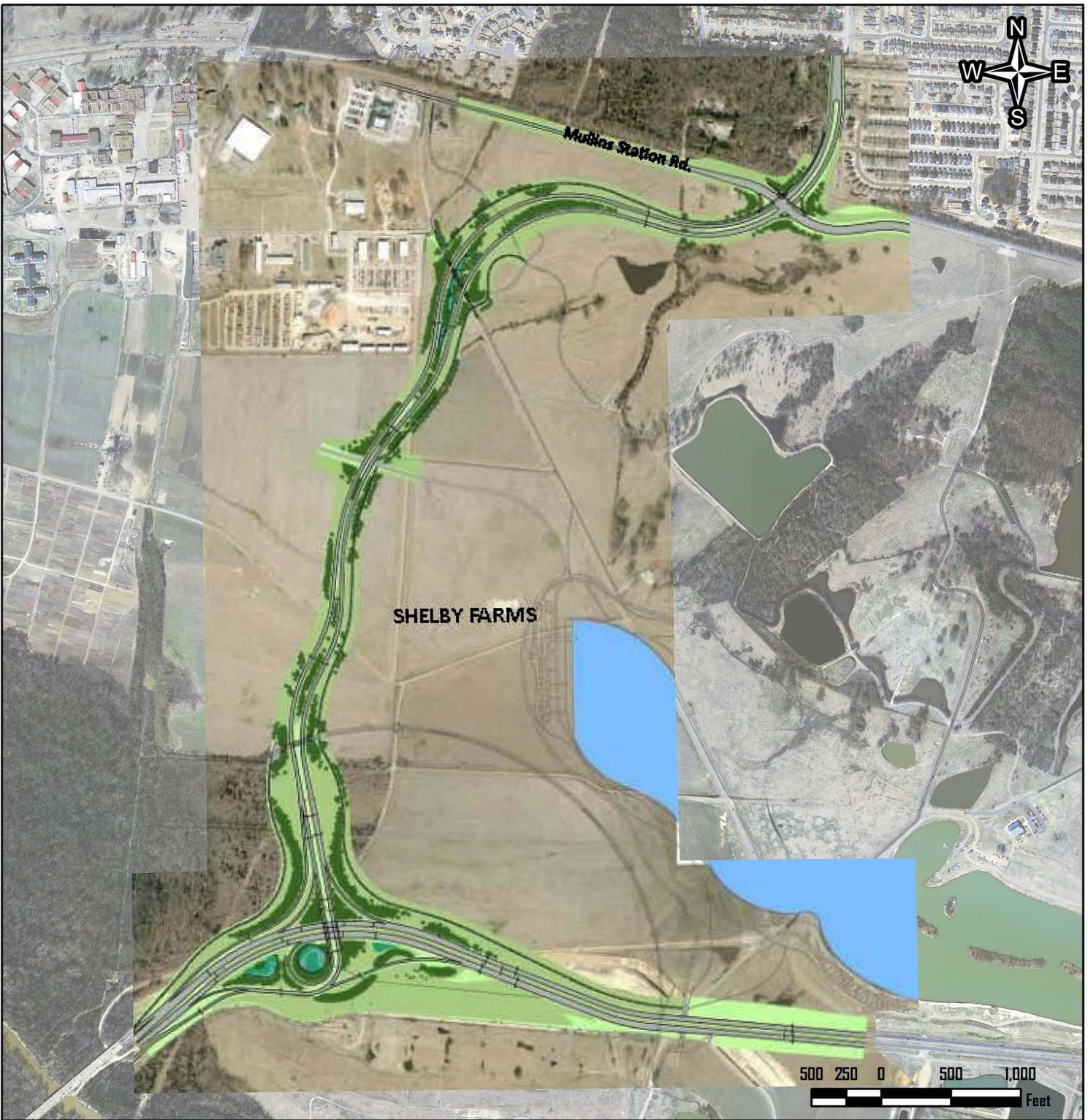


Figure 4.8 - Proposed Landscape Plan

Memphis, Shelby County, Tennessee



IV.P. Construction Impacts

Impacts from construction are primarily short-term in duration (i.e., they exist only during construction periods). Some construction inconveniences, such as noise, dust, and/or traffic conflicts are unavoidable at times. Compliance with TDOT's *Standard Specifications for Road and Bridge Construction* and the use of Best Management Practices seeks to minimize these impacts.

In order to minimize possible detrimental effects due to siltation, soil erosion, or possible pollution of area watercourses, construction contractors will be required to comply with the special provisions of the *Standard Specifications for Road and Bridge Construction* as issued by TDOT and as amended by the most recent applicable supplements. These provisions implement the requirements of the FHWA's *Federal-Aid Policy Guide, Subchapter G, part 650b*. According to these provisions, contractors will be required to conduct and schedule operations as stated.

Construction procedures will also be governed by Section 107.01 of the Standard Specifications to observe any noise ordinance in effect within the project limits. Detoured traffic will be routed during construction so as to cause the least practicable noise impact upon residential and noise sensitive areas.

In addition, disruption to utility services will be minimized since it is the standard policy of TDOT to coordinate all utility relocations with the affected utility companies. Furthermore, TDOT will coordinate with local governments during the construction phase to minimize disruption of communities resulting from any required detouring of traffic.

Any action taken on open burning will be in accordance with *Chapter IV, "Open Burning"*, of the *Tennessee Air Pollution Control Regulations*; specifications regarding air pollution control (Section 107.21) will be followed. Also the regulations on fugitive dust will be in accordance with *Chapter VIII, "Fugitive Dust"*. The general contractor and all asphalt plants, quarry operations, etc. associated with the project will be required to have a valid operation permit from the Tennessee Air Pollution Control Division or to obtain an exception from the regulations through board action.

