APPENDIX A

EXISTING CONDITIONS ASSESSMENT Ö

A.1 ELEMENTS | EXISTING VEHICULAR CIRCULATION Ö

Shelby Farms Park is easily accessed by the automobile to both its benefit and its detriment. Sited just east of the I-240 / I-40 loop, Shelby Farms is bisected into northern and souther halves by the divided highway Walnut Grove Road. This arterial services a high volume of traffic in the mornings commuting westward into Memphis, and return traffic in the afternoon and evenings moving back to the eastern suburbs of Germantown and Collierville. Walnut Grove Road provides 3 entry points to the Agricenter property to the south, but only 2of these are accessible from the westbound lanes. There is one major access point to Shelby Farms Park to the north along Walnut Grove Road, though it is poorly marked and easily missed. This intersection with Farm Road is often the site of heavy congestion and backups during heavy commuting times. It is also a dangerous crossing point for bicycles and pedestrians since it was not designed to accommodate such traffic.

Farm Road is a heavily trafficked connector between Walnut Grove Road and Mullins Station Road running along the northern edge of the Park. Though this is actually not a public thoroughfare, its convenience factor creates a high demand for its use. Farm Road further bisects the Shelby Farms Property by isolating Area 10 and the Senior Gardens to the west from the rest of the park. It is anticipated that Farm Road will be replaced by the proposed Shelby Farms Parkway currently in design.

Though Mullins Station Road is immediately adjacent to the northern edge of the Park, its 4 access points are easily missed because of deficient entry signage. They are also difficult to access because of a combination of the narrow dimension of Mullins Station Road and the high rate of speed typical of the roadway. Connection to Germantown Road vis Raleigh-Lagrange and Trinity Roads is a potential asset, but currently is underutilized. A turning lane along Mullins Station Road would improve access to the Park, but widening beyond this would likely be a detriment to the Park.

Germantown Road is another significant arterial that has the potential to connect a significant population to Shelby Farms Park. At present there is no marking or signage designating the presence of Shelby Farms Park along Germantown Road, though the Agricenter property is visible and fairly well indicated.

The Wolf River Parkway and Humphries Boulevard provide no direct access to Shelby Farms Park. In order to access the property from this thoroughfare one must connect with either Walnut Grove or Germantown Roads.

Once inside the Shelby Farms Property, navigating the internal Park roads is difficult and often disorienting because of an absence of way-finding elements or a logical hierarchy of vehicular circulation. One frequently gets the sense they are “missing something” because of the confusing configuration of vehicular ways, particularly in the Plough Park area of Shelby Farms. The deficiency of the internal park circulation system is made acutely apparent during large events at the Park when the concentrated influx of Park visitors quickly creates a congestion situation that impacts not only vehicular circulation within the Park, but also regional traffic, often backing up Walnut Grove Road and its tributaries.

At present there is no bus service to Shelby Farms of any utility. Existing stops are poorly marked, unconnected to the Park via sidewalk or pedestrian path, and are sited too far from the major program areas of the Park to be of any real service. This makes Shelby Farms Park singularly usable by only those with access to an automobile other than those coming from the neighborhoods to the north of Mullins Station Road and the Park.

EXISTING VEHICULAR CIRCULATION Ö

A.2 ELEMENTS | EXISTING PARKING

The parking facilities currently available within Shelby Farms Park to the north of Walnut Grove Road are a combination of paved lots near the Visitor Center and Patriot Lake, the stables, the Plough Park playground, the existing amphitheater, Pine Lake and Beaver Lake and an assortment of gravel lots including those along Farm Road, Mullins Station Road and Raleigh Lagrange Road. These lots are capable of accommodating the typical weekday volume of current park users, however the increase in user population on the weekends and during special events places a particularly high burden on the Park. On non-event days, this overflow tends to create a kind of parking free-for-all where the grass strips adjacent to roadways become the default parking location once the marked lots are full. This is not only an inconvenience, but also creates a maintenance problem, as well as a potentially dangerous situation for Park users.

On event days, the Park does have designated overflow parking areas. These are primarily located on the slope to the northeast of the visitor center; in the area of the Kite Flying Fields near the Farm Road - Walnut Grover intersection; and in the area of upland fields along Mullins Station Road adjacent to the Park entries. Though these overflow areas can accommodate most episodic traffic, major events like Earth Day or the Forth of July tend to overwhelm the capacity of the Park both in terms of parking and egress. A more efficient strategy for dealing with these type of events would be of significant use to the Park

To the south of Walnut Grove Road, the parking deficiencies are less acute. The campus areas around the Agricenter and the Showplace Arena has a significant parking advantage, but still has volume needs. For the most part, the existing capacity of Catch 'Em lakes is sufficient for its current volume of users. However, like the northern half of the Park, events at the Lakes like the Children's Fishing Rodeo create a significant traffic and parking-related deficiency.

Any increase in park usage must be accompanied by increase in parking facilities.

Existing paved parking (Plough Park):	790 spaces
Existing paved parking (Catch 'Em Lakes + Agricenter + Showplace Arena):	2,315 spaces

EXISTING PARKING Ö

A.3 ELEMENTS | EXISTING PATH + TRAIL SYSTEM

The area of Shelby Farms Park north of Walnut Grove Road features a diverse assortment of trails and paths ranging in quality from paved to primitive. These paths are wonderful resources for those capable of navigating them, but for the casual user many of the trails are disorienting and/or poorly marked. The paved trails in this area of Shelby Farms Park are heavily utilized, though they are limited to the multi-use loop around Patriot Lake, and the Chickasaw trail that weaves through the hills and hollows of Plough Park. The Chickasaw trail extends from nearby the Visitor Center north to tangentially touch Mullins Station Road. Another trail within the norther half of the park that is heavily used is the Tour de Wolf. It is primarily a mountain biking trail that extends from Patriot Lake east through the rolling landscape of the Park, nearly reaching Raleigh Lagrange Road. Despite its popularity, the Tour de Wolf is a perfect example of a disorienting trail that could be improved by better marking and way-finding elements

Another unique feature of the northern half of the Park is the series of numbered gates that mark entries to the park. Most of these entries are typically used more for maintenance and agricultural purposes that public gateways. However, an enhancement to these gates, and an opening of them for public access could become part of a way-finding system for the Park tying the entries to the park's path and trail system.

The trail and path system in the southern half of the Park exhibits less variation than the trails in the north and is far less comprehensive in the territory it covers. This limitation in trail location is due in large part to the need to isolate the public thoroughfares from the research being done in the fields within the Agricenter Campus. The trail circuit that wraps the Agricenter property is a mix of paved and unpaved surfaces. It is partially composed of the White Trail which connects the agricultural fields with the bottomland forest along the Wolf River.

In addition to the White Trail, the trail system within the bottomland forest along the Wolf River and within the Lucius Burch Natural Area includes the Blue and Yellow trails, as well as a number of other unmarked wilderness trails. The trails within this area are all extremely primitive in character and are expected to remain this way.

historic shelby farms gate

primitive trail within the wolf river corridor

EXISTING PATH + TRAIL SYSTEM Ö

PAVED TRAIL

UNPAVED TRAIL

TOUR DE WOLF

3 GATES BY NUMBER

UNDERPASS

A.4 ELEMENTS | EXISTING WATER BODIES + HYDROLOGICAL SYSTEM Ö

The upland hills and hollows of Shelby Farms Park north of Walnut Grove Road, currently referred to as Plough Park, is home to nearly 20 small fishing lakes and drainage basins. The lakes were all artificially made and are connected through a complex system of sloughs and drainage basins designed to irrigate the penal farm. The southern half of the park also contains several small water bodies, including a series of lakes called Catch 'Em Lakes that are used for recreational catfishing. The existing 56-acre Patriot Lake located in the heart of the site is one of the Park's biggest draws. Patriot lake is a magnet for a variety of boating and fishing activities and is surrounded by a popular 1.67 mile paved running and biking path. The site's entire hydrological system is undergoing assessment as part of a feasibility study for the proposed Patriot Lake expansion. Several observations of the existing water bodies and hydrological system are as follows:

1. There are four pipe crossings of Farm Road that drain to the west. These drainage basins comprise about 270 acres and include the discharge from Chickasaw Lake.
2. Several existing swales cut around Chickasaw and Mayor Lake and function as water retention areas. Most of these appear stagnant and there is no obvious pipe or weir connection between the lakes and swales. Just east of Pine Lake Drive, north of Chickasaw trail, the drainage swale appears to cut off the drainage from the north and route it to the west. Most of the swales appear disconnected from each other and the lake surface elevations looked low.
3. Due to the cutoff swales surrounding Mayor Lake, the lake's drainage basin is minimized to the rainfall that falls directly into it - roughly 4.5 acres. The lake appears a little stagnant.
4. Several small retention basins throughout the site do not appear to offer much benefit and do not have a significant drainage basin.
5. Currently, about 329 acres of the Park drain to Patriot Lake. The lake discharges to the south through a pipe beneath Walnut Grove Road.

mayor lake

6. Concrete swales were constructed around the perimeter of Patriot Lake to divert surface drainage from entering the lake. The majority of Patriot Lake's current drainage basin comes from Pine Lake and it's surrounding low areas. The water moves from Pine Lake through a vegetated channel into a small sediment basin just north of the Visitor Center before finally entering Patriot Lake.
7. There are two low lying areas south of Pine Lake that serve to cut off downhill drainage flows to Patriot Lake and route it back to Pine Lake. The western-most drainage swale appears stagnant, but the eastern-most one appears healthy and vegetated.
8. Nearly 232 acres drain through Beaver Lake and Boy Scout Lake and discharge through a pipe south across Walnut Grove Road.
9. Four additional pipe crossings under Walnut Grove Road to the east of Patriot Lake route water from one side of the road to the other.
10. Most of the upland water bodies aside from Patriot Lake do not appear to have any drainage structures for water release. Chickasaw Lake has a corrugated metal pipe discharging overflows, but the smaller ponds appear to fill up and spill over the dams.

EXISTING WATER BODIES + HYDROLOGY Ö

1. CHICKASAW LAKE: 11 ACRES
2. MAYOR LAKE: 3 ACRES
3. PINE LAKE: 10 ACRES
4. PATRIOT LAKE: 56 ACRES
5. BEAVER LAKE: 21 ACRES
6. BOY SCOUT LAKE: 3 ACRES
7. UNNAMED LAKE: 5 ACRES
8. PATTERN LAKE: 2 ACRES
9. UNNAMED LAKE: 4 ACRES
10. INDIAN LAKE: 4 ACRES
11. WILLOW LAKE: 2 ACRES
12. UNNAMED LAKE: 2 ACRES
13. CATCH 'EM LAKES: 27 ACRES
14. MEANDER LAKE: 18 ACRES
15. TRAP LAKE: 17 ACRES
16. UNNAMED LAKE: 5 ACRES

WATER FLOW

WATER BODIES

A.5 ELEMENTS | EXISTING ECOLOGICAL STRUCTURE

Ecologically, Shelby Farms Park is characterized by a highly fragmented landscape and contains habitats that have been significantly altered from their natural state. Essentially, Shelby Farms is composed of upland and bottomland habitats. Vegetation appears to have remained similar to that typical of the region, although variation in composition is evident within local sites. The following information is a general and limited assessment of the ecological condition of the Park, although detailed appraisals of the status and distribution of biota have not been conducted.

Major Ecological Assets

1. Significant land area for a park surrounded by urban development
2. Location adjacent to the Wolf River and the existing Wolf River corridor
3. Rich soils typical of the region
4. Relatively mild climate of the region
5. Presence of bottomland and upland forests represented by a mosaic of habitat types, with considerable diversity in plant species
6. Assemblage of older age class hardwood trees
7. Relatively high biodiversity of animal species
8. Potential for restoration of native grasslands
9. Presence of existing lakes, ponds, sloughs, and wetlands
10. Presence of existing natural habitats (e.g., old-age forest, mature upland forest, wetlands) in the region which provide models and insight toward potential habitat restoration

Major Ecological Concerns

1. Habitat fragmentation and a highly altered landscape significantly impacted by anthropogenic practices
2. Impact of exotic species, especially the alien shrub, Chinese privet
3. Erosion of selected drainages
4. Blockage of water flow in selected drainages
5. Maintaining the ecological integrity of the park

Bottomland Forest Ö

Existing bottomland forest (extending west to east along the Wolf River and including the Lucius Birch Jr. Natural Area) is characterized by an assortment of canopy trees. Existing species include oaks, hickories, sycamore, maples, sweetgum, tulip poplar, cottonwood, bald cypress, hackberry, elm, green ash, river birch, willow, and other species in lesser numbers. Loblolly pine has been planted in bottomlands near the Wolf River. This species is scattered throughout the site but is primarily on the southeastern edge of Shelby Farms in this habitat.

While a wide range of age structure exists within trees in bottomlands, a most striking feature in this habitat is the older age class of many of the hardwood species (e.g., oaks, sycamore, hackberry, cypress, and sweetgum). Overall, the bottomland forest represents a wide range of species diversity as well as a mix of age structure in canopy trees.

