

Air Quality Analysis

Kirby Parkway
at Shelby Farms
Memphis, Tennessee

for
Tennessee Department of Transportation
Shelby County Government

January 2006



AIR QUALITY ANALYSIS

Shelby Farms Parkway

Shelby County, Tennessee

Prepared For:

**TENNESSEE DEPARTMENT OF
TRANSPORTATION**

Nashville, Tennessee

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ABSTRACT

The proposed project consists of the construction of the Shelby Farms Parkway between Walnut Grove Road and Macon Road along with a new interchange/ramp system at Walnut Grove Road, approximately 2.5 miles in length.

According to the calculated existing and future microscale emissions of carbon monoxide (CO), the maximum CO concentrations for the 2005 Existing Alternative are 9.6 ppm for one hour and 6.5 ppm for eight hours. The maximum concentrations for the 2026 No-Build Alternative are 8.0 ppm for one hour and 5.4 ppm for eight hours. The maximum concentrations for Alternative L are 5.5 ppm for one hour and 3.7 ppm for eight hours. The maximum concentrations for Alternative M are 5.8 ppm for one hour and 3.9 ppm for eight hours. All existing and future carbon monoxide concentrations are below the one-hour standard of 35 ppm and the eight-hour standard of 9 ppm.

Shelby County is currently designated as a marginal nonattainment area with respect to the eight-hour ozone standard (June 15, 2004) and in attainment for the remainder of transportation related pollutants. Based on current and future one-hour and eight-hour carbon monoxide levels, the proposed project will not have a negative impact on the ambient air quality of Shelby County. The proposed project will also not have a negative impact on the *Metropolitan Memphis Interstate Air Quality Control Region* when current and predicted carbon monoxide levels are compared to the National Ambient Air Quality Standards.

Based on this analysis, the proposed project is found to be in conformity with the State Implementation Plan using EPA's Transportation Conformity Rule Amendments, August 2, 2004.

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1. DESCRIPTION OF THE PROPOSED PROJECT

The proposed project is located in Memphis, Tennessee, in south central Shelby County. The proposed project consists of the construction of the Shelby Farms Parkway between Walnut Grove Road and Macon Road along with the construction of a new interchange/ramp system at Walnut Grove Road. The project location is shown in Exhibit 1.

The primary purpose and need of the proposed construction is to create a new north-south route in the East Memphis area of Shelby County which will improve system linkages, improve access between the residential areas of Bartlett and Germantown and the commercial corridor of Poplar Avenue. Implementation of the proposed project will also improve mobility and reduce congestion along the existing routes in the project area, thus providing a safer and more efficient roadway system along with reduced travel times and delays on existing routes.

For the proposed project, an analysis of four alternatives was conducted. These include the Existing Alternative (2005), the No-Build Alternative (existing facilities using design year traffic volumes), and two alternatives designated as Alternative L and Alternative M for the design year of 2026.

Within the existing project corridor, Whitten Road consists of two 11-foot lanes with 12-foot turn lanes located at Southbound Whitten Road and Kamali Avenue, Southbound Whitten Road at Manslick Road, and in the vicinity of Show Boat Lane.

Farm Road consists of two 11-foot lanes with an additional 11-foot turn lane at the intersection with Walnut Grove Road. Walnut Grove Road is comprised of four 11-foot lanes with a 26 to 36-foot median. Turn lanes, 10-foot in width, are located at the entrance to the Shelby Farms Tournament Park BMX Track and at the intersection with Farm Road. Vehicle speeds along these facilities range from 40 mph along Whitten Road to 45 mph along Farm Road and Walnut Grove Road.

Alternative L 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), 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 will be 100-foot, 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 a 5-foot sidewalk on each side of the roadway. A travel speed of 40 mph is proposed for Alternative L. Alternative L will also 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 and 2,500 feet west of the existing signalized intersection of Walnut Grove and Farm Road. The trumpet interchange requires Walnut Grove Road to be relocated north of the existing roadway for 3,500 feet to provide for the loop ramp. 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 range from 20 to 45 mph.

From the interchange, Alternative L will travel in a northerly direction while curving to the west and back to the east, intersecting the proposed Sycamore View Extension at a 90⁰ angle. The Sycamore View intersection will be a signalized intersection to provide traffic movements in all directions. The alignment continues 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 will be realigned to eliminate an existing skew and provide turn lanes on all approaches. Alternative L will then continue north along the existing alignment of Whitten Road to Macon Road.