Solid waste generated by construction activities will be disposed of in accordance with all state rules and regulation concerning solid waste management. Where possible, land debris will be disposed of in a registered sanitary landfill site. If the use of a landfill is not possible, the contractor will dispose of solid waste in a manner that will not create a hazard to public health or become a public nuisance.

V. COMMENTS, CORRESPONDENCE, AND PUBLIC INVOLVEMENT

V.A. Correspondence

Correspondence with governmental agencies occurred throughout the project development process. Such entities as; the Tennessee Department of Transportation (TDOT); the Federal Highway Administration (FHWA); the Tennessee Department of Environment and Conservation (TDEC); the Natural Resource Conservation Service (NRCS); the United State Army Corp of Engineers (USACE) were contacted for pertinent environmental information concerning the project area. A list of the appropriate agency contacts and several correspondence letters are located in several of the Appendices.

V.B. Public Involvement via Context Sensitive Solutions

The Shelby Farms Parkway Advisory Team acts as a collective body representing opinions of both experts and public stakeholders. The Team's integration throughout the project's development falls under a concept known as Context Sensitive Solutions (CSS). CSS places emphasis on affected parties and acknowledges their contributions to the process.

The Shelby Farms Parkway Advisory Team consists of 17 members whose purpose it is to provide guidance for improvements made to the area's land resources. Table 5.1 lists SFPAT members and their respective affiliations. Resource Team Meetings commenced in early 2005 at regular intervals to the present. Project Team Members from the Shelby County Government, the City of Memphis, and consultant companies assisted in the coordination of these meetings. Figures 5.1 and 5.2 were photographed during Resource Team meetings and project site reconnaissance.

The Shelby Farms Parkway Advisory Team made these recommendations as things that should be considered in the Park's Master Plan. If funding becomes available, these items, with the exception of tractor trailer exclusions, will be incorporated into the parkway design. Currently, tractor trailer use is restricted on Walnut Grove Road west of I-240 (southeast of the project area). According to 23 CFR 658.19(a), reasonable access between National Network routes, such as nearby I-240, 1-40, and US 79, and points of loading and unloading to household goods carriers, motor carriers of passengers, and other covered truck tractor/semitrailer combinations is required; therefore, since non-motorized traffic and tractor trailer traffic will be separated in the proposed parkway, thereby making the road safer for all users, tractor trailer traffic cannot be prohibited from using the parkway because the state cannot deny reasonable access to tractor trailers (23 CFR 658.19(h)(ii)).



Figure 5.1. Brainstorming Session



Figure 5.2. Site Reconnaissance

Citizens of Shelby County have been encouraged to attend the public workshops, take project surveys, ask questions, and be completely engaged in the process. By incorporating CSS, this project has monumental significance to the area which can be attributed to the community's involvement and commitment.

Table 5.1. Shelby Farms Parkway Advisory Team Members and Affiliations

SHELBY FARMS PARKWAY ADVISORY TEAM	
Participants	Stakeholder Group
Laura Adams	Friends of Shelby Farms Park
R. Larry Brown Sr.	County Commission, Shelby Farms Advisory Committee
Brad Corey	Mid-South Trails Association
John Dudas	Memphis Regional Chamber, Major Roads Committee
Gregg Elliott	North Community Representative
Randy Graves	Ducks Unlimited
Richard Hollis	Agricenter
Larry Jensen	Memphis Tomorrow
Dan Johnson	Commuter
Keith Kirkland	Wolf River Conservancy
Marty Lipinski	University of Memphis, Traffic Engineering
Steve Reynolds	Baptist Healthcare
Charlie Rond	Sierra Club
Ritchie Smith	Park Planner/Landscape Architect
Mark Stansbury	Shelby Farms Board
David Stevens	Major Employer (Accredo Health)
Barry White	Briar Neighborhood Association

A partnering meeting was held on February 10, 2005. The meeting included a project history, and discussions of the context sensitive solutions process and project design parameters. The meeting concluded with a "brainstorming session" to define critical project issues. An initial public workshop was conducted on March 24, 2005 to inform interested parties of the proposed project's purpose, need, and goals. The first initial Team Meeting was held on April 28, 2005. This meeting served to advance past brainstorming sessions whereby design, alternatives, limitations, and other considerations were discussed among the Advisory Team and Project Team Members. Several meetings ensued; August 18, 2005; October 6, 2005; October 31, 2005; January 11, 2006; and February 16, 2006. Through the project development process, design criteria were conceptualized to form specific alternatives presented at these meetings. Summaries of the meetings are as follows:

Partnering Meeting #1 was held on February 10, 2005, and served to introduce the Shelby Farms Parkway Advisory Team (the Team) to each other, to the consultant team, and to the local and state agencies representatives.

The Team was provided information about the Context Sensitive Solutions (CSS) process and given an opportunity to ask questions regarding the scope of the process. The consultant team answered those questions, and then facilitated the process for the Team to develop the following:

1. Project Design Parameters
2. Critical Project Issues
3. Team Goals
4. Project Goals

The Team was split into small groups and participated in break-out sessions to develop the above listed items.

Public Meeting #1 was held on March 24, 2005. Information regarding the history of the project, the CSS process, the Team and the 4 items developed by the Team were presented to the attendees. The consultant team and local government agencies representatives were on hand to answer questions.