Reforestation in this habitat is evident on parts of Shelby Farms Park. In 1986, for example, nuttall oak, willow oak, red maple , sycamore, box elder, and green ash were planted at selected sites. Such habitat restoration efforts appear to have been focused on portions of the northern edge of the bottomland forest.

Other species of hardwoods (e.g., sweetgum, elm, maples) have naturally colonized these areas as well and are intermixed with the planted trees. Thus, younger age class forest occurs along much of the northern edge of the bottomland forest which borders agricultural, recreational, and maintained areas.

Permanent and intermittent sloughs and pools of standing water characterize parts of the bottomland habitat. Cypress trees, standing water, and moist soil conditions at sites along the northwestern part of the bottomland forest reflect patches of wetland habitat. Overall, the bottomland habitat forms a long, narrow, yet continuous block that makes provides the largest area of forested habitat on Shelby Farms Park. This habitat provides a forested corridor along the Wolf River that allows movement of animal species and is an important site for wildlife in the region.

Forest edges and openings as well as riparian habitats along smaller drainages in the bottomlands provide habitat for additional species biodiversity. Trees and vegetation in these areas include black locust, box elder, eastern red cedar, blackberry, (Continued) Japanese honeysuckle, nettle, poison ivy, Virginia creeper, trumpet flower, Chinese privet, and various weeds, vines, and grasses.

A large portion of the bottomlands of SFP are involved in agricultural practices. While such practices alter the natural state of the habitat, they can have significant and positive aspects for wildlife when incorporated into management plans.

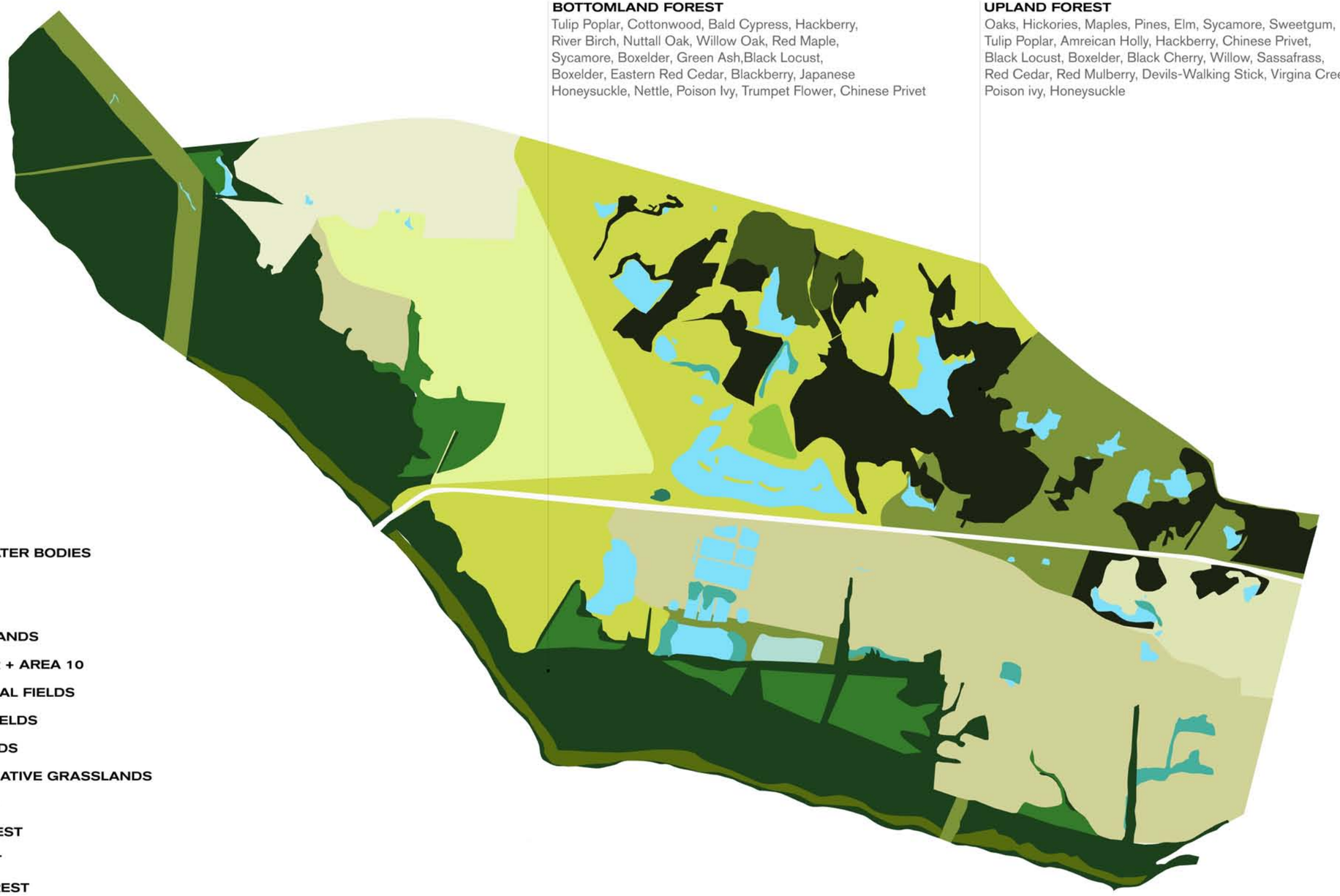
Upland Forest

Upland forest habitat is also characterized by an assortment of canopy trees. These include oaks, hickories, maples, pine, black locust, elm, sycamore, sweetgum, tulip poplar, American holly, hackberry, black cherry, and other species in less abundance. Upland forest is less dense and more fragmented than the bottomland habitat. As in the Shelby Farms Park bottomland forest, a range of age classes exist among the canopy trees (from early successional to older age classes typical of climax stages of succession). The two largest patches of upland forest are associated with Pine Lake and Beaver Lake. The pine forest associated with Pine Lake

EXISTING ECOLOGICAL STRUCTURE Ö

BOTTOMLAND FOREST
Tulip Poplar, Cottonwood, Bald Cypress, Hackberry, River Birch, Nuttall Oak, Willow Oak, Red Maple, Sycamore, Boxelder, Green Ash,Black Locust, Boxelder, Eastern Red Cedar, Blackberry, Japanese Honeysuckle, Nettle, Poison Ivy, Trumpet Flower, Chinese Privet

UPLAND FOREST
Oaks, Hickories, Maples, Pines, Elm, Sycamore, Sweetgum, Tulip Poplar, Amreican Holly, Hackberry, Chinese Privet, Black Locust, Boxelder, Black Cherry, Willow, Sassafrass, Red Cedar, Red Mulberry, Devils-Walking Stick, Virgina Creeper, Poison ivy, Honeysuckle



- EXISTING WATER BODIES
- WETWOODS
- WETLANDS
- CYPRESS STANDS
- AGRICENTER + AREA 10
- AGRICULTURAL FIELDS
- MANAGED FIELDS
- MOWED FIELDS
- RESTORED NATIVE GRASSLANDS
- TURF GRASS
- YOUNG FOREST
- PINE FOREST
- UPLAND FOREST
- BOTTOMLAND HARDWOOD FOREST

is intermixed with hardwoods. This forest patch appears to have been damaged due to some weather event in the past. While most of the upland forest is represented by deciduous trees, patches of red cedar and scattered pines occur in this area of SFP. These patches of red cedar are undergoing succession where cedar is being shaded out by invading hardwoods.

Edges and forest openings associated with larger habitat patches and riparian areas of upland forest are characterized by a number of tree and plant species (e.g., privet, black locust, boxelder, black cherry, willow, sassafras, red cedar, red mulberry, devils-walkingstick, Virginia creeper, poison ivy, honeysuckle; additionally, weeds, vines, grasses, and wild rose. These areas provide valuable wildlife habitat on the uplands of Shelby Farms Park.

Much of the upland habitat is open fields where grasses are cut for hay. Other parts of the upland habitat are used, for the most part, for recreational purposes by visitors and include maintained areas that are mowed and roads, parking lots, and buildings. Some of this area is in pasture for bison and horses. Most noticeable in the uplands are the single and small clusters of large canopy trees (primarily oaks). Many of these are older age class trees and add significantly to the appeal of the landscape. Additionally, they provide valuable wildlife habitat and could potentially be important in construction of corridors that connect habitat patches.
Overall, the upland forest habitat represents a mosaic of successional stages that supports a high degree of plant and animal diversity. Greatest species richness for many non-game species on Shelby Farms Park likely occurs in the habitat east of Beaver Lake that is represented by an intermediate state of succession and is characterized by a mixture of grasses, shrubs, and trees. Historically present native grasslands and wildflowers of western Tennessee are sparse on Shelby Farms Park. Significant opportunities exist for enhancement of such vegetation on the site (both in distribution and abundance).

Invasive Plant Species
Several exotic species of plants exist on Shelby Farms Park (e.g., Chinese privet, Japanese honeysuckle, kudzu, Puerania lobata, and nettle). No attempt has been made at this time to inventory all exotic species on the park. However, the most serious threat to the health of Shelby Farms Park appears to be the invasive Chinese privet. This shrub is considered problematic in much of the southern United States. It can spread rapidly and is difficult to control or remove. At Shelby Farms Park, both bottomland and upland forest are under siege by this species. This alien shrub has become established throughout the edges and interior of most forested areas in the Park, although it appears to be most problematic in the bottomland forest. No doubt, this species is altering the natural composition of plant communities on the site.

Water Resources Ö
The presence of permanent and intermittent water sources (e.g., lakes, ponds, sloughs, and the Wolf River) provide a valuable ecological resource. Selected sites where sloughs are located could provide areas for wetland restoration. The ecological health of these resources are undetermined at this time.

Fish Ö
The Wolf River supports a relatively high fish fauna despite the dredging and industrialization associated with the lower portion of the river (portion in the immediate Memphis area). Specific efforts to investigate the status and distribution of fishes on the Park are yet to be conducted. However, anecdotal reports by fisherman suggest that ponds and lakes have numerous small fish (gizzard shad and sunfish) and large carp, but large bass and crappie are less abundant. Open fishing is popular and, in many cases, successful. A fee fishing lake has operated on Shelby Farms Park for some time, is very popular, and people readily catch fish. Aquaculture ponds have also been established and have supported research and commercial culture of channel catfish and red swamp crawfish. Given the extent of lakes, ponds, and sloughs on Shelby Farms Park and the location adjacent to the Wolf River, there is a high potential for improving the biodiversity of fish and fisheries at Shelby Farms Park. Ö

Amphibians and Reptiles Ö
About 75 species of amphibians and reptiles are known in the region. Species richness and densities within species on Shelby Farms Park are uncertain for this group of vertebrates. Several species of snakes have been reported in Shelby Farms Park (e.g., copperhead, eastern kingsnake, banded water snake, garter snake, and cottonmouth). Other reptiles reportedly include turtles (e.g., eastern box turtle, red-eared slider, and others). Reported frog species are likely to include the bullfrog, northern leopard frog, gray tree frog and others. Toads, salamanders, and other amphibians represent this group. Data gathered by Shelby Farms Park personnel suggest that counts of frog populations are not representative of the higher counts recorded at other sites.

Birds Ö
Bird species have been relatively well documented at Shelby Farms Park from the mid-1930's to the present. A checklist of birds, recorded by the Memphis Chapter of the Tennessee Ornithological Society, reports the occurrence of about 265 species. Common, uncommon, rare, and exceptional occurrences are delineated for all seasons of the year in this work. These counts, and recorded sightings of neotropical migratory taxa, demonstrate that Shelby Farms Park is clearly an important site for conservation and management programs locally, regionally, and nationally.

Canada geese and mallard ducks are among the most visible birds on the Park. In general, an examination of the population counts of the Memphis Chapter of the Tennessee Ornithological Society over recent years could provide valuable insight as to the ecological health of the site. Shelby Farms Park is not only a significant habitat for birds, it also provides numerous opportunities for viewing, photographing, and listening to birds as well as wildlife.

Mammals Ö

Formal surveys of mammals have not been conducted at SFP. Some 55 game and non-game species are known in western Tennessee, although the majority of mammals in the region are non-game. On-site visualizations verify the presence of white-tailed deer , coyote, raccoon, Virginia opossum, bobcat, eastern mole, gray squirrel, and others. The status of most non-game species (e.g., shrews, bats, and small rodents) is unknown. However, given the assemblage of several highly visible species in Shelby Farms Park, it is likely that mammalian biodiversity could be fairly high.