Alternative M from Walnut Grove Road to Mullins Station is to be constructed with a variable right-of way, with four 12-foot traffic lanes (two in each direction), and a variable width median. Alternate M will use an independent roadway concept wherein the grade and alignment will be varied to blend the roadway into the natural topography. From Mullins Station Road to Macon Road, the right-of-way for Alternative M will be 100-foot, consisting of four 12-foot traffic lanes with a 14-foot center turn lane, 10-foot shoulders, and curb and gutter on either side of the road. A 5-foot sidewalk is proposed for each side of the roadway. A travel speed of 45 mph is proposed for Alternative M. Alternative M will also include the construction of a new interchange with a fly-over for eastbound traffic using the proposed road. This alternative will also include a signalized intersection for vehicles traveling south and turning east on Walnut Grove Road. The proposed interchange will be 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 will not require Walnut Grove Road be relocated off the existing roadway. This alternative will provide Farm Road with right-in right-out access to Westbound Walnut Grove Road and eliminate access to Eastbound Walnut Grove Road. Travel speeds associated with the proposed interchange/ramp system will range from 40 to 45 mph.

From the interchange, Alternative M will travel in a northerly direction curving to the west and back to the east, intersecting the proposed Sycamore View Extension at a 90⁰ angle. The Sycamore View intersection will be a signalized intersection to provide traffic movements in all directions. The alignment continues north curving east, crossing south of a gas regulator station located within the farm area, then back east before crossing the relocated Mullins Station Road at a slight skew. The signalized Mullins Station Road intersection will be realigned to eliminate an existing skew and provide room for turn lanes on all approaches. Alternative M would then continue north along the existing alignment of Whitten Road to Macon Road. Travel speeds along these facilities will remain from 40 to 45 mph.

The No-Build Alternative would involve no new construction; only that is required to maintain the existing facilities within the project corridor (routine paving, striping, drainage, and maintenance). Palmer Engineering provided proposed alignment and design information.

2. AIR QUALITY CONTROL

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 of 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 so June 15, 2004. For all other criteria pollutants listed above, Shelby County is designated as in attainment.

3. ASSESSMENT METHODOLOGY

Current state-of-the-art models were utilized for the air quality analysis of the proposed project. Carbon monoxide (CO) emission factors for the existing year (2005) and design year (2026) were calculated by using the U. S. Environmental Protection Agency's MOBILE6.2.03 emissions factor program. Input data representing most likely worst case conditions was selected to generate the required carbon monoxide emission factors. The following parameters were used:

- Ambient temperature of 42.0°F
- Fuel RVP of 13.4 psi
- Inspection/Maintenance program
- Arterial roadway facility
- Vehicular speeds ranging from 2.5 mph to 65 mph
- Month of evaluation: January

Two receptors were chosen within the project corridor to represent locations where human activity may be affected by transportation related carbon monoxide emissions. The U. S. Environmental Protection Agency's CAL3QHC Version 2.0 dispersion model was used to calculate CO concentrations at each receptor for the Existing Alternative, No Build Alternative, and Alternatives L and M.

Roadway geometrics required for the dispersion model were expressed as a series of links defined by X and Y coordinates on a Cartesian coordinate system. Other input included traffic volumes for each link as listed in Appendix A, emission factors

calculated by MOBILE6.2.03 (Appendix B), link widths, CO source height, and meteorological data.

Meteorological input data for the modeled worst-case conditions were:

- Wind speed of 1 meter per second
- Pasquill Stability Class D
- Mixing Height of 1,000 meters
- Roughness Length of 100 centimeters
- Background CO concentrations of 4.7 ppm (one-hour) and 3.1 ppm (eight-hour)

4. MICROSCALE ANALYSIS

For the Shelby Farms Parkway, a hot spot microscale analysis was performed for the Existing Alternative, No-Build Alternative, Alternative L, and Alternative M (Exhibits 2 and 4). 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 (Appendix C). 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 9.6 ppm and a maximum eight-hour CO concentration of 6.5 ppm were calculated at Receptor 1 of Alternative L. For the No-Build Alternative, a maximum one-hour CO concentration of 8.0 ppm and a maximum eight-hour CO concentration of 5.4 ppm were calculated for Receptor 1 of Alternative L. For Alternative L, the maximum one-hour and eight-hour CO concentrations of 5.5 ppm and 3.7 ppm, occur at Receptor 1. For Alternative M, the maximum one-hour and eight-hour CO concentrations of 5.8 ppm and 3.9 ppm, occur at Receptor 1.