Team Meeting #1 was held on April 28, 2005. This meeting included a discussion of the results of the March 24, 2005 Public Workshop. Following discussions of the first Public Workshop, the Team discussed traffic forecasting and similar projects. The Team next engaged in a “brainstorming” session concerning the applicable design criteria and the range of alternatives that were considered appropriate for this project. The discussions included design speed, typical section, intersecting roads, alternative alignments within the corridor, and other considerations or constraints. The meeting concluded with the team breaking into smaller groups and sketching alignments on aerial photographs illustrating their ideas for location of the Shelby Farms Parkway.

Information from the February 10, 2005 and the April 28, 2005 meetings of the Shelby Farms Parkway Advisory Team and the March 24, 2005 Public Workshop were used to develop five alternative design concepts. Alternative design concepts G, H, I, J, and K were developed. These included both four and six lane alternatives, various concepts for median design, four different design speeds, and both grade separated and at-grade intersections.

Team Meeting #2 was held on August 18, 2005. The Memphis Area Travel Forecasting Model was presented to the Team and a summary of activities underway for traffic modeling for this project was presented.

The consultants then presented the five alternatives, G-K, that were developed based on input and comments from the Team breakout session at the last meeting. The Team then addressed the specific design guidelines developed at the last meeting and arrived at the following conclusions:

1. Design Speed: 40 to 45 mph
2. Typical Section: 40 foot variable median with curb and gutter with varying elevation.
3. Number of lanes: 4-lane and 6-lane alternates should be developed

Then, each of the interchanges and intersections were discussed in detail.

Team Meeting #3 was held on October 6, 2005. This meeting began with a walk-thru of the alignments that were discussed in the previous meeting. Alignments M and N were staked through the farms. The participants walked the alignment from the intersection of Whitten Road and Mullins Station Road to the location at which the alignments crossed Farm Road to get a feel for the lay of the land and the topography that the alignment followed. They drove to the various other locations that were staked, ending with the final location where Walnut Grove would be relocated and discussed the alignments.

A summary of the alternatives A through K were presented by the design team, followed by an explanation of how the team arrived at two alternatives, L through M. The presentation also included review of the typical sections for each alternative, and summary of travel times for each alternative. This was followed with presentation of simulations for the two alternatives. The consensus of the Advisory Team was around the independent roadway approach.

It was decided by the team that a six-lane roadway would not be presented at the Public Meeting as long as the proposed intersections could function with a four-lane roadway with potential for the road to be widened to a six-lane, if deemed necessary. The extra lanes were deemed unnecessary. Currently, the road is only planned for four lanes. The potential for the road to be widened to a six-lane was a proposal

and does not apply to the current design or immediate plans. Currently, the road is planned for four (4) lanes. The MPO is in the process of developing a new TIP and updating the Long Range Transportation Plan; both will be SAFETEA-LU compliant and must be in effect by October 1, 2007.

There were some concerns raised regarding the bridge at Farm Road. Some team members wanted to communicate that there was a need for more bike and pedestrian access, more than what will exist at the intersections alone.

Suggestions were made to shift Alternative M to the west more, south of the Sycamore View and Shelby Farms Parkway intersection, for the independent segment of road and to save and maintain trees between the independent roadways. An independent design allows for a bifurcated roadway whereby the north and south lanes are not parallel.

Public Meeting #2 was held on November 15, 2005. Two alternatives, L and M were presented at this Public Meeting. Comments were received at the meeting and during a 10 day comment period.

Team Meeting #4 was held on January 11, 2006 at which time the results of the Questionnaire. The most commonly held issues were the results of the following:

- L vs. M
- Constant width vs. independent roadway
- Trumpet vs. flyover

Refinements to Alternatives and simulations which focused on the following were also presented:

- Opportunities to move interchange further west
- Looked at weaving section
- How do the following items change as a function of weaving distance:
 - 1) Delay
 - 2) Avg. Queuing
 - 3) Max Queuing
- Queue changes drastically from 1,100 feet to 1,000 feet
- Once you get to 950 feet on north side, you can't move the south ramp anymore anyway.

Travel Times for the Alternatives were also presented. The issues he discussed included the following:

- Four-lane with two-lane exit works similarly to a six-lane with two-lane exit ramps. The reason may be that when you have more lanes, the volume increases.
- Level of Service does not change much. So, we are using other sensitivities such as delays, etc. to evaluate.
- Refined alignment for flyover with shifting "bulge" of flyover 180 feet west and maintaining a 1,150 feet weaving section.

The Team was polled for their preference of interchange between L & M, and a draft recommendation using items team established as priorities at the onset of the process will be developed for signatures by the Team members.

Team Meeting #5 was held on February 16, 2006 at which time the Flyover and Trumpet alternatives were presented to the Team. The Team recommended the "trumpet" configuration for the interchange at Walnut Grove that provides for free-flowing traffic for all movements through the interchange with the following design elements:

- 40 mph design speed;
- 4 lanes (12 feet each);
- Curvilinear alignment;

- At-grade intersections at Sycamore View Road and at Mullins Station Road;
- Grade separation at Walnut Grove Road;
- Stabilized grass shoulders where feasible;
- Independent roadway concept; and
- Tractor Trailers will not be permitted.

This recommendation was announced at a **Press Conference** held on February 22, 2006. Future Studies of bicycle and pedestrian facilities at Humphreys Blvd. were to take place in May 2006. At the request of TDOT we looked at possible changes that could be made to the Humphreys Blvd interchange currently under construction. This was done in response to local groups that have objected to what they saw as an unfriendly bicycle and pedestrian design. Since changes made by the Shelby Farms Parkway Advisory Team affected the forecasts for this interchange, we looked at possible modifications to all turning movements with the lower traffic volumes at the Single Point Urban Intersection. A letter report was sent to TDOT on April 26, 2006.