Endangered and Threatened Species

No endangered or threatened species of plants and animals are known to reside on the park at this time. However, species for groups of plants and animals Deemed in Need of Management at the state level (e.g., mammals; southeastern shrew and Rafinesque's big-eared bat) could occur on Shelby Farms Park. Inventories are needed. Ö

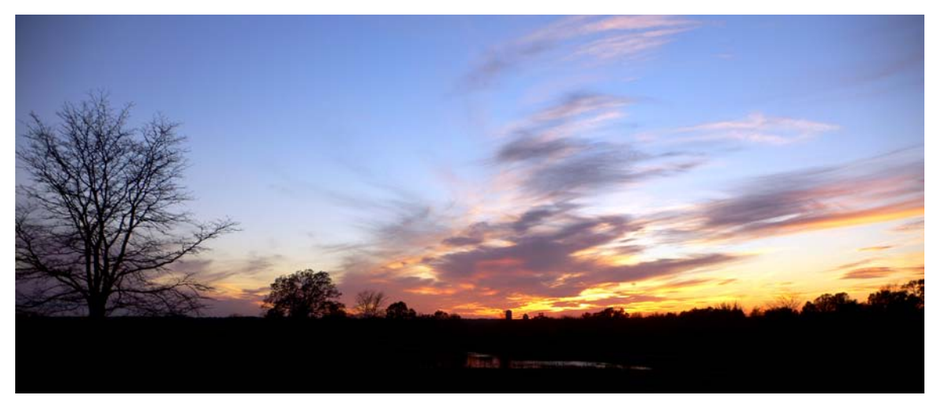
A.7 ELEMENTS | EXISTING VIEWS + VISTAS

Some of the most memorable features of Shelby Farms are the spectacular views a visitor is afforded as they look across the Park in nearly every direction. These perspectives provide a great deal of the Park's inherent character and should be valued and protected as such. Fragmented tree masses in the upland area of the Park frame many of the vistas in this area. Other views are opened wide in the lowland area of the Park looking across the wide horizon of the agricultural fields. The varied topography of the Park adds to the quality of these vistas. For example, the upland areas of the park offer some of the highest elevations between Germantown and Downtown Memphis.

Each of these views and vistas are important not only for their beauty, but because they provide a sense of scale for the Park. It is from these vantage points that a Park visitor is made aware of the true scale and size of Shelby Farms.

Any reforestation of the Park must respect these view corridors, and should look to enhance them by better defining the frame of the landscape through which they are viewed, and improving the characteristics of prospect and refuge that are critical to spatially understanding the Park.

hills + hollows + horizon



a spectacular november sunset

EXISTING VIEWS + VISTAS Ö

EXISTING CANOPY

VIEW CORRIDOR

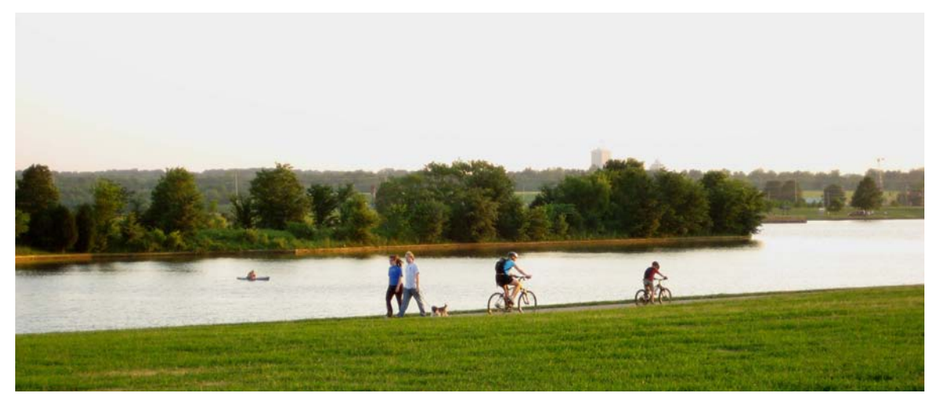
SCENIC VIEWSHED

A.8 ELEMENTS | EXISTING PROGRAM AREAS + FACILITIES

The majority of Park-related activity at Shelby Farms north of Walnut Grove Road is centered around the Visitor Center, Patriot Lake and Plough Park. Within this area are picnicking venues, playgrounds, fishing lakes and a small amphitheater. In addition there are accommodations for frisbee-golf, kite-flying, horse riding lessons and the bison fields. In addition to these activities, this area of the park is typically utilized for strolling, running, dog-walking, bicycling and roller blading. The remainder of the northern half of the park is utilized with much less frequency, and as such is home to very few structured venues or facilities.

Major park-related activities in the southern half of the Shelby Farms Property are concentrated around the Catch 'Em Lakes and the Agricenter. In addition to fishing, facilities nearby Catch 'Em Lakes include a BMX track, sports fields used primarily for Ultimate Frisbee, and an unused shooting range. The area around the Agricenter campus include a farmers market, exhibition and office facilities, stables, an RV park, and a migratory bird viewing area. Outside of Area 10, the Agricenter is home to the largest concentration of buildings and structures within the Shelby Farms property.

shelby farms park visitor center



late-afternoon activity around patriot lake

EXISTING PROGRAM AREAS + FACILITIES Ö

A.9 ELEMENTS | INFRASTRUCTURAL EASEMENTS

At 4,500 acres, the scale of Shelby Farms means that it is incapable of escaping the presence of large infrastructural elements within its territory. Though these systems are unavoidable, the key to their presence within the Park is minimizing their impact, and where possible, isolating them from the active uses of the other Park areas. In addition to the presence of Walnut Grove Road and its right of way, there are three other areas of major infrastructure within the Shelby Farms Property.

Power Line Easement: To the west of Area 10 is an approximately 400' wide easement for high tension power lines moving northwest to southeast along the edge of the Shelby Farms property before turning due south after crossing the dormant CSX line. From this point the easement moves through an area of bottomland forest, south across the Wolf River. The location of this infrastructure has little impact on existing or anticipated uses within the Park.

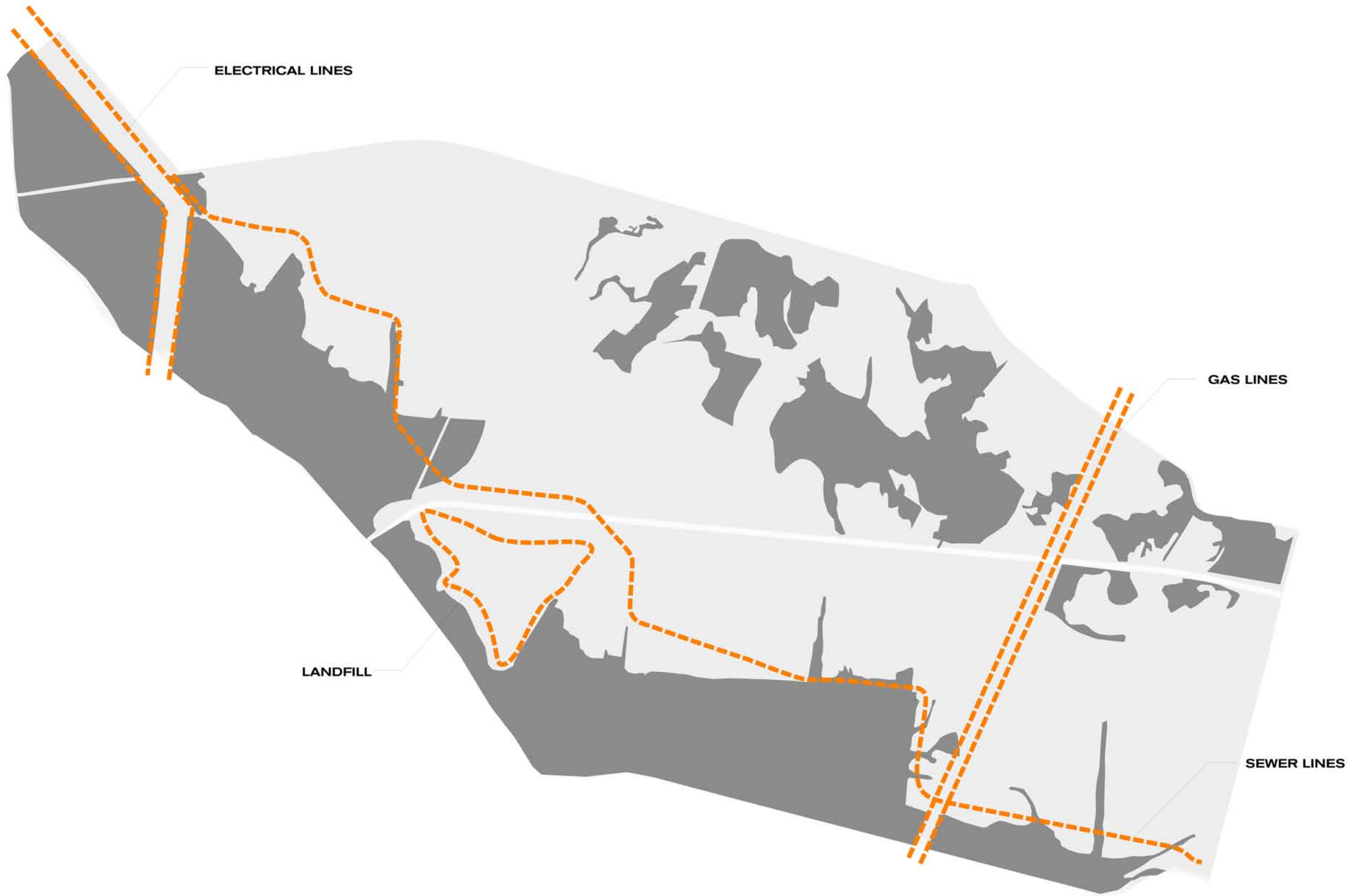
Landfill Area: Immediately east of the Walnut Grove Road - Wolf River intersection is an approximately 125 acre territory within which a capped landfill is sited. The mound is managed by the Shelby County Department of Public Works and is currently inaccessible by the public. The integrity of the mound is unknown, though it has shown signs of settlement and does allow water to sit atop it, both signs of a deficient landfill structure. The location of the landfill mound does create some concern because of its adjacency to the Wolf River, Trap Lake and the proposed Walnut Grove-Shelby Farms Parkway Intersection. Once capped, a properly structured and managed landfill mound should be able to accommodate public activity on its surface. We will need to determine the capacity of the Shelby Farms landfill mound to accommodate public activity on its surface before assessing any adverse impact on the Park.

Gas Line Easement: Beginning approximately 800' southeast of the Gate 11 entry to the Park along Raleigh Lagrange Road is an approximately 150' wide easement for a high pressure natural gas line. This easement extends south, southwest across the site, crossing Walnut Grove Road just west of the Ducks Unlimited building. From here it moves through the Agricenter's research fields to a point approximately 5,300' west of Germantown Road where it crosses the Wolf River and the Wolf River Boulevard. Other than limitations on tree planting within the easement, this corridor has little impact on Park usage beyond where it crosses the Agricenter's leasable building property along Moore Road. Here there are particular limitations to how close the foundation of a building can come to the alignment of the gas line.

power line easement through bottomland forest along wolf river

landfill mound south of walnut grove road

INFRSTRUCTURAL EASEMENTS Ö



EASEMENT BOUNDARY

APPENDIX B
CONSERVATION EASEMENT Ö

Tom Leatherwood
Shelby County Register

As evidenced by the instrument number shown below, this document has been recorded as a permanent record in the archives of the Office of the Shelby County Register.

184

07021070
02/01/2007 - 02:11 PM

23 PGS : R - EASEMENT	
HERTHA 467561-7021070	
VALUE	0.00
MORTGAGE TAX	0.00
TRANSFER TAX	0.00
RECORDING FEE	115.00
DP FEE	2.00
REGISTER'S FEE	0.00
WALK THRU FEE	0.00
TOTAL AMOUNT	117.00

TOM LEATHERWOOD
REGISTER OF DEEDS SHELBY COUNTY TENNESSEE

160 N. Main St., Suite 519 ~ Memphis, Tennessee 38103 ~ (901) 545-4366
http://register.shelby.tn.us

Tom Leatherwood, Shelby County Register of Deeds: Instr. # 07021070

GRANT OF CONSERVATION EASEMENT

This Grant of Conservation Easement ("Grant") is made by the County of Shelby, Tennessee ("County") and the Shelby County Agricenter Commission ("Agricenter") (collectively, "Grantors") as of the _____ day of January, 2007, and shall become effective upon being properly recorded in the office of the Shelby County Register ("Effective Date") pursuant to the Conservation Easement Act of 1981, Tenn. Code Ann. 66-9-301 et seq., as amended, and the common law.

Section I - Recitals

Grantors are "public bodies" as defined in Tenn. Code Ann. 66-9-303(5).

County is the owner of the property designated on Exhibit A hereto as "County Property." Agricenter was established by the Tennessee General Assembly, and is the recipient of a grant of the property designated on Exhibit A hereto as "Agricenter Property," said property having been granted to Agricenter pursuant to resolution of the Board of County Commissioners of the County subject to reversion to the County under certain circumstances. All of the property described on Exhibit A, including that designated as "County Property" and that designated as "Agricenter Property," is hereinafter collectively referred to as the "Property."

For purposes of this Grant, four areas of the Property ("Tiers" 1 through 4) have been designated, as reflected and described on Exhibit B hereto.

The Property has significant conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values in the fields, forests, open spaces, vistas, wetlands, ponds, lakes, and streams on the Property, which resources and values are worthy of protection, maintenance, preservation, and enhancement for the benefit of the people of Tennessee. Grantors deem that it is in the public interest to grant a conservation easement with respect to the Property as herein provided and that the public will gain a substantial benefit by the granting of the conservation easement.