The calculated one-hour and eight-hour CO concentrations are listed in Table 1 on the following page. 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 1 Carbon Monoxide Concentrations, ppm

RECEPTORS	2005 Existing		2026 No-Build		2026 Alternative L		2026 Alternative M	
	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr	1 hr	8 hr
Receptor 1 Alternative L	9.6	6.5	8.0	5.4	5.5	3.7	-----	-----
R1 on Southern ROW of Alternative L								
47' and 76' south of Ramps B and B3, respectively								
Receptor 1 Alternative M	6.0	4.0	5.6	3.7	-----	-----	5.8	3.9
R1 on South ROW of Alternative M at Shelby Farms BMX								
Tournament Track								
34' south of Humphries to Walnut Grove Ramp								
	Greater than Existing Levels							
	Equal to Existing Levels							
	Less than Existing Levels							

5. CONCLUSIONS

According to the calculated existing microscale emissions of carbon monoxide, the maximum carbon monoxide concentrations in 2005 were 9.6 ppm for one-hour concentrations and 6.5 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 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.

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 September 30, 2005 Transportation Improvement Program (TIP) Fiscal Years 2006 through 2008 for the Memphis Urbanized area. The project, with no changes in the concept and scope, is included in the TIP and also in the Memphis Metropolitan Area Long Range Transportation Plan for the Year 2026, approved by FHWA and FTA on October 24, 2005. It is found to be in conformity with the SIP using EPA's Transportation Conformity Rule Amendments, August 2, 2004.

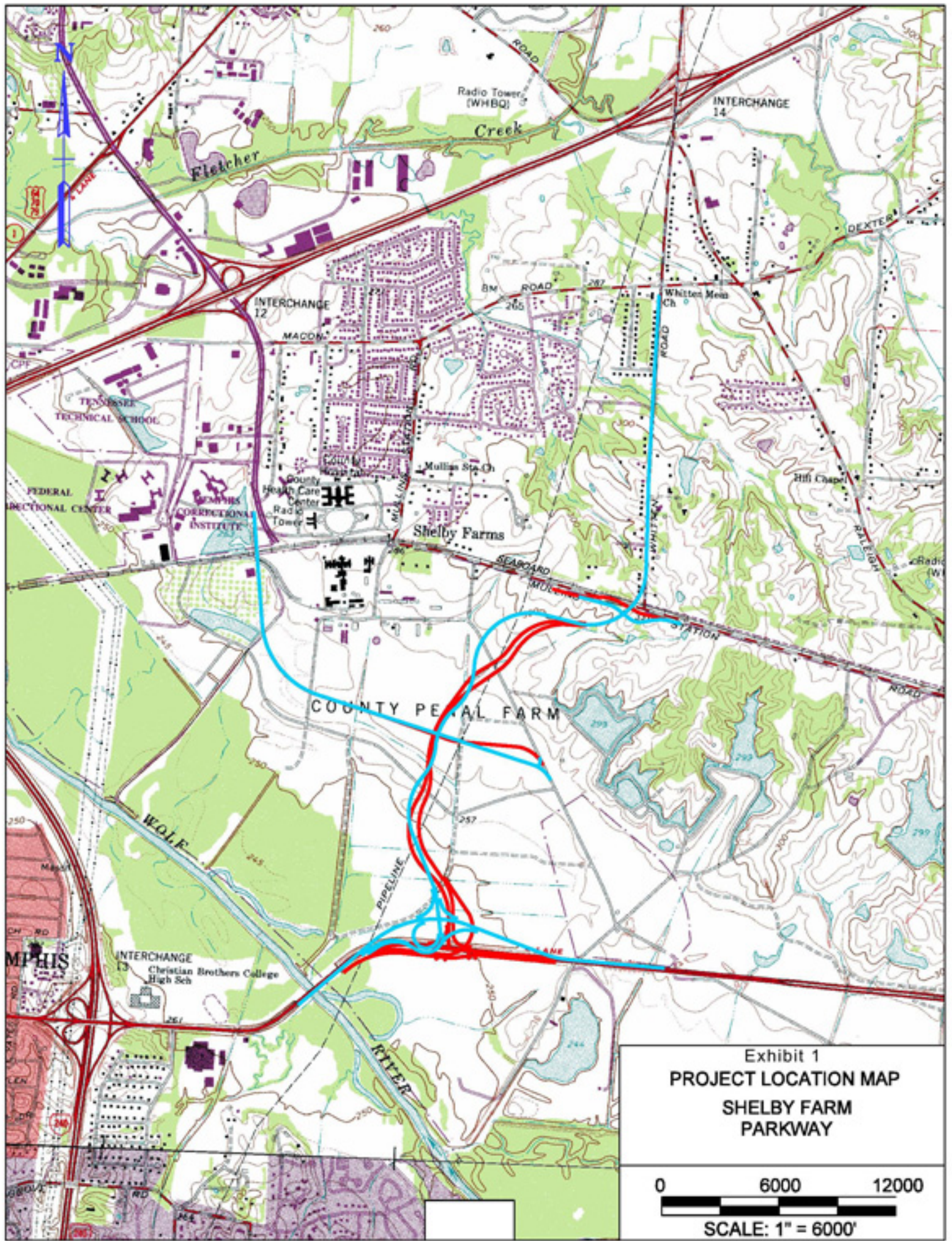
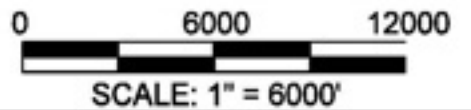