The **Public Hearing** was held on December 13, 2007, at the Shelby Farms Visitors Center from 5:00 pm to 7:00 pm. Sixty-nine individuals attended the open-format hearing. Ten individuals gave verbal statements to a court reporter; 55 people submitted comment sheets while at the public hearing or through the mail at a later date; 6 letters were received in conjunction with the hearing.

The purpose of the Public Hearing was to allow the public the opportunity to review the Supplemental Draft Environmental Impact Statement, which was approved on October 18, 2007, and to ask questions or make comments. These comments are included in this Supplemental Final Environmental Impact Statement. At the Public Hearing, the following materials were made available to attendees:

- Electronic and bound copies of the signed Draft Supplemental Environmental Impact Statement;
- Comment sheets;
- VISSIM traffic simulation software showing future traffic volumes for trumpet and fly-over interchanges, as well as Alternative Q;
- Typical sections for Alternative Q (Macon Road to Mullins Station Road and Mullins Station Road to Walnut Grove Road);
- Four-page, signed board listing Team Recommendations and Team Members of the Shelby Farms Parkway Advisory Team;
- Large-scale aerial maps showing the proposed build alternatives (Alternatives L, M, and Q);
- Visualizations with 1) aerial views of the alternative interchanges at Walnut Grove Road facing north; 2) aerial views of the Shelby Farms Parkway facing south at Mullins Station Road; and 3) ground-level views of the alternative interchanges looking east from Walnut Grove Road after crossing Wolf River;
- Tri-folded handouts with a description of the project's key features;
- Handouts describing the right-of-way process; and
- Handouts regarding TDOT Title VI policies in English and Spanish.

A summary of comments received at the Public Hearing and a disposition to those comments is located in Section V.E.



Figure 5.3. Displays at Public Hearing

Team Meeting #6 was held on July 31, 2008. The landfill feasibility study was presented to the Team. The landfill limit was shown to be along Walnut Grove Road; therefore, the alternative recommended by

the Team, particularly roadway elements associated with the interchange, would have some small impact to the landfill not previously anticipated. The following options were presented to the Team:

- No Impact (reduces loop ramp design speed from 25 mph to 20 mph);
- Option 1 (Team Recommended Alternative); and
- Option 2 (Walnut Grove Road to remain in current location with 25 mph ramp shifted to the south over landfill).

For multiple reasons, including original design, it is not feasible to construct anything over the landfill without an associated cost. Cost estimates were presented to the Team. It would cost an additional \$33 million to build Option 2 and an additional \$6 million to build Option 1. A drawing of the options is depicted in Figure 2.8

Portions of the July 2008 Shelby Farms Master Plan were presented to the Team members as an update of the plans for pedestrian and bicycle facilities, including circulation, overpasses and underpasses, pedestrian bridges, and access. A drawing of the pedestrian and bicycle facilities, as proposed in conjunction with the Master Plan, is located on page ix. When funding becomes available for pedestrian and bicycle facilities, the trails and associated structures within the predefined study area as presented in the aforementioned drawing may be built.

A recommendation was made by the nine Advisory Team members in attendance: *The no impact option with the reduced speed was selected with the understanding that strong consideration would be made to incorporate trails, underpasses, and address bicyclists and pedestrians in the Shelby Farms Parkway design in an effort to achieve a multimodal community.*

V.C. List of Agencies, Officials, and Organizations to Whom the SDEIS was Submitted

Federal Agencies

U.S. Department of Housing and Urban Development
U.S. Department of the Interior, Office of Environmental Policy and Compliance
National Oceanic and Atmospheric Administration
U.S. Department of Agriculture-Natural Resource Conservation Service
Federal Aviation Administration
U.S. Army Corps of Engineers-Memphis District-Regulatory Branch

State Agencies

Tennessee Department of Environment and Conservation: Commissioner's Office; Department of Economic and Community Development; Division of Water Pollution Control; Division of Ground Water Protection; Division of Air Pollution Control; Division of Remediation
Tennessee Wildlife Resources Agency
Tennessee Historical Commission-State Historic Preservation Officer
Tennessee Department of Agriculture
Tennessee Department of Education

Local and Regional Agencies and Organizations

Memphis Area Association of Governments
Memphis & Shelby County Office of Planning & Development
Memphis-Shelby County Public Library and Information Center
Memphis-Shelby County Public Library-Cordova Branch
University of Memphis Library-Government Publications Department
Sierra Club
TN Chapter of the Sierra Club
The Nature Conservancy
World Wildlife Fund

V.D. Dispositions to Comments made by Agencies and Organizations

V.D.I U.S. Department of the Army, Memphis District, Corps of Engineers

Date Comments Submitted to TDOT: June 4, 2007

Response to USACE comments submitted to TDOT: July 17, 2007

1. As pointed out in the document, we would require verification of all waters of the United States within the project area as part of an application for any department of the Army permit. This should include a delineation of all wetlands as well as a determination of whether the “intermittent blue-line streams” and “channelized wet weather conveyances” (p. 41) are considered waters of the U.S.

Statement “a determination of whether intermittent blueline streams and channelized wet weather conveyances are considered waters of the U.S. will be completed” added to p. 41.