For the purpose of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values of the Property and providing for its use in keeping with such protection, maintenance, preservation and enhancement, Grantors desire to grant a conservation easement with respect to the Property, subject to the terms and conditions hereinafter provided. Grantors acknowledge receipt of good, valuable, and sufficient considerations for this Grant.

The Land Trust for Tennessee, Inc., a Tennessee nonprofit corporation ("Grantee"), has received from the Internal Revenue Service an exemption under 501(c)(3) of the Internal Revenue Code, and is therefore an "exempt organization" as defined in Tennessee Code Ann. 66-9-303(2).

Grantors deem Grantee to be qualified and to be an appropriate entity to receive and enforce the conservation easement herein granted.

12/18/2006
As amended by Shelby County Commission
12947N:061467:706599:6:NASHVILLE

Grantee desires to accept this Easement, subject to the terms and conditions hereinafter provided.

Section II - Grant and Agreements

NOW THEREFORE, for the benefit of the people of Tennessee, Grantors agree as follows:

1. Grant. Grantors grant to Grantee a conservation easement ("Easement") on, over, under, and across the Property for the purposes of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, agricultural, scientific, recreational, and parkland resources and values of the Property, including without limitation the fields, forests, open spaces, vistas, wetlands, lakes, ponds, and streams of the Property, the biological and ecological integrity and value of the Property, and the use of the Property by the public as an urban park, in keeping with such protection, maintenance, preservation, enhancement, and for other purposes incidental, necessary, and appropriate to the foregoing, such grant being subject to the terms and conditions hereinafter provided.

Included in the Property is property designated as the Lucius Burch Natural Area ("LBNA") by the State of Tennessee. The parties agree that any and all use of the LBNA pursuant to the terms of this Easement shall be consistent with T.C.A. 11-14-101 et seq., as it may hereafter be amended, and all rules and regulations promulgated thereunder, that control the use of the LBNA.

Excluded from the provisions of this Easement is the road right of way property as designated on Exhibit A-1.

Also excluded from the provisions of this Easement is property designated as "Area 10," that is to be reserved for governmental and government-related uses pursuant to a plan to be adopted by the Board of County Commissioners of Shelby County, Tennessee. This Area is described on Exhibit A-2 attached hereto.

2. Declaration of Restriction. Grantors and Grantee declare and agree that the uses of the Property shall be restricted and limited to the uses permitted under this Easement. Such restrictions and limitations shall run with the land and apply to any successive owners of the Property, or any portion thereof, and Grantors shall do all things necessary to ensure that this is the case.

3. Master Plan. It is understood and agreed by Grantors and the Grantee that a Master Plan is to be developed, subject to the provisions of Paragraph 18 herein, for the Property through a planning process to be initiated by the County in the future. Grantors and Grantee agree that Grantee shall become a party to the planning process for said Master Plan, which upon completion shall become incorporated into this Easement as though set out fully herein. Grantors and Grantee hereby declare and agree that, until the completion of said Master Plan and its adoption by the County, or until December 31, 2008, whichever occurs first, no permanent buildings, structures, or infrastructure shall be constructed or placed upon the Property, and no permanent changes shall be made in the topography of the land, except those specific buildings and structures described in Exhibit A-3, it being the intention of the parties that there be a

moratorium on the construction or placement of such buildings, structures, or infrastructure, and on change in the topography of the land, other than those described in Exhibit A-3, until said Master Plan has been adopted or such December 31, 2008 deadline occurs. It is understood and agreed that the Master Plan may increase, but may not decrease, the prohibitions and restrictions on the uses permitted under in this Easement.

If during the moratorium period, a party proposes construction which was not anticipated on the date of this Grant, which is not included on Exhibit A-3, and which is in keeping with the uses and purposes of this Grant, said party may propose an amendment to Exhibit A-3 to permit such construction. The parties will in good faith negotiate the amendment, and consent to the amendment will not be unreasonably withheld, conditioned, or delayed.

4. Permitted Uses. The following uses of the Property are permitted, reserved, and retained, subject to the moratorium set forth in the preceding paragraph, and subject to any restrictions or prohibitions set forth in the Master Plan, and to any restrictions or prohibitions set forth in the 1981 Private Act of the Tennessee Legislature creating the Agricenter Commission (Chapter 141 of the Private Acts of 1981), the 1981 Resolution of the Shelby County Commission adopting and approving said Act, and the 1982 Resolution of the Shelby County Commission granting the property to the Agricenter:

a. pedestrian, bicycle, skating, and equestrian trails and paths, paved and unpaved, and equestrian operations;

b. nature trails, boardwalks and wildlife observation areas and improvements;

c. gardens;

d. recreational sports and uses consistent with the purposes and uses herein provided and in accordance with the approved Master Plan;

e. pavilions, picnic areas, and playgrounds;

f. agronomy and horticulture uses, including but not limited to farming, educational, aquaculture, and nursery uses;

g. scientific purposes, including agricultural, archeological and environmental sciences, which have no material adverse impact on the Property and the uses herein provided and are consistent with the purposes of this grant;

h. dog exercise and training;

i. boating activities consistent with the purposes and uses herein provided; only small electric motors or trolling motors are acceptable; gas powered motors, jet skis, etc. are prohibited;

j. fishing;

k. development and enhancement of wildlife habitat;

l. development and enhancement of forests (including without limitation reforestation), fields, vistas, and open spaces;

m. access by designees of Grantors to the Property at all times in connection with the uses permitted hereunder;

n. short term events not inconsistent with the uses and purposes herein provided, including without limitation outdoor festivals; collection of fees normally associated with the use of park facilities; special events, educational, agronomy and horticultural uses; and food, drink, and merchandise sales incidental to permitted uses. Permanent concessions of permitted uses may be permitted to have food, drink or merchandise sales but with size or quantification limitation on these types of incidental sales to permanent uses;

o. animal control as may be necessary to control property damage, to protect the Property, and/or to protect the health, safety, and welfare of the public;

p. direction, location, and use signs consistent with the purposes and incidental to the uses herein provided;

q. classes, demonstrations, projects, and other educational uses to promote and teach environmental protection and conservation;

r. retreat and/or camping facilities that are compatible with the rustic and natural setting of the Property, and in accordance with the Master Plan;

s. existing and currently planned uses of the Property or in accordance with the approved Master Plan and prior written approval of Grantee, which approval shall not be unreasonably withheld, conditioned or delayed;

t. maintenance, repair, removal, rearrangement, reconfiguration, renovation, relocation, and reconstruction of existing buildings, structures, facilities, sewer and/or utility lines, and other improvements; and

u. a carousel or historic rollercoaster, in a location to be mutually approved by Grantors and Grantee.

The following additional uses are permitted in the areas designated as Tier 2, Tier 3 and Tier 4 on Exhibit B, attached hereto, subject to the same conditions set forth above (i.e., the moratorium, the prohibitions or restrictions of the Master Plan, and the restrictions and prohibitions set forth in the Private Act and Resolutions referred to above):

Tier 2: Agricenter Campus Area

a. Continuation of construction of any buildings now under construction and construction of additional buildings, structures, facilities, sewer and/or utility lines, and other improvements related to agriculture; and

b. Use, maintenance, repair and replacement of roads and parking areas and construction of new roads.

Tier 3: Agricenter Crop and Recreation Area

a. Construction of ancillary buildings, barns, silos, storage structures, facilities, sewer and/or utility lines, and other improvements;

b. Maintenance, repair, and replacement of roads and parking areas and construction of new roads;

c. A demonstration area for animal husbandry science;

d. Hiking and biking trails, lakes and ponds, and other recreational uses for the public now existing and further additional recreational uses..

Tier 4: Show Place Arena Area

a. Restaurant; catering facility;

b. Showplace arena including indoor arena, enclosed warm-up arena, outdoor covered arena, and outdoor uncovered arena;

c. Six barns (two of which are located on the Agricenter property);

d. Parking area; and

e. Such other commercial uses as may be added as a result of the Master Plan.

Each Grantor reserves the right to adopt rules and regulations with respect to the permitted uses of its property consistent with the uses permitted and purposes provided herein and with respect to protecting the health and safety of the public and consistent with the Master Plan. Each Grantor also reserves and retains the right to move, remove, rearrange, reconfigure, renovate, relocate, and reconstruct facilities, improvements, and features of its property from time to time consistent with uses and purposes herein stated and consistent with the Master Plan.

5. Prohibited Uses. Except as expressly permitted in other Tiers, the following uses of the Property are prohibited:

a. stadiums; arenas; race tracks for animals or motor vehicles; commercial uses other than those specifically permitted by this Easement, provided

that the existing horse show place arena on the Property may be located elsewhere on the Property as determined by the approved Master Plan;

b. electromagnetic transmission lines and towers, other than those permitted under existing leases as such leases may be extended or renewed, without adding additional lines or towers; provided that additional antenna may be added to the existing tower and transmission lines for operation of the Property;

c. use of motorized vehicles on the unpaved paths and trails of the Property except for maintenance and operation of the Property;

d. commercial, industrial, residential, or other real estate development;

e. manufacturing and industrial uses, excluding the mulch facility on the County property;

f. commercial mining activities, except those related to lead recovery and removal on the former firearms range site on Tier 1;

g. residential uses or hotel/motel uses, excluding temporary shelter in case of emergency or disaster;

h. subdivision of the Property;

i. dumping of garbage, trash, or building materials, provided, however, that this prohibition shall not apply to (i) lawful temporary disposal of waste resulting from daily operations of the Property (dumpsters, etc.) or (ii) lawful temporary disposal of products as part of a recycling or recovery operation established for the purpose of environmental preservation and protection (mulch recycling, cardboard recycling, etc.)

j. public or private facilities except those which implement and facilitate the purposes and uses herein provided;

k. zoos;

l. permanent fairgrounds;

m. billboards;

n. commercial advertising, except for temporary signs for marketing of special events and concessions and except for the existing signs on the Agricenter property;

o. schools;

p. colleges, except for the existing Southwest Tennessee Community College facilities on the Agricenter property;

q. structures used primarily for exhibitions and performances except for one amphitheater and outdoor exhibition facilities consistent with park purposes and uses herein provided;

r. roads and parking areas other than existing roads and parking areas and future roads and parking areas permitted by the Master Plan;

s. activities which cause significant erosion or pollution;

t. other uses inconsistent with the Master Plan; and

u. any other activities inconsistent with the purposes and uses herein provided.

6. Right of Entry and Enforcement. Grantee, its agents, and independent contractors shall have the right of entry and access to the Property at all times to make such inspections and investigations as Grantee deems appropriate and to enforce this Grant. Grantee may enforce this Easement by action at law or by injunction or other proceedings in equity. No delay of or forbearance in enforcement of Grantee's rights and remedies under this Easement shall be deemed a waiver of such rights and remedies or preclude Grantee from exercising any of its rights and remedies. Defenses of laches and estoppel based on delay in enforcing rights and remedies are waived. If Grantee is successful in enforcing its rights and remedies under this Easement in a proceeding at law or equity, Grantee shall have the right to recover from the government of Shelby County, Tennessee, its reasonable costs and expenses actually incurred including reasonable attorney's fees, irrespective of whether the need for such enforcement is caused by Grantors or a third party. In the event that Grantee or Grantee's assigns fail to enforce the provisions of this Easement or at the invitation of the Grantee, the Attorney General of the State of Tennessee may enforce the provisions of this Easement by any action at law or in equity.

In the event there is a dispute between Grantor and Grantee whether or not an activity or use is permitted or prohibited, the parties will arbitrate the dispute to a committee of 3 individuals who have significant experience with land use and conservation easements. One individual shall be selected by the Grantor, one individual by the Grantee, and the third selected by those two individuals. The three individuals will determine the dispute by majority vote, following the rules of the American Arbitration Association. The decision of the arbitration committee shall be binding or nonbinding by agreement between Grantee and Grantor prior to selection of the arbitration committee.

7. Duration. The duration of the Conservation Easement herein granted shall be perpetual, provided that Grantors may terminate this Grant to become effective on the date of any fiftieth anniversary of this Grant. Grantors shall give notice as provided in Paragraph 17 herein. This Grant shall run with the land. This Grant shall be binding on the successors and assigns of the parties and shall inure to the benefit of the successors and permitted assigns of the parties.

8. Construction. This Easement shall be liberally construed in favor of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values of the Property. Captions shall not be

used in interpreting this Grant. If any provision of this Easement is found to be ambiguous, an interpretation consistent with the purposes of this Easement and that would render the provision valid shall be favored over any interpretation that would render it invalid.

9. Severability. If any provision of this Easement shall be determined by a court of competent jurisdiction to be invalid or unenforceable, such determination shall not affect the other provisions of this Grant, which other provisions shall be enforced to the full extent permitted by law.

10. Hazardous Materials. Each Grantor agrees that it will comply with all applicable laws with respect to any hazardous or toxic substances, materials, wastes, or other substances regulated by law now located on its property. County will comply with all applicable laws with respect to the landfill and firearms range on the County property. Nothing in this paragraph shall impair Grantors' right to pursue third parties with respect to violations of environmental laws caused by such third parties. Grantee shall have no responsibility with respect to such substances, materials, waste, landfill, and firearms range.