Exhibit 1
PROJECT LOCATION MAP
SHELBY FARM
PARKWAY



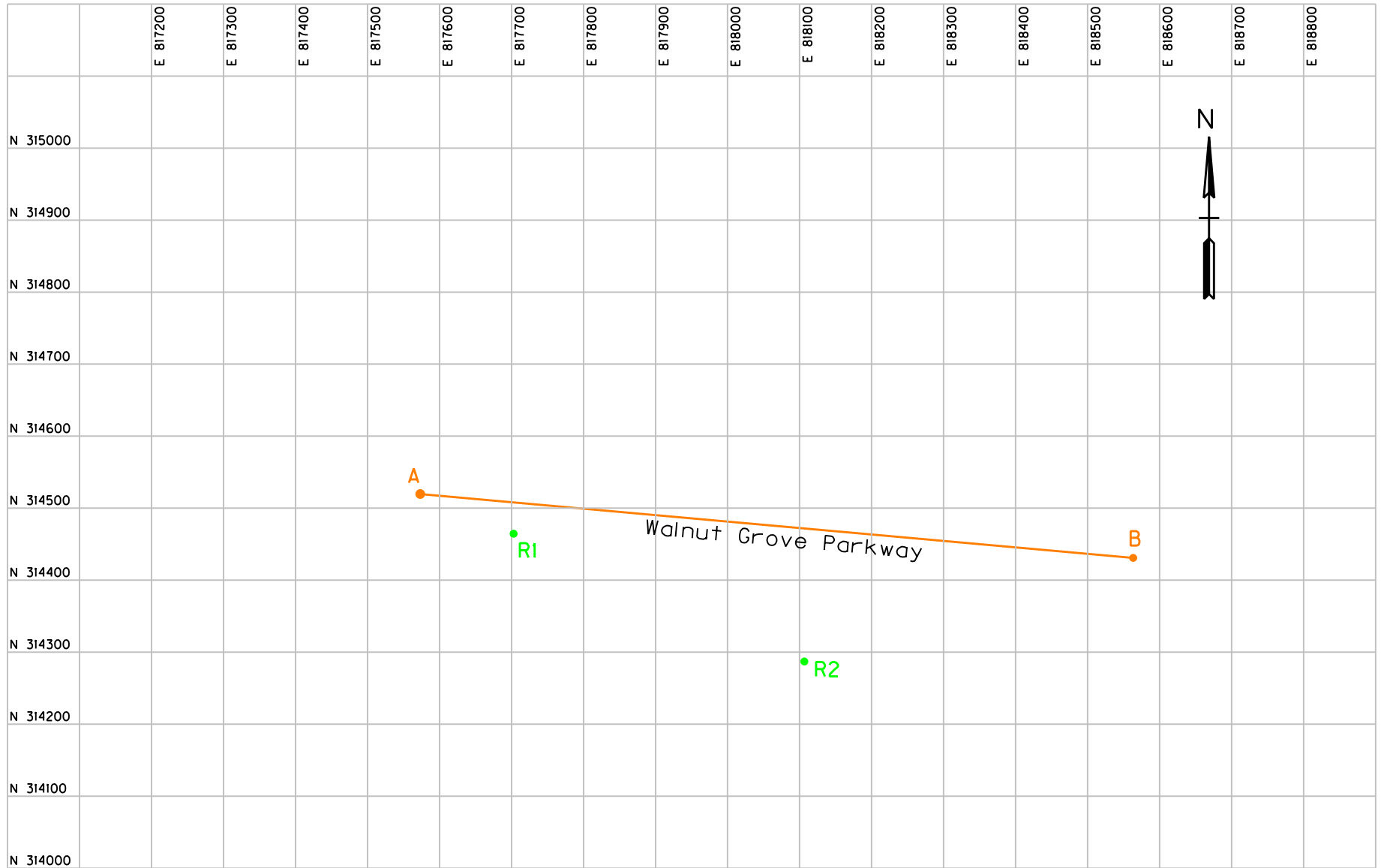


Exhibit 2
Link - Receptor Map
2005 Existing 2026 No Build