2. The statement on page 42 that “The Resource Team did not recognize the half-acre difference in wetland impacts among the alternatives as a major point of discussion” is a bit disconcerting. A half-acre wetland impact is not necessarily an insubstantial amount; this is actually the upper limit of impacts that could be covered under many of the Corp’s recently issued Nationwide Permits (including Nationwide Permit 14 {Linear Transportation Projects}). The consideration of wetland impact and avoidance in the context of other environmental impacts (p. 42) is appropriate; however, this discussion should be strengthened with the inclusion of a description of these other impacts.

Descriptions of how stream, floodplain, and recreational resources impacts were avoided and that the opportunity for further avoidance will be available in final design.

3. For Department of Army (DA) permits, each crossing of a water of the United States is typically considered a single and complete project. Therefore, although it is appropriate to examine the full extent of impacts for each of the considered alternatives, the proposed wetland and stream impacts at each impact site should be specified as part of a permit application. This will determine the appropriate type of DA permit for this project.

Added as an environmental commitment and on p. 42.

4. There is a wetland mitigation bank located within the Wolf River watershed. However, given the available space and the nature of the proposed project area, it would be appropriate to consider on-site wetland mitigation for unavoidable wetland and stream impacts. Of particular interest would be mitigation that could enhance the function of the existing wetlands within or adjacent to the project area.

Impacts to wetlands will be mitigated through a wetland mitigation bank. If available, on-site wetland banks should be utilized; however, if not available, a wetland mitigation bank within the Wolf River watershed is capable of holding such an area.

5. The text includes documentation of the avoidance of the wetland between Mullins Station and Walnut Grove Road (p. 42). If applicable, this discussion should be expanded to include other measures to avoid and minimize wetland impacts.

Wetlands are less likely to be bisected in the Selected Alternative, as compared to Alternatives L & M. To the east of the Lucius E. Burch SNA in the southern portion of the study area, a preliminary wetland

study found several large wetlands. Alternatives L & M bisect one of these large wetlands. Opportunity to alter Alternative Q will be made available during final design.

6. Based on a review of the text and figures provided, the DSEIS suggest that flowlines would not rise greatly upstream of the Walnut Grove bridge and that local drainage will not be blocked. (However, [if concurrence is needed, the Memphis District’s Hydraulics and Hydrology Branch would need to review the road profiles and hydraulic model to provide a more detailed analysis of the expected effect on the flowlines or assess the likelihood of increased scour at the Walnut Grove Road bridge as a result of this project.]

[Statement] added as an environmental commitment

7. The top of proposed Kirby Parkway through Shelby Farms is indicated in Figure 2.5 as being slightly above natural ground. However, the roadway is outside of the floodway as mapped in Figure 2.7. No profile of the proposed parkway was provided so it is not possible to tell if the road would be overtopped during floods.

A profile of the section of the proposed roadway within the floodplain has been included. Within this section, the roadway ranges from 11 feet to 38 feet above the existing roadway.

8. Water carried by the ditches/streams within Shelby Farms should be handled through a provision of culverts through the proposed parkway.

Added as an environmental commitment

9. Additionally, we found four minor errors in the text:
 - a. On page iii the statement “Walnut Grove Road to be relocated north of the existing roadway by 3,500 feet” is not clear.

The interchange required Walnut Grove Road to be relocated 450 feet to the north to provide for the loop ramp. The trumpet interchange is approximately 3,500 feet west of Farm Road.

- b. On page v (Vicinity map), “Wolf Creek” should be changed to “Wolf River”.

Corrected

- c. On page 18, Figure 2.4, “looking east” should be “looking west”.

Corrected

- d. On page 42, Table 4.5, “feed” should be “feet”.

Corrected

V.D.2 Sierra Club, Chickasaw Group-Tennessee Chapter

On April 30, 2008, Shelby County Government responded to the Sierra Club’s comments with the following letter:

“Dear Ms. Van Tol,

In regards to your December 17, 2007 letter, the following answers are given to your questions and concerns. Most of the items you listed, Comments #1-4 and #6, can be summarized by stating bicycle and pedestrian access to/from Shelby Farms will accompany the Humphreys Boulevard/Walnut Grove Road intersection reconstruction to the south and the Greater Memphis Greenmile to the north. The Shelby Farms Parkway Advisory Team has been very much in favor of including non-motorized transportation facilities within the Shelby Farms area. Facility locations were studied and discussed during the Context Sensitive Solutions (CSS) process, but the Team ultimately decided to defer specifics of the bicycle, pedestrian, and other facilities to the development of the Shelby Farms Master Plan. That process is currently underway. Once the selected Master Plan consultant delivers their conceptual plan for access and connectivity within Shelby Farms, those concepts will be incorporated in the Final Environmental Impact Statement (FEIS).

A dedicated road and parking area will be considered under the development of the Master Plan. In addition, the City of Memphis and Shelby County are committed to coordination of the final design with the development of the Master Plan and the inclusion of crossings and other areas of the Shelby Farms Parkway where feasible and practical.

Comment #5; wetlands typically require a 2:1 replacement ration. Consultation with the United States Army Corps of Engineers and Tennessee Department of Environment and Conservation (TDEC) will occur during the permitting process to establish mitigation measures. If available, on-site wetland banks should be utilized; however, if unavailable, a wetland mitigation bank within the Wolf River watershed is capable of holding such an area. Your request of a 3:1 ratio for mitigation will be taken under advisement.

Comment #6; aesthetically appropriate materials and landscaping were recommended by the Shelby Farms Parkway Advisory Team. The Team's vision for the Shelby Farms Parkway is a road that blends into the natural and topographic setting of Shelby Farms. As such, the Shelby Farms Parkway Advisory Team recognizes that connectivity, access, and aesthetic characteristics of the Shelby Farms Parkway must be consistent with the Master Plan and has deferred development of specific recommendations to the Shelby Farms Master Plan.