11. Assignment by Grantee. Grantee may assign its rights and interests under this Easement to another organization which is an exempt organization as defined in Tenn. Code Ann. 66-9-303(2), which has the power and authority to hold the conservation easement herein granted subject to the provisions of this Grant, which is a state or nationally recognized conservation organization, or other similar organization accredited to hold conservation easements by the Land Trust Alliance or other successor organization of similar stature, which is approved in writing by Grantors, and which accepts the assignment. If Grantee ceases to be an exempt organization, it will assign its rights and interests under this Easement to an exempt organization approved by Grantors. Grantors will not unreasonably withhold its consent to assignment.

12. Assignment by Grantors. Grantors may assign their rights, privileges, and interests under and as reserved and retained in this Easement (including without limitation all rights of approval, determination, and regulation as to purposes and uses) to an assignee using and operating the Property, provided that such assignment shall be made expressly subject to this Easement, and Grantors agree to take all steps necessary to enforce the provisions of this Easement against any such assignee.

13. Eminent Domain. If any of the Property shall be taken under the power of eminent domain, the entire award shall be the sole property of the County.

14. Maintenance and Insurance. Each Grantor shall continue to maintain its respective property and the improvements thereon in good order, condition, and repair, and in compliance with applicable laws.

As of the date of this Easement, County is self insured as to both casualty and liability insurance with respect to the Property. If and when County shall carry casualty insurance with respect to the improvements, County shall insure the improvements for their full replacement value in accordance with County's insurance standards applicable from time to time to County's facilities. The proceeds of casualty insurance shall be used for repair and restoration of

improvements on the County property. If and when County shall carry public liability insurance with respect to the County property, County shall maintain such insurance in accordance with County's liability insurance standards applicable from time to time to County's facilities, and Grantee and Agricenter shall be named as additional insureds under such liability insurance policies. Grantors will provide Grantee and Agricenter proof of the insurance required by this paragraph.

The Agricenter shall keep the contents of the improvements on Agricenter property insured for their full replacement value. The proceeds of insurance on improvements on the Agricenter Property insured by the County shall be used for repair and restoration of such improvements. The Agricenter shall carry and maintain public liability insurance with respect to the Agricenter property. Initial limits of such liability insurance shall be $1,000,000.00 per incident, $2,000,000.00 aggregate, and thereafter the limits shall be in accordance with commercially reasonable business practices. Grantee and County shall be named as additional insureds under such liability insurance policies. Agricenter will provide Grantee and County proof of the insurance required by this paragraph.

15. Default, Right to Cure. If either party shall default under this Grant, the party in default shall have 30 days after receipt of notice of the default to cure the default, or if such default cannot reasonably be cured within said 30 days, the party in default shall have such additional time as is reasonably necessary to cure the default provided that the party in default begins to cure the default within said 30 days and diligently pursues to completion the curing of the default. No remedy shall be exercised with respect to such default unless and until the default is not cured as herein provided.

16. Notices. All notices required or permitted under this Easement shall be in writing and shall be given by hand delivery or by certified mail, return receipt requested, addressed to the parties as follows:

Grantors:
Shelby County, Tennessee
160 N. Main Street, Suite 850
Memphis, Tennessee 38103
Attention: Chief Administrative Officer

Shelby County Agricenter Commission
7777 Walnut Grove Road
Memphis, Tennessee 38120
Attention: Chairman of the Commission

with a copy to:
County Attorney
160 N. Main Street, Suite 660
Memphis, Tennessee 38103

Grantee: The Land Trust for Tennessee, Inc.
209 10th Avenue South, Suite 530
Nashville, Tennessee 38203
Attention: Executive Director

A party may change its notice address by notice as above provided.

17. Termination. Should circumstances arise that render the purposes of this Grant impossible to accomplish, this Grant may be terminated or extinguished, in whole or in part, by judicial proceedings in a court of competent jurisdiction, subject to the provisions of Paragraph 18 herein. In addition, Grantors reserve the right to terminate this Grant at the end of each fifty-year term, said terms being measured from the Effective Date hereof, and upon notice to the Grantee of intent to terminate no later than ten (10) years before the end of each fifty-year term. Said notice shall be delivered to the Grantee within a one year period beginning on the first day and ending on the last day of such respective fortieth year period. Said notice shall be effective only if in writing and delivered either (i) in person to the parties' respective authorized agent or (ii) by First Class U.S. Mail or (iii) by overnight courier with tracking capabilities to the addresses provided herein, or to such other person or address as either party may designate in writing and deliver as herein provided. Should Grantors fail to provide timely notice of intent to terminate as herein provided, this Grant shall automatically renew for an additional fifty-year term.

18. Interpretation. Nothing in this Grant or the Master Plan shall be interpreted or intended to be utilized to interfere with the rights and duties granted to the Agricenter Commission pursuant to Chapter 141 of the Private Act of 1981, nor shall this Grant, or any provisions herein, be construed or interpreted as in any way modifying or exceeding the provisions of any law with respect to the use of the Property.

IN WITNESS WHEREOF, the parties hereto have caused this Conservation Easement to be duly executed and delivered by their respective officials thereunto duly authorized as of the date first written above.

GRANTEE:

THE LAND TRUST FOR TENNESSEE, INC., a Tennessee nonprofit corporation

By: _____

Print Name: Jean C. Nelson

Title: President and Executive Director

GRANTORS:

SHELBY COUNTY, TENNESSEE

By: _____
A C Wharton, Jr., County Mayor

SHELBY COUNTY AGRICENTER COMMISSION

By: _____
Hamilton Smythe, III, Chairman

Approved as to Form:

By: _____
Brian Kuhn, County Attorney

Other County Approvals:

By: _____
Michael Oakes, P.E.
County Engineer

By: _____
Bill Goss
County Real Estate Manager

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, the undersigned, a Notary Public within and for said State and County, duly commissioned and qualified, personally appeared **HAMILTON SMYTHE, III**, with whom I am personally acquainted, and who upon oath acknowledged himself to be the **Chairman of the Shelby County Agricenter Commission**, the within named bargainor, and that he as such **Chairman**, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the **Shelby County Agricenter Commission** by himself as such **Chairman**.

9th WITNESS my hand and Notarial Seal, at office in Memphis, in the County aforesaid, this day of January, 2007.

Paula M. Lewis
Notary Public

MY COMMISSION EXPIRES:

PAULA M. LEWIS STATE OF TENNESSEE NOTARY PUBLIC COUNTY OF SHELBY MY COMM. EXP. JUNE 15, 2010

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, the undersigned, a Notary Public within and for said State and County, duly commissioned and qualified, personally appeared **A C WHARTON, JR., Mayor of Shelby County, Tennessee**, with whom I am personally acquainted, and who upon oath acknowledged himself to be the **Mayor of Shelby County, Tennessee**, the within named bargainor, one of the counties of the State of Tennessee, and that he as such Mayor of said county, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of **Shelby County, Tennessee**, by himself as such **Mayor** of said **Shelby County, Tennessee.**

16 WITNESS my hand and Notarial Seal, at office in Memphis, in the County aforesaid, this day of January, 2007.

Paula M. Lewis
Notary Public

MY COMMISSION EXPIRES:

PAULA M. LEWIS STATE OF TENNESSEE NOTARY PUBLIC COUNTY OF SHELBY MY COMM. EXP. JUNE 15, 2010

STATE OF TENNESSEE)
)
COUNTY OF Davidson)

Personally appeared before me, the undersigned, a Notary Public in and for said State and County, Jean C. Nelson, with whom I am personally acquainted, and who acknowledged that She executed the within instrument for the purposes therein contained, and who further acknowledged that She is the President + Exec. Director of the maker, **The Land Trust for Tennessee, Inc.**, and is authorized by the maker to execute this instrument on behalf of the maker.

WITNESS my hand, at Nashville, Tennessee, this 4th day of January, 2007.

TRACY N. MARSH
NOTARY PUBLIC AT LARGE
DAVIDSON COUNTY, TENN.

Tracy N. Marsh
Notary Public
My Commission Expires: My Commission Expires July 21, 2007

Tom Leatherwood, Shelby County Register of Deeds: Instr. # 07021070

EXHIBIT A

PROPERTY DESCRIPTION

"County Property"

BEGINNING at the intersection of the west right-of-way line of Germantown Parkway and the south right-of-way line of Walnut Grove Road; thence south along said west right-of-way line to the north top of bank of the Wolf River; thence with said north and northeasterly top of bank of the Wolf River to a point on the east line of the Brandon Family, LP property (Instrument Number HC 7038); thence N 06°08'17" E along said east line a distance of 529.49 feet to an angle point; thence N 38°15'51" W along said east line a distance of 245.57 feet to an angle point; thence N 46°44'09" E along said east line a distance of 124.00 feet to an angle point; thence N 27°45'51" W along said east line a distance of 83.00 feet to an angle point; thence N 01°29'09" E along said east line a distance of 111.00 feet to an angle point; thence N 31°00'51" W along said east line a distance of 185.00 feet to an angle point; thence N 03°14'09" E along said east line a distance of 175.00 feet to an angle point; thence N 39°45'51" W along said east line a distance of 230.00 feet to an angle point; thence S 69°59'09" W along the north line of said Brandon property a distance of 191.00 feet to a point on the west line; thence S 01°44'09" W along said west line of Brandon property a distance of 241.00 feet to an angle point; thence S 04°44'09" W along said west line a distance of 217.00 feet to an angle point; thence S 18°44'09" W along said west line a distance of 185.00 feet to an angle point; thence S 16°44'09" W along said west line a distance of 127.00 feet to an angle point; thence S 26°44'09" W along said west line a distance of 248.53 feet to a point on the north top of bank of the Wolf River; thence northwestwardly along said top of bank of the wolf river the following courses and distances; N 61°22'43" W a distance of 113.88 feet to a point; N 54°02'51" W a distance of 336.69 feet to a point; N 39°37'53" W a distance of 223.56 feet to a point; N 28°04'22" W a distance of 391.30 feet to a point; thence N 33°32'36" W a distance of 162.98 feet to a point on the east line of the Brandon family property (Instrument Number HC 7038); thence N 35°29'06"E along said east line a distance of 338.46 feet to an angle point; thence N 07°29'06" E along said east line a distance of 250.00 feet to an angle point; thence N 21°00'54" W along said east line a distance of 130.00 feet to an angle point; thence N 76°30'54" W along the north line of said Brandon property a distance of 260.00 feet to an angle point; thence N 60°00'54" W along said north line a distance of 210.00 feet to an angle point; thence S 57°29'06" W along said north line a distance of 408.91 feet to the top of bank of said wolf river; thence N 40°59'52" W a distance of 522.57 feet to an angle point; thence N 41°06'18" W a distance of 406.90 feet to an angle point; thence N 23°49'38" W a distance of 100.55 feet to an angle point; thence N 11°49'27" W a distance of 136.72 feet to an angle point; thence N 01°38'31" W a distance of 142.54 feet to a point on the south line of the CSX Railroad (100 foot ROW); thence N 81°49'23" E along said south line a distance of 670 feet, more or less, to the point; thence N 04°20'02" E crossing said CSX Railroad (100 foot ROW) to a found 1/2" iron pin in the north line of said CSX Railroad, said point also being on the east line of the Brandon family property (Instrument Number HC 7038), said point having Tennessee State Plane Coordinates of N 320530.8667 and E 810031.3384; thence N 04°20'02" E along said east line and along the east line of the Richard Pearce property (Instrument Number DK 6926) a distance of 2072.48 feet to

the northeast corner of said Pearce property; thence N 86°16'39" W along the north line of said Pearce property a distance of 830.34 feet to a point on the said south line of Interstate Highway 40; thence N 44°20'04" E along said south line a distance of 646.52 feet to an angle point; thence N 50°30'38" E along said south line a distance of 493 feet, more or less, to a point in the northwest corner of the federal correctional facility property; thence in a southeastwardly direction along the westerly property line of the federal correctional facility property to a point in the southerly right-of-way line of the said CSX Railroad; thence in an eastwardly direction along said southerly right-of-way line of said CSX Railroad to a point in the southwesterly right-of-way line of Raleigh-LaGrange Road; thence in a southeastwardly direction along the southwesterly right-of-way line of Raleigh-LaGrange Road to its intersection with the west right-of-way line of Germantown Parkway; thence in a southwardly direction along the west right-of-way line of Germantown Parkway to the POINT OF BEGINNING.

Less and Except that portion of the said CSX Railroad (100 foot ROW) contained within this description.