Shelby Farms Parkway
Scale : 1"=200'

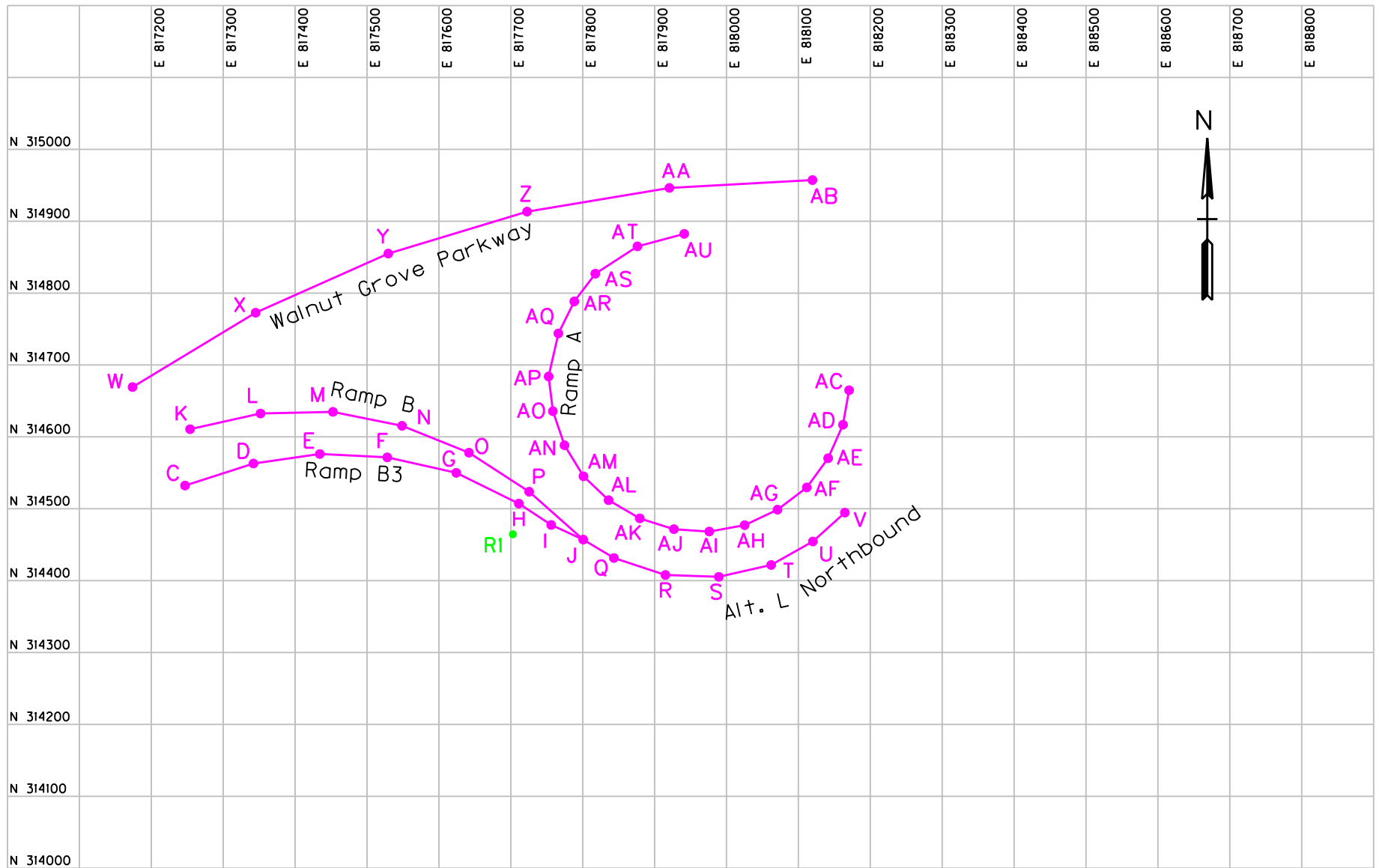


Exhibit 3
Link - Receptor Map
2026 Alternative L
Shelby Farms Parkway
 Scale : 1"=200'