Comment #7; during Final Design, the Team will look at ways of minimizing harm and impacts to the floodplains. The floodplain impacts (short- and long-term) may be greatly reduced by implementing drainage structures, where possible. Spill protection and natural filtration basins will be analyzed in Final Design to determine their feasibility to reduce impacts to Wolf River or the aquifer. In addition, a Storm Water Plan will be developed during Final Design to address storm water runoff.

Thank you for your input, and we appreciate the advice on future endeavors with Shelby Farms. All of your comments will be considered during Final Design and the development of the Master Plan. If you have any questions or comments, please contact me at your earliest convenience."

V.E. Disposition To Comments Made At The Public Hearing

Questions and Comments below are summarized from questionnaires handed out at the Public Hearing and sent in during the 21 day comment period following the Hearing. Questions and comments have been rephrased in a Frequently Asked Questions format.

1. Will there be bicycle, pedestrian, hike, and horse trails after the project has been constructed?

Bicycle and pedestrian access to/from Shelby Farms will accompany the Humphreys Boulevard/Walnut Grove Road intersection reconstruction to the south and the Greater

Memphis Greenmile to the north. The Shelby Farms Parkway Advisory Team has been very much in favor of including non-motorized transportation facilities within the Shelby Farms area. Facility locations were studied and discussed during the CSS Process, but the Team ultimately decided to defer specifics of the bicycle, pedestrian, and other facilities to the development of the Shelby Farms Master Plan. With the release of the Shelby Farms Park Master Plan in July 2008, a more concurrent plan could be established. At the July 31, 2008 Advisory Team meeting, Project Team members presented to the Advisory Team a depiction of potential pedestrian and bicycle facilities, as laid out in the Master Plan (see Appendix A). In order to be considered for inclusion in the project, those facilities located outside the project study area were amended to fall within the boundaries of the proposed project. When funding becomes available, these facilities—all or in part—will be constructed to meet the needs of commuters and recreational users.

2. How will runoff from the parkway affect the Wolf River and the aquifer?

The new roadway, and the resulting loss of forested areas, will increase storm event runoff by creating impervious surfaces. In order to move the roadway as far west as possible to minimize bisecting the Farms open areas, the roadway is closer to Wolf River. Increased flow during storm events must be partially stored on the floodplains to prevent excessive damage to downstream areas that may result in erosion, substrate scouring, and aquatic habitat alterations. Since the Selected Alternative is designed for at-grade construction through Shelby Farms, direct floodplain impacts (short- and long-term) may be greatly reduced by implementing drainage structures, where possible. Spill protection and natural filtration basins will be analyzed in final design to determine their feasibility to reduce impacts to Wolf River or the aquifer. In addition, a Storm Water Plan will be developed during Final Design to address storm water runoff.

Recommendations from Dr. Jerry Lee Andrews of the University of Memphis Ground Water Institute are commitments for construction and implementation of the proposed project. They are listed on page viii.

3. Will there be additional roadway noise from vehicles?

Yes; however, noise levels are acceptable according to FHWA standards. Noise barriers are not considered to be reasonable for the project based on their location with respect to anticipated multipurpose bike and walking paths. Traffic volumes are predicted to increase within the project corridor whether or not the proposed project is constructed. These volumes would need to double from predicted levels for the year 2030 in order to produce an increase of 3 dBA in noise levels, which is regarded as a threshold where most people are able to notice a difference in noise levels when heard sequentially for comparison. Therefore, cumulative impacts with respect to changes in future traffic volumes are not anticipated.

4. Why can't the interchange be pushed further south in the Shelby County Penal Farm Landfill?

A landfill feasibility study was performed on the 130-acre Shelby County Landfill located at 6791 Walnut Grove Road. The objective was to assess the feasibility of constructing roadway elements, specifically ramps associated with the interchange, within the limits of the current landfill facility.

Three conceptual interchange alignments were under consideration, one of which (“Option 1”) was the original Alternative Q interchange as described in the DSEIS; it was previously thought to not encroach upon the landfill. The others included a base alignment wherein no construction elements were assumed to be located within the current facility footprint (“No Impact”) and an alignment that encroached upon the current facility footprint (“Option 2”) to a greater extent than Option 1.

Based on the modeling approached used to assess the options presented above, it was estimated that 93,800 cubic yards of waste materials would be excavated for Option 1 and 651,600 cubic yards would be excavated for Option 2. The costs associated with these alternatives range from roughly \$6.4 million for Option 1 and \$33.4 million for Option 2. In a July 31, 2008 meeting, the Advisory Team accepted the study, and they decided to proceed without moving the interchange south of Walnut Grove Road into the landfill facility. Therefore, in order to eliminate the costs associated with Option 1 or 2, the Project Team elected to move the interchange ramp slightly north by keeping the southern edge of the future right-of-way within the existing right-of-way of Walnut Grove Road (“No Impact”). As a result, the ramp design speed was reduced from 25 mph to 20 mph.

5. There is too much land from Shelby Farms that is taken to construct the parkway. Why?

Through the CSS process, the design team looked at all options to minimize impacts to Shelby Farms. The proposed typical section requires the design to accommodate 4-lanes of traffic, with shoulders and bike paths through Shelby Farms. Although impacts were necessary, they were minimized.

6. Will the proposed roadway have an Interstate look?

No, the roadway will have the characteristics of a parkway (meandering design, curb and gutter, and landscape appointments) with a 40 mph design speed in comparison to 70 mph interstate design speeds. The curvilinear parkway design was selected to discourage speeding.