"Agricenter property"

BEGINNING at a point in the south line of Walnut Grove Road (160 feet wide), said point being 1274.81 feet west of the west line of Germantown Parkway (160 feet wide) and said point being the northwest corner of the Shelby Farms Equestrian Center; thence S 16°08'46" E along the west line of the Equestrian Center 727.93 feet to a monument; thence S 02°25'53" W continuing along the west line of the Equestrian Center 1149.38 feet to a monument set in a paved road; thence S 03°17'55" W continuing along the west line of the Equestrian Center along the centerline of said road 518.12 feet to a monument set in the centerline of an intersecting paved road, said point being the southwest corner of the Shelby Farms Equestrian Center; thence S 87°25'42" E along the south line of the Equestrian Center along the centerline of said road 559.09 feet to a monument set in the west line of Germantown Parkway; thence S 14°44'58" W along the west line of Germantown Parkway 2158.85 feet to a monument set in the north line of a power line easement; thence leaving said west line of Germantown Parkway S 60°28'32" W along the north line of said easement 310.02 feet to a monument; thence N 87°25'42" W 5627.20 feet to a monument set on the bank of a drainage ditch; thence N 33°29'14" W 174.81 feet, more or less, to a point in the east line of the 374.5806 acre mature bottomland hardwood/bald cypress forest property designated by the Tennessee General Assembly as the Shelby Farms Forest, known as the Lucius Burch Natural Area (southern forest); thence N 07°00'31" E 2238.00 feet, more or less, to a point, said point being the northeast corner of said Lucius Burch Natural Area; thence N 85°58'13" W along the north line of said Lucius Burch Natural Area 1832.32 feet, more or less, to a point; thence leaving said north line N 33°29'14" W 120.00 feet, more or less, to a monument set in the west edge of a silt levee; thence N 70°58'24" W 3593.12 feet to a monument set in a field; thence N 31 °50'38" W 184.46 feet to a point in the east line of the Walnut Grove Landfill; thence along said east line N 04°00'00" E 740.61 feet to an angle point; thence continuing along said east line N 09°00'00" W 450.00 feet to an angle point; thence continuing along said east line N 48°30'00" W 400.00 feet to a point in the north line of said Walnut Grove Landfill; thence along said north line S 81 °36'16" W 332.10 feet to a point; thence N 03°55'00" E 246.46 feet to a point in the south line of Walnut Grove Road (160 feet wide); thence with said south line of Walnut Grove Road S 84°13'16" E 11373.52 feet to a point of curvature; thence continuing along said south line on a curve to the right having a radius of

Tom Leatherwood, Shelby County Register of Deeds: Instr. # 07021070

2247.83 feet a distance of 288.35 feet to a monument, said point being the POINT OF BEGINNING.

The Agricenter property includes Tier 2 which is the Agricenter campus and Tier 3 which is the property outside the campus.

The Tiers are shown on the map attached hereto as Exhibit B.

12947N:061467:706599:6: NASHVILLE

EXHIBIT A-1

ROAD RIGHT-OF- WAY PROPERTY

The following land is **EXCLUDED** from the provisions of this Conservation Easement:

1. Existing and future widening of designated public roads and rights-of-way including, but not limited to, Walnut Grove Road (160' R.O.W.), Mullins Station Road (108' R.O.W.), and Raleigh-LaGrange Road (108' R.O.W.).

2. Land for proposed "Parkway right-of-way" to be used for the Shelby Fam1S Parkway and Walnut Grove Road widening and improvement projects.

Tom Leatherwood, Shelby County Register of Deeds: Instr. # 07021070

EXHIBIT A-2

AREA 10 PROPERTY DESCRIPTION

The following land is **EXCLUDED** from the provisions of this Conservation Easement:

"Area 10"

BEGINNING at a point in the southerly right-of-way line of the Louisville and Nashville Railroad, said point being located 1500 feet, more or less, west of the centerline of Whitten Road; thence S 13°42'00" W a distance of 710 feet, more or less, to a point; thence S 69°50'04" W a distance of 419.19 feet to a point of curvature; thence along a curve to the left, having a radius of 2710 feet, a distance of 2554.12 feet to a point of tangency; thence S 15°50'04" W a distance of 2119.19 feet to a point; thence N 83°09'56" W a distance of 148.41 feet to a point of curvature; thence along a curve to the right, having a radius of 3000 feet, a distance of 2199.11 feet to a point of tangency, said point being in east line of the 413.7512 acre mature bottomland hardwood/bald cypress forest property designated by the Tennessee General Assembly as the Shelby Farms Forest, known as the Lucius Burch Natural Area (northern forest); thence along said easterly line N 41°09'56" W a distance of 4648.41 feet to a point in the southerly line of the Louisville and Nashville Railroad right-of-way; thence in an eastwardly direction along said southerly line of the Louisville and Nashville Railroad right-of-way to the POINT OF BEGINNING.

EXHIBIT A-3

EXCEPTIONS TO MORATORIUM

On Tier I:

a. Lucius Burch Natural Area Gateway Project, if permitted by the State of Tennessee;
b. Visitors Center/Plough Park Sewer Extension;
c. Public Restroom Construction (Plough Park/Gate 12)
d. Renovation/Expansion of Plough Park for playground equipment; and
e. Shelby Farms Parkway.

On Tier 2:

Construction of improvements devoted exclusively to agriculture, which may include agricultural trade association offices but may not include manufacturing.

Office Space Expansion to Helena Chemical Co. office space - 7664 Moore Road

Agricenter East Pavilion - Clear span addition to main complex facility - 7777 Walnut Grove Road

Monsanto - storage area for equipment and cotton sample office - 7616 Moore Road

Equipment shed area for farm equipment for research vendors - 7518 Moore Road

TCI Landscape - office building adjacent to Quonset Hut - 7546 Moore Road
Farmers Market tent on south side of RV Park-7777 Walnut Grove Road

Parking area for Wildlife Observation Tower

On Tier 3:

Catch'em Lake Bait Shop, restrooms and pavilion area - 6913 Moore Road

On Tier 4:

Buildings to accommodate shows of horse show associations.

Agricenter Show Place Arena restroom upgrades - 105 S. Germantown Parkway

EXHIBIT B

MAP OF TIERS

12/11/06
12947N:061467:706599:6:NASHVILLE

Tom Leatherwood, Shelby County Register of Deeds: Instr. # 07021070

Exhibit "B", MAP OF TIERS

APPENDIX C

Patriot Lake Feasibility

PATRIOT LAKE FEASIBILITY

Prepared by Pickering Firm, Inc.

Expanding Patriot Lake into a recreational lake with 150 acres of surface area is an ambitious, but feasible, goal. The important factors in transforming Patriot Lake into a successful amenity for Shelby Farms involve water quantity, water quality and the aesthetics of the banks. Additional concerns include constructability and permitting.

To assess the hydrologic and stormwater functions of an expanded lake, a conceptual grading and drainage plan was established. This concept was used to analyze the drainage basins, model the functionality of the lake and estimate the earthwork requirements. Any final design can and will vary from these conceptual ideas that are presented here as proposed features. However, the principles of the design should remain the same. The following pages include a summary of the hydrological and feasibility analysis.

Water Quantity

1. Existing Hydrologic System
(See Map A)
For the purposes of analyzing Patriot Lake, the study area is comprised of three major drainage basins. These basins are the Patriot Lake Basin, the area northwest of Patriot Lake and the area east of Patriot Lake.

Patriot Lake currently has a water surface area of 54 acres at elevation 262.00 feet. Per original construction plans, the depth of Patriot Lake varies from nine to fourteen feet. Although much of the adjacent land has been graded to drain away from Patriot Lake through a system of concrete swales, approximately 329 acres of surface drainage enters the lake. This includes the recent addition of roughly 119 acres from the north that is piped under the walking trail on the northeast end of the lake. The discharge from Patriot Lake crosses Walnut Grove Road via a 38”x60” corrugated metal pipe. Pine Lake, located upstream of Patriot Lake, appears to be fed by overland drainage and two cut-off ditches found further south. The eastern swale appears healthy and has active vegetation. The western swale appears stagnant. All of this area ultimately drains overland to the upper pond of Patriot Lake.

The land northwest of Patriot Lake is comprised of roughly 270 acres, including Chickasaw Lake and Mayor Lake. These drainage basins route westward and cross Farm Road at four different locations before continuing westward towards the Wolf River. There are low-lying, marshy areas located around Chickasaw Lake and Mayor Lake that appear to have lost their hydrologic function. From field observation, it is not clear how these water bodies are connected, if at all. In addition, there may be some seepage occurring through the dam at Chickasaw Lake.

The upland area east of Patriot Lake drains to Beaver Lake and Boy Scout Lake before entering a 60” diameter corrugated metal pipe that crosses Walnut Grove Road. This drainage basin measures approximately 232 acres.

2. Proposed Hydrologic System
(See Map B)
The expanded 150-acre Patriot Lake will maintain the water surface elevation of 262.00 feet. The drainage basin will be expanded to accommodate the additional lake volume. A ratio ranging between 4:1 and 10:1 for drainage area to surface water area is desirable to balance water levels and manage stormwater in lakes. The restructured basins shown in Map B include approximately 980

acres. This drainage area compared to the expanded lake water surface provides a ratio of 6.5:1. The expanded drainage basin will include the areas west and east of the existing Patriot Lake. With the relocation of Farm Road and construction of Shelby Farms Parkway, 286 acres can be routed directly to Patriot Lake from the northwest. This includes the discharge from Chickasaw Lake and Mayor Lake. On the eastern side, the lake grading will allow the discharges and overland routing from Beaver Lake and Boy Scout Lake to route directly into Patriot Lake. This provides an additional 209 acres of drainage runoff area.

3. Stormwater Function

The expanded drainage basins and hydrologic connectivity was modeled with a computer program called Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) Version 3.2 published by the US Army Corps of Engineers Institute for Water Resources. The discharge structures were modeled first with a program called Hydraflow Hydrographs 2007 published by Intellisolve and then input into the HEC-HMS model. The HEC-HMS model was used to determine maximum discharges for all sub-basins and maximum water elevations within Patriot Lake.

These calculations are modeled with the assumption that no water is detained by the upper lakes. If detention is occurring within the existing systems, the runoff will reach Patriot Lake at a slower rate. It may be necessary to install discharge structures in these upland ponds to ensure that the desired quantity of water reaches Patriot Lake. In addition, any decrease in water elevation due to evaporation in the upper lakes will reduce the amount of runoff that reaches Patriot Lake. The final design should address detention and evaporation in the upper lakes.

The Soil Conservation Service (SCS) Type II hypothetical storm was used to model the precipitation. Rainfall depths of 4.00, 5.61, 7.12 and 7.88 inches were used for the 2, 10, 50 and 100 year storm events respectively.

The SCS curve numbers and unit hydrographs were used to model the runoff, infiltration and basin discharge rates. The curve numbers are determined by soil type and ground cover. The Natural Resources Conservation Service Soils Map for this area can be seen in Map C. The soils vary between three different hydrologic soil groups but the majority of the site is comprised of Memphis silt loam in the upland areas and Falaya silt loam in the lowlands. The stream routing was modeled with lag time.

The restructured drainage area, comprising the 980 acre basin, surrounds the lake and is broken down into seven sub-basins. The drainage sub-basins, as modeled, can be seen on the map in Map D along with the data used in the model. These sub-basins are routed to Patriot Lake and discharged through storm pipes. There are three existing crossings of Walnut Grove that can be utilized for discharge. Some discharge also needs to be routed west to replenish the swales that are currently filled with overland drainage from Chickasaw and Mayor Lakes.

The discharge structures were modeled as two 5' x 5' concrete boxes with weir openings on all four sides. The structures include 42" diameter outflow pipes. Based on the Federal Emergency Management Agency Flood Insurance Rate Map for the area, a tailwater of 257.50 feet was applied to the discharge structures. These maps are included in Appendix E (which can be found in the full feasibility report).

When the sub-basins combine and route through the expanded Patriot Lake, the maximum water surface elevation and discharge rate are obtained. Hydrographs showing the discharge rates into and out of the lake are found in Appendix F (which can be found in the fullfeasibility report). These rates will work with the existing structures but consideration of the proposed downstream activities is needed to correctly divide the discharge into multiple locations.

The maximum water surface elevation and peak outflow from Patriot Lake during the various storm events is summarized below:

Storm Event	Elevation (ft)	Max. Outflow (cfs)
2	262.70	70.65
10	263.20	121.19
50	263.70	172.22
100	263.96	198.79

As a stormwater management tool, the expanded 150-acre Patriot Lake with a drainage basin of 980 acres functions very well and can utilize the existing downstream structures.

4. Water Loss

It is expected that some water will be lost through evaporation. From historical data and pan evaporation equations, the total loss per year is estimated at 40 inches. The distribution of this evaporation varies with heat and humidity but can be expected to peak in July and August. This maximum loss is estimated at 6.5 inches of elevation change per month during the dry, summer conditions. These evaporation numbers combine with the precipitation to create a cumulative effect on the lake. Based on average monthly precipitation data, the lowest lake elevation estimated for the lake is 261.00 feet.

PATRIOT LAKE FEASIBILITY (continued) Ö

If this is an unacceptable amount of change in water surface elevation for the surrounding amenities, pumping from the Wolf River could be used to supplement the overland drainage. The unpredictable nature of drought events makes this an attractive alternative. Details regarding this permitting process and allowable volume of water pumped follow later in this report.