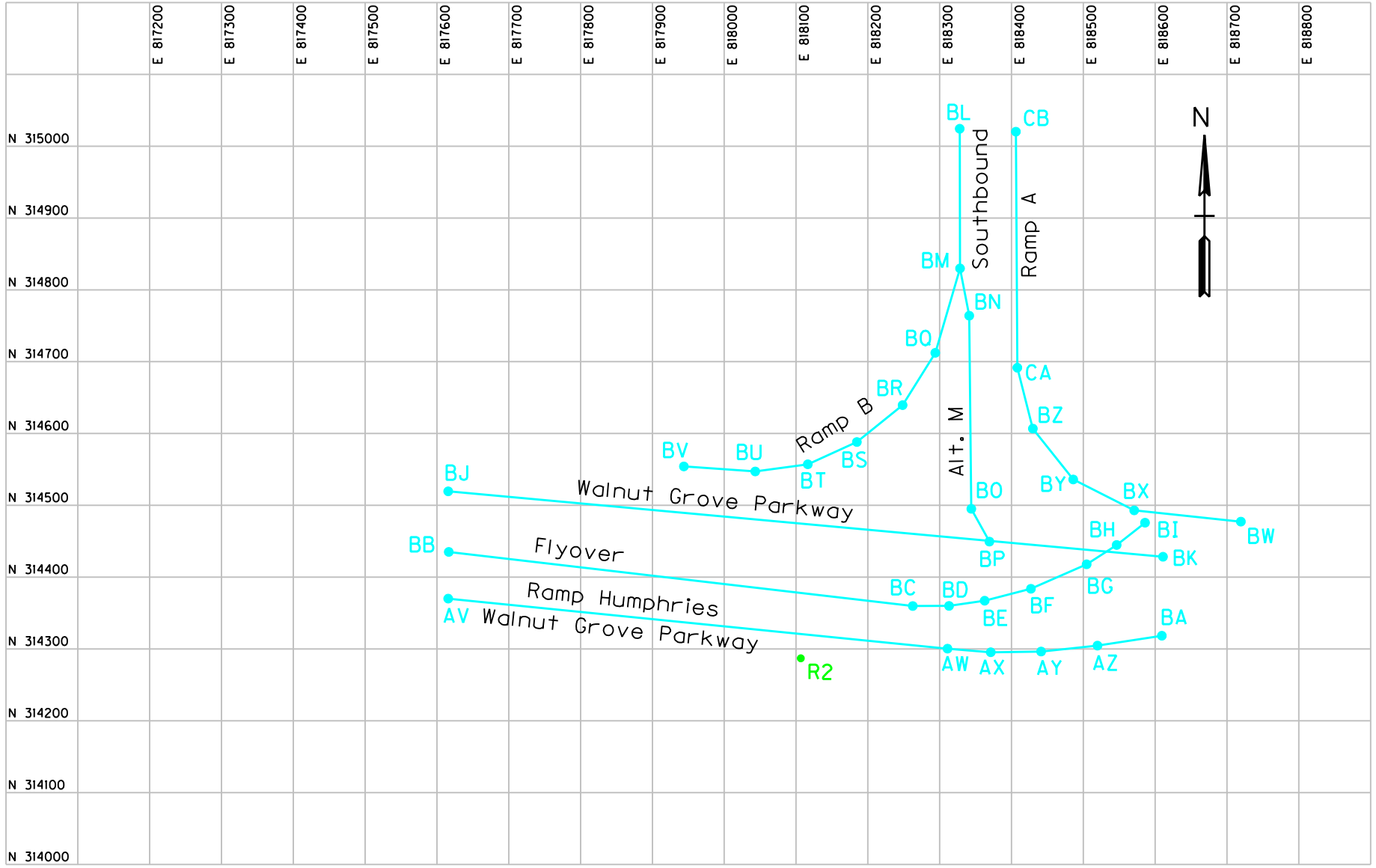


Exhibit 4
Link - Receptor Map
2026 Alternative M
Shelby Farms Parkway
Scale : 1"=200'