7. How will this project be funded?

Funding has been determined for this project. The Memphis Metropolitan Planning Organization 2008-2011 Transportation Improvement Program shows (on page 64) an 80 percent federal share and a 20 percent match by the City of Memphis.

8. Will this project implement “green” culverts or tunnels for habitat crossings?

Final Design, in conjunction with the Shelby Farms Park Master Plan, will determine where there is a need or desire for placement of culverts or tunnels. If desired, final design will address the feasibility of providing these crossings both for drainage and wildlife purposes.

9. How will wetlands impacts be mitigated?

Wetlands typically require a 2:1 replacement ratio. For example, if 1.5 acres of wetlands are taken, 3.0 acres must be replaced. Consultation with the USACE and TDEC will occur during the permitting process to establish mitigation measures. Impacts to wetlands will be mitigated through a wetland mitigation bank. If available, on-site wetland banks should be

utilized; however, if unavailable, a wetland mitigation bank within the Wolf River watershed is capable of holding such an area.

10. Is the project corridor going through parkland?

In the past, Shelby County Government, which exercised jurisdiction over Shelby Farms, determined that the area was a multi-use area and that the project did not go through or utilize any parkland within the multi-use area. FHWA had concurred with this determination. Since the Grant of the Conservation Easement described the entire Shelby Farms Park as a park, FHWA asked for this question to be revisited. The proposed pathway for this project would pass through agricultural fields and the buffalo grazing area. Because a corridor for a north-south road was envisioned concurrently with use of Shelby Farms as a park, project planners do not think that any land intended for park use is being used for the parkway. To the extent that the project is going through any parkland, that use of parkland is minimal.

11. How will the project impact air quality?

The air quality analysis for this project shows existing pollution levels to be the same or improved after the project has been completed. The proposed project will not violate EPA Clean Air standards. Traffic patterns are expected to improve, allowing for improved air quality. In addition, with the removal of several stop conditions at Farm and Whitten Roads, vehicles will have fewer emissions than existing stop and go conditions.

12. Will there be additional parking created within Shelby Farms after the project is constructed?

This project has no plans for additional parking within Shelby Farms. The Shelby Farms Master Plan may include provisions for additional parking facilities or areas.

13. Will the visual aesthetics from the parkway include natural barriers and employ a sunken roadway?

Alternatives were studied that utilized a sunken roadway for the entire length of the project through Shelby Farms in order to remove the roadway from view of the park areas and reduce noise, but Shelby Farms Park Advisory Team (SFPAT) members felt that it was more important for drivers to be able to see the park from the roadway in order to entice more users. Team members felt that if properly designed as a parkway, the road should be a visual enhancement to the park.

The currently proposed parkway will be 11 to 38 feet above existing elevation instead of sunken below existing elevation. As discussed in Section IV.N, approximately three to five meters of loess overlie the shallow aquifer, which ranges from 14 to 17 meters thick. In an area near Walnut Grove Road, a paleochannel into the aquifer breach has been found. Keeping the proposed parkway above the existing elevation will assist in protecting the aquifer.

No specific park signage has been developed in conjunction with this project. The Park Master Plan (Appendix A) depicts several signage opportunities for the park. More concrete signage plans, if any, may be developed during final design of the roadway.

14. Did the traffic counts factor in north-south Appling Road traffic?

No. North Appling lies outside of the traffic study area as developed for the project and agreed to by the Resource Team.

15. Is a future Sycamore View connection part of this project?

No. The connection was shown only as a potential project and shows a logical connection to the parkway.

16. How will pedestrians, cyclists, and runners enter Shelby Farms at various locations along Walnut Grove?

This has not been determined. Suggestions and recommendations made to the Shelby Farms Park Master Plan will look at all reasonable options. Final design will work in concert with the ideals proposed by the Master Plan.

17. How was the Public Hearing advertised?

Advisory Team members were given handouts prior to the meeting to pass on to constituents and a flyer was posted at the Shelby Farms Park Visitors Center. Additionally, the meeting was advertised in the Memphis Commercial Appeal on November 11 and 12, 2007 and December 10, 2007 as well as the Daily News on November 12, 2007. Attendance for this December 13, 2007 Public Hearing (69 attendees) was similar to the first two Public Meetings held on March 24, 2005 (75 attendees) and November 15, 2005 (57 attendees).

18. Why is the project called Kirby Parkway and not the Shelby Farms Parkway?

In the original EIS for this project, the roadway was called the Kirby Parkway beginning at I-240 west of Shelby Farms and ending at I-40 north of Shelby Farms. At the first SFPAT Meeting, the Advisory Team decided on the name Shelby Farms Parkway for the portion of the project passing through Shelby Farms in order to show emphasis that the roadway should have a parkway feel and to bring attention to the recreational usages in Shelby Farms. The name Kirby Parkway has been used in the DSEIS to match the name of the original EIS.

19. Will the construction of the roadway open the Farms up for development?

Shelby County Government has ownership of the land in Shelby Farms adjacent to the Shelby Farms Parkway corridor. Future plans for the park's usage is now under the direction of the Shelby Farms Conservancy. The Shelby Farms Conservancy is currently in the process of developing a Master Plan for the future uses of Shelby Farms that will guide decision making regarding land use adjacent to the new roadway.

20. What impact will there be on rare and endangered bird species in the Farms area?

According to the United States Fish and Wildlife Service (USFWS), no records regarding proposed threatened and/or endangered species of plants and animals exist within the proposed project corridor. However, according to TDEC, seven state-listed rare species may be near the project area (see Section IV). If any of these are discovered in or near the project site, protection measures will be used to prevent or minimize impact to these

species. With heightened potential for nesting site destruction of two state sensitive bird species, it was suggested that the ROW in the Shelby Farms area be cleared and grubbed between mid September to March prior to construction.