There could also be some water lost through seepage into the soil, but it is an undesirable condition. Further study is needed to verify soil conditions at the site, but geotechnical investigations on adjacent properties indicate that the soils will be comprised primarily of silt and clay. The silty overburden is susceptible to erosion and seepage, but the deeper clay layers provide a fairly impermeable surface. The clay depths vary but it seems feasible that the lake could be lined with this clay to avoid water loss through seepage. If the depths of clay in this area make this impossible, a liner could be installed to address the loss of water through seepage.

5. Other Improvements

In addition to the improvements for Patriot Lake, it is recommended that three other areas be addressed – Chickasaw Lake, Mayor Lake and the slough west of Pine Lake. Based on preliminary discussions with Brian Waldron, Ph.D. PE, Assistant Professor of Civil Engineering at the University of Memphis, there are indications of seepage across the dam at Chickasaw Lake. If seepage is occurring through this dam, it can undermine the structural integrity of the dam and pose a safety issue for the downstream land. Geotechnical investigation can confirm the possible seepage and identify the magnitude of the problem and solution.

To enhance the quality and function of Mayor Lake, it is recommended that the adjacent low-lying areas be connected to the lake. This would expand the drainage basin and create a more visually attractive water body. A discharge pipe or weir could be added to regulate the stormwater function of the lake and route the discharge to Patriot Lake.

A similar, but less extensive remedy is suggested for the marshy area just south and west of Pine Lake. Based on field observation, this slough is stagnant and odorous. Cleaning this area of debris and locating the discharge route may be enough action to provide a properly functioning habitat. If this does not seem sufficient, the area could be connected directly to the downstream swale on the south end. The goal should be to promote positive drainage within the slough.

Water Quality

1. Lake Conditions

A key component of good water quality is the depth and variance of the bottom surface. To promote a healthy fish habitat, the lake bottom needs to be irregularly shaped and sloped with depths varying from eight to sixteen feet. In order to promote natural aeration and water circulation within the lake, much of the water body should be twelve to sixteen feet deep. This depth is the ideal depth for the majority of the lake. Additional lake aeration by means of air compressors is possible, but not necessary if the lake is deep enough.

The maximum change in water surface elevation modeled in this concept is two feet. This allows room for stormwater management, but provides a fairly consistent normal pool elevation for the beaches and dock areas. An additional foot of freeboard is provided above this elevation so that the top of dam in the fill areas is at elevation 265.00 feet.

2. Wetlands

Based on a preliminary onsite evaluation of Patriot Lake, there are potential fringe and wooded wetlands that will be impacted by the expansion of the lake. The US Army Corps of Engineers (USACE) will require a Preliminary Wetland Delineation on the entire project site and then will decide where they have jurisdiction. This could include the wetlands, the lake itself and the ditches that cross the expansion area.

The permitting for these impacts is addressed later in the report, but one component of permitting wetlands is the mitigation of them. This mitigation presents a great opportunity for the expanded Patriot Lake to include some constructed wetlands. These features will aid in filtering the runoff into the lake as well as provide variety in vegetation and water features.

3. Quality Control

The surface water runoff may need pre-treatment before entering the lake. A typical approach is to install oil/water separators on the underground drainage system that collects any runoff from paved areas or to install vegetative swales in overland flow areas. This is especially important where parking is concentrated. The final design should include pretreatment provisions for pavement runoff.

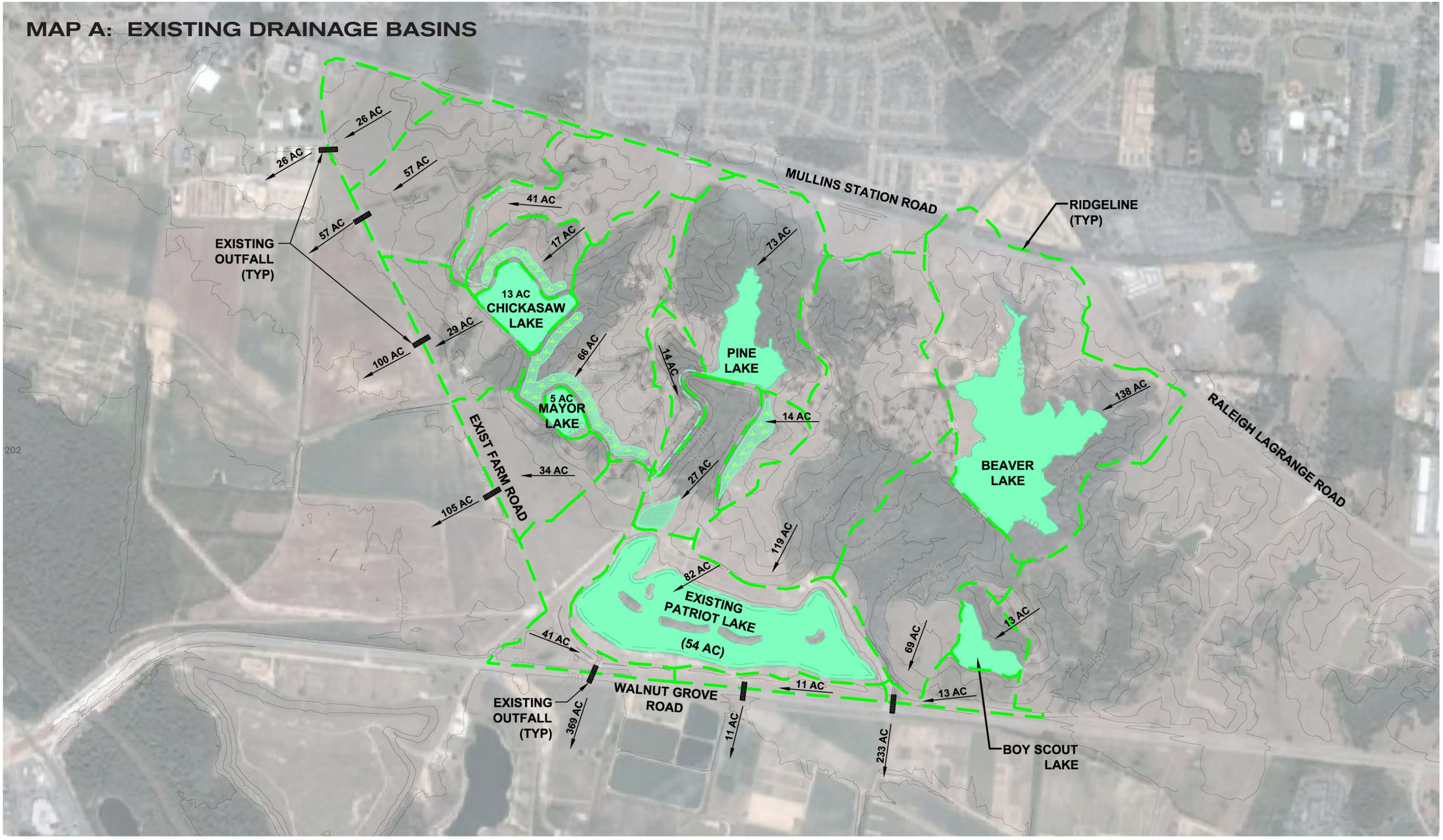
In addition to oil, sediment could be carried into the lake with the runoff. This is especially true when the upland areas topsoil is comprised of erosive silt. The best solution is to maintain the uplands of the park with vegetation in place to secure the soil. The magnitude of the upland area will make this

difficult so it should be anticipated that at some point, the lake may need to be mucked out to remove excess siltation that can occur over time.

If water from the Wolf River is going to be used to supplement the lake, samples should be taken to verify the quality. It is our understanding that this river should require little, if any, in situ treatment at the lake. However, varying usages of water bodies require different levels of screening for pollutants.

In addition, geotechnical and environmental testing should be done to confirm that there are no contaminants leaching from the adjacent landfill. If any contaminants are traveling through the subsoil, the extents of the effects should be determined.

MAP A: EXISTING DRAINAGE BASINS

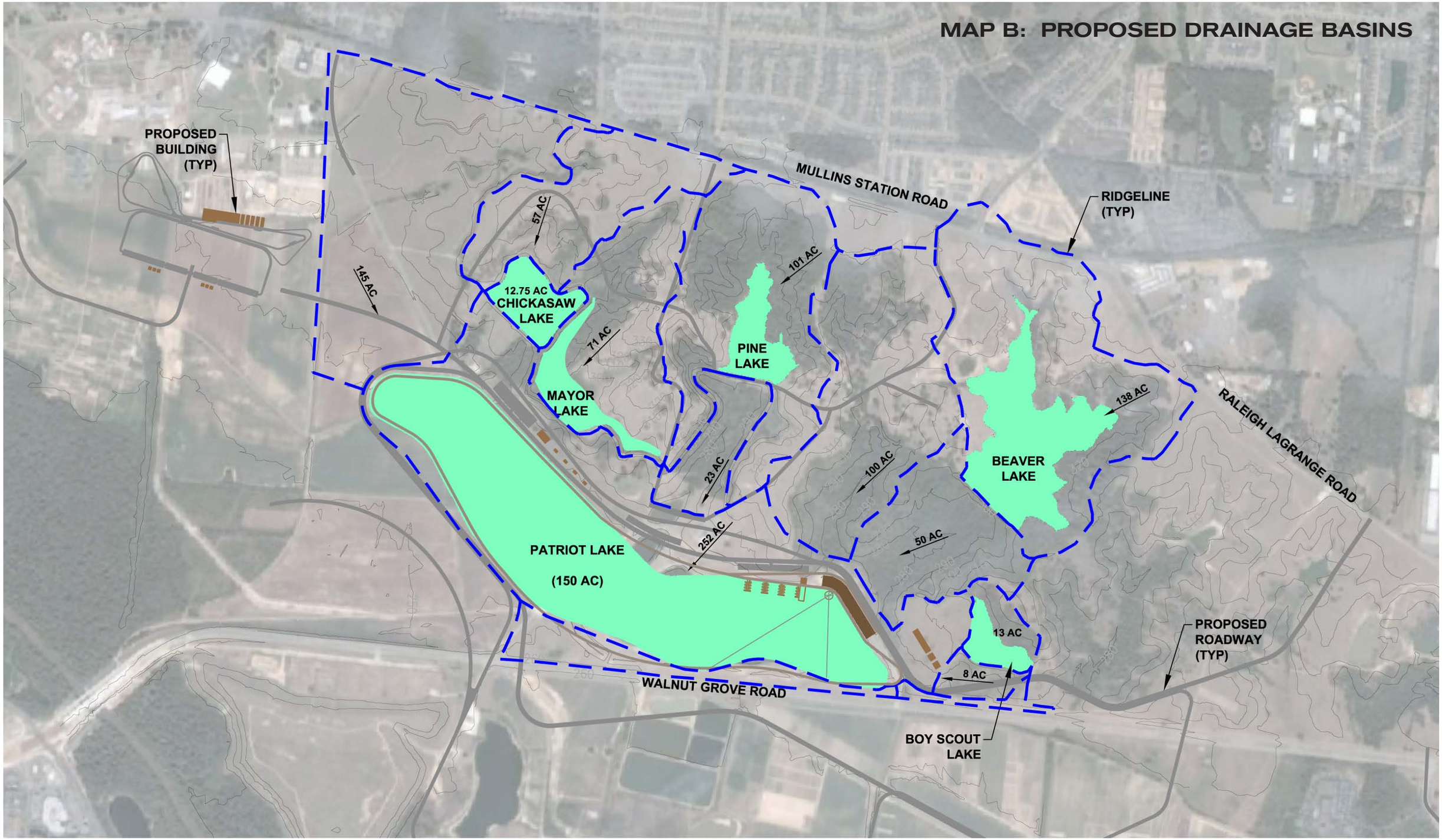


NORTH

0 1000

1 INCH = 1000 FEET

MAP B: PROPOSED DRAINAGE BASINS



NORTH

0 1000

1 INCH = 1000 FEET

MAP C: SOIL SURVEY Ö

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Shelby County, Tennessee
Survey Area Data: Version 5, Aug 10, 2006

Date(s) aerial images were photographed: 1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Shelby County, Tennessee (TN157)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bo	Bonn silt loam	18.1	1.7%
Ca	Calloway silt loam	3.7	0.3%
Fm	Falaya silt loam	227.4	21.3%
GaB	Grenada silt loam, 2 to 5 percent slopes	29.9	2.8%
GaB2	Grenada silt loam, 2 to 5 percent slopes, eroded	8.8	0.8%
GaD2	Grenada silt loam, 8 to 12 percent slopes, eroded	6.9	0.6%
He	Henry silt loam	23.4	2.2%
LoB	Loring silt loam, 2 to 5 percent slopes	3.3	0.3%
LoC2	Loring silt loam, 5 to 8 percent slopes, eroded	0.6	0.1%
LoD2	Loring silt loam, 8 to 12 percent slopes, eroded	0.6	0.1%
MeB	Memphis silt loam, 2 to 5 percent slopes	137.0	12.8%
MeB2	Memphis silt loam, 2 to 5 percent slopes, eroded	27.6	2.6%
MeC2	Memphis silt loam, 5 to 8 percent slopes, eroded	64.7	6.1%
MeD2	Memphis silt loam, 8 to 12 percent slopes, eroded	238.8	22.4%
MeD3	Memphis silt loam, 5 to 12 percent slopes, severely eroded	52.0	4.9%
MeE	Memphis silt loam, 12 to 20 percent slopes	95.2	8.9%
W	Water	128.4	12.0%
Totals for Area of Interest (AOI)		1,066.5	100.0%