21. Where will large animals go if their habitat is destroyed?

Most new construction will take place north of the river where the habitat is predominantly pasture and row crops. These areas generally do not provide substantial cover or shelter for wildlife. As such, any impacts are likely to be minimal and temporary as there is abundant similar type habitat outside the project boundary.

22. What measures will the city employ to enforce the speed limit of the road to ensure vehicles won't speed through the Shelby Farms area?

Aside from normal speed limit signing, the city will provide patrol and enforcement of the speed limit as needed. It should be noted that the SFPAT chose a design for the roadway with a curvilinear alignment utilizing a 40 mph design speed to discourage drivers from speeding.

23. Can renderings of the proposed roadway be provided to help us understand the footprint of the new parkway?

Renderings of the proposed project from three viewpoints were developed at the request of the SFPAT. Aerial views were provided both from the southern end of the project looking north and the northern end of the project looking south. A third view of the two interchange alternatives was prepared looking east along Walnut Grove Road. The first two visualizations were presented at the November 15, 2005 Public Meeting. All three views were available on multiple boards at the December 13, 2007 Public Hearing and were presented in the DSEIS available at local libraries. The boards for each location showed the existing photograph and all three different alternatives (L, M, and Q) for comparison.

24. Will the construction of I-69 divert traffic from this corridor?

The construction of I-69 is anticipated to be far enough away from the Shelby Farms Parkway that any diversion will be negligible. I-69 will be more of a regional project whereas the Shelby Farms Parkway is anticipated to handle more local traffic.

25. How will Farm Road connect to the new Shelby Farms Parkway and Walnut Grove Road?

Alternatives presented in the DSEIS show Farm Road connecting to the Shelby Farms Parkway with an at-grade intersection with full turning movements and at Walnut Grove Road with only right-in/right-out movements. It is important to note that the SFPAT recommended that the Shelby Farms Master Plan provide recommendations regarding the connections to Farm Road and the disposition of Farm Road once the Parkway is completed. Final design will work hand-in-hand with the development of the Master Plan to ensure compatible uses of the portions of Farm Road remaining.

26. Will bicycle lanes be provided on the shoulder of the Shelby Farms Parkway or will separate multi-use paths be utilized? Was a representative of bicycle interests included on the Shelby Farms Parkway Advisory Team?

The SFPAT recommended that decisions regarding the inclusion of bicycle facilities be deferred until the Master Plan has been developed to ensure compatibility with the facilities provided to connect to the Shelby Farms areas. The Team also recommended that the use of reinforced earth shoulders be explored along the Parkway to reduce the width of asphalt. Decisions made during final design regarding shoulder types could influence the location of bicycle lanes. Brad Corey of the Mid-South Trails Association represented bicycle interests on the Advisory Team.

With the release of the Shelby Farms Park Master Plan in July 2008, a more concurrent plan could be established. At the July 31, 2008 Advisory Team meeting, Project Team members presented to the Advisory Team a depiction of potential pedestrian and bicycle facilities, as laid out in the Master Plan (see Appendix A). In order to be considered for inclusion in the project, those facilities located outside the project study area were amended to fall within the boundaries of the proposed project. When funding becomes available, these facilities—all or in part—will be constructed to meet the needs of commuters and recreational users.

27. How will the Greenway along the abandoned railroad tracks parallel to Mullins Station Road connect to bicycle and pedestrian facilities provided on the parkway?

Mullins Station Road will connect to the Shelby Farms Parkway with a signalized, at-grade intersection. At a minimum, crosswalks will be provided for cyclists and pedestrians using the greenway to enter Shelby Farms. If recommended as part of the Master Plan, an over or underpass structure could be studied for feasibility during final design to provide a safer crossing.

28. How many acres of the Shelby Farms are impacted by the footprint of the trumpet interchange and the relocation of Walnut Grove north to stay out of the landfill?

The footprint of the interchange and shift of Walnut Grove to the north will impact 46.2 acres. It should be noted also that once Walnut Grove Road has been shifted north, the existing Walnut Grove Road will be removed which will create an additional 7.5 acres of vegetated open space that will be available for other land uses.

29. Does TDOT have plans for adding lanes to I-240 South between I-40 and Walnut Grove Road?

No plans are currently in the 2008-2011 Memphis MPO Transportation Improvement Program for the widening of I-240 South between I-40 and Walnut Grove Road. An interchange modification project is proposed for the I-240/I-40 Interchange, but no widening is expected along I-240 from I-40 to Walnut Grove Road.

30. What are the ecological effects of the road separating the Burch Natural Area from the field/meadow/wetland particularly to wildlife?

The project is not expected to result in any substantial impacts to wildlife. Most new construction will take place north of the River where the habitat is predominantly pasture and row crops. These areas generally do not provide substantial cover or shelter for

wildlife. As such, any impacts are likely to be minimal and temporary as there is abundant similar type habitat outside the project boundary.

31. Will there be additional public meetings or hearings before the FEIS is completed?

It is not anticipated that additional public meetings or hearings will be held as part of the environmental process unless major shifts are made to the plans and additional studies are required. It is anticipated that a public meeting will be held during final design to present the right of way plans to the public before acquisition begins. In addition, Preliminary habitat assessments on site visits determined that no state-listed threatened, endangered, or sensitive species will likely be impacted by the Selected Alternative.