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features

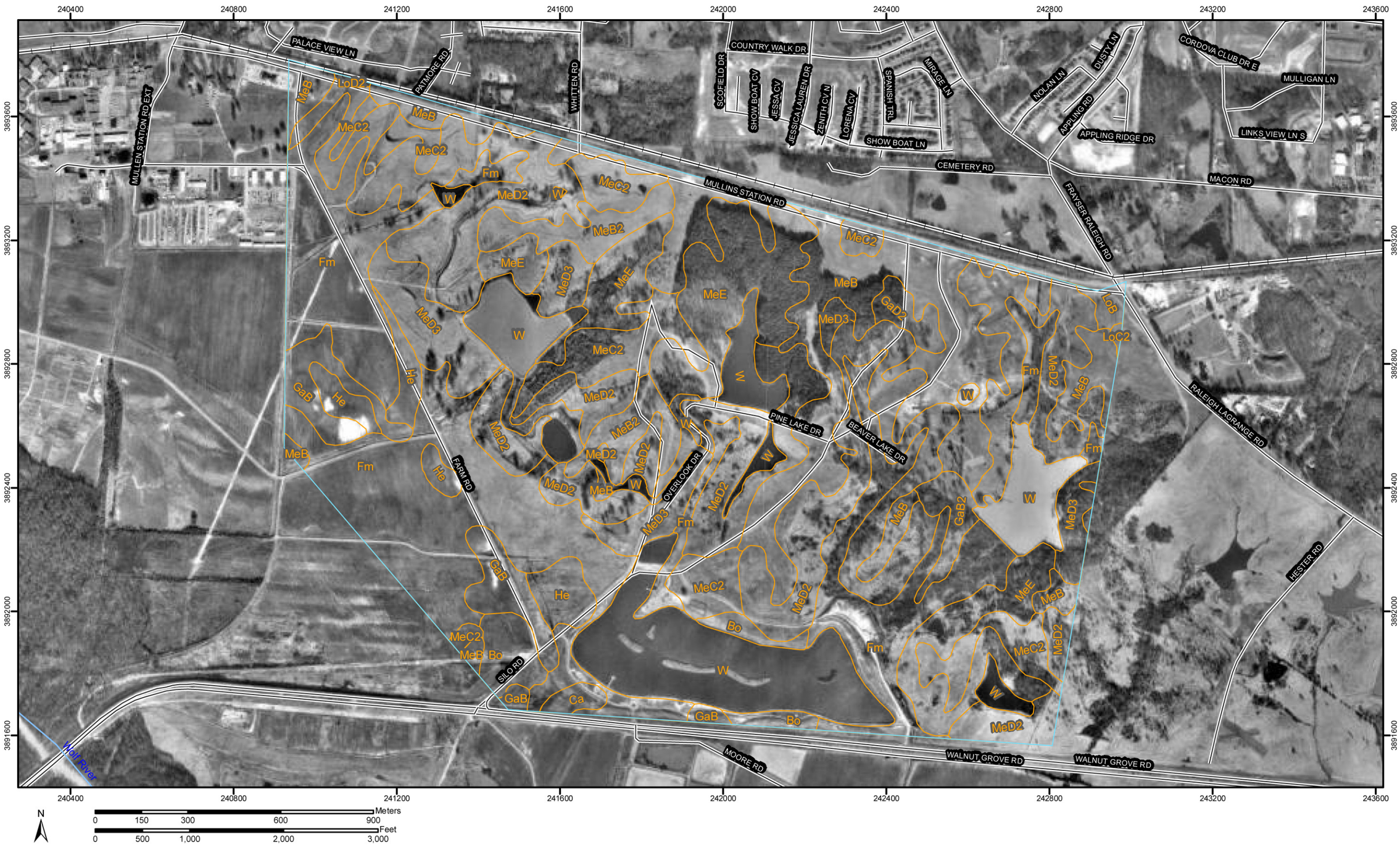
Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

Soil Map–Shelby County, Tennessee
(Shelby Farms)



N

0 150 300 600 900 Meters

0 500 1,000 2,000 3,000 Feet

Natural Resources Conservation Service

Web Soil Survey 2.0
National Cooperative Soil Survey

6/25/2008
Page 1 of 3

MAP D: HEC + HMS PROPOSED BASIN MAP Ö

Equations Used

Storage at Saturation [S'] (inches) = (1000 / CN) - 10

Initial Abstraction (inches) = 0.2 * S'

Lag Time (hours) = $\frac{L^{0.8} (S' + 1)^{0.7}}{1900\ w^{0.5}}$

L = Travel Length (feet)
w = watershed slope (%)

Western Overland Flow – Subbasin 1

Drainage Area = 145 acres (0.23 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Pasture/Grassland	79	44
Loring Silt Loam	C	Pasture/Grassland	79	1
Grenada Silt Loam	C	Pasture/Grassland	79	5
Falaya Silt Loam	D	Pasture/Grassland	84	35
Henry Silt Loam	D	Pasture/Grassland	84	15

Composite Curve Number = 82

Saturation Storage = 2.20 inches
Initial Abstraction = 0.44 inches
Impervious Area = 10%

Travel Length = 3700 feet Slope = 1.20%

Lag Time = 46.83 minutes

Reach 1
No attenuation – May be piped

Chickasaw Lake – Subbasin 2

Drainage Area = 70 acres (0.11 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Brush/Weeds/Grass	56	84
Water	n/a	n/a	98	16

Composite Curve Number = 63

Saturation Storage = 5.87 inches
Initial Abstraction = 1.17 inches
Impervious Area = 3%

Travel Length = 4180 feet Slope = 1.10%

Lag Time = 91.20 minutes

Reach 2
Travel Length = 960 feet Slope = 3.96%

Lag Time = 14.90 minutes

Mayor Lake – Subbasin 3

Drainage Area = 71 acres (0.11 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Brush/Woods/Grass	60	83
Water	n/a	n/a	98	17

Composite Curve Number = 66

Saturation Storage = 5.15 inches
Initial Abstraction = 1.03 inches
Impervious Area = 2%

Travel Length = 3260 feet Slope = 1.23%

Lag Time = 65.72 minutes

Reach 3
Travel Length = 440 feet Slope = 8.64%

Lag Time = 5.00 minutes

Pine Lake – Subbasin 4

Drainage Area = 124 acres (0.19 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Woods/Grass	65	86
Falaya Silt Loam	D	Brush/Weeds/Grass	77	4
Water	n/a	n/a	98	10

Composite Curve Number = 69

Saturation Storage = 4.49 inches
Initial Abstraction = 0.90 inches
Impervious Area = 4%

Travel Length = 3880 feet Slope = 1.80%

Lag Time = 57.55 minutes

Reach 4
Travel Length = 650 feet Slope = 2.77%

Lag Time = 11.00 minutes

Eastern Overland Flow – Subbasin 5

Drainage Area = 100 acres (0.16 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Woods/Grass	65	78
Grenada Silt Loam	C	Meadow	71	9
Falaya Silt Loam	D	Woods/Grass	82	13

Composite Curve Number = 68

Saturation Storage = 4.71 inches
Initial Abstraction = 0.94 inches
Impervious Area = 3.5%

Travel Length = 3620 feet Slope = 1.71%

Lag Time = 57.55 minutes

Reach 5
No attenuation – May be piped

Beaver/Boy Scout Lake – Subbasin 6

Drainage Area = 209 acres (0.33 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Woods/Brush/Meadow	60	74
Loring Silt Loam	C	Woods/Grass	76	2
Grenada Silt Loam	C	Woods/Grass	76	3
Falaya Silt Loam	D	Woods	79	9
Water	n/a	n/a	98	12

Composite Curve Number = 67

Saturation Storage = 4.93 inches
Initial Abstraction = 0.99 inches
Impervious Area = 5%

Travel Length = 5080 feet Slope = 1.18%

Lag Time = 93.30 minutes

Reach 6
No attenuation – May be piped

Direct Rainfall – Subbasin 7

Drainage Area = 252 acres (0.39 sq miles)

Soil Name	Soil Type	Description	Curve Number	Percent of Total
Memphis Silt Loam	B	Open Space	61	25
Water	n/a	n/a	98	75

Composite Curve Number = 89

Saturation Storage = 1.24 inches
Initial Abstraction = 0.25 inches
Impervious Area = 10%

Travel Length = 1300 feet Slope = 3.54%

Lag Time = 9.20 minutes

Reach 7
No attenuation – Direct rainfall into Patriot Lake and surrounding areas

Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 3, 2008

Pond No. 1 - Patriot Lake

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 262.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	262.00	5,978,610	0	0
2.00	264.00	6,093,173	12,070,390	12,070,390
3.00	265.00	6,150,672	6,121,288	18,191,680

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 256.80	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

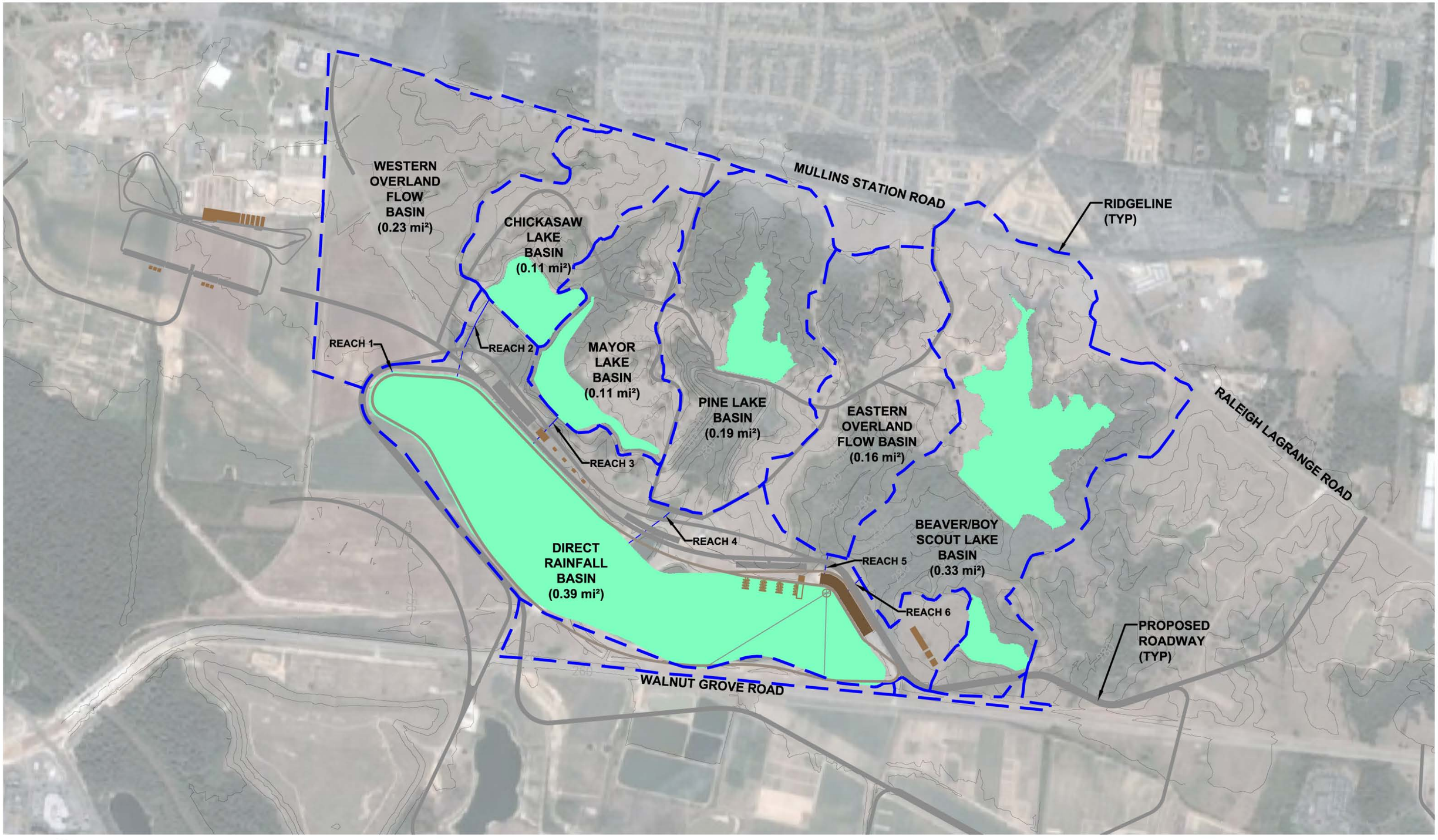
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 32.00	0.00	0.00	0.00
Crest El. (ft)	= 262.10	0.00	0.00	0.00
Weir Coeff.	= 3.30	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (o) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	262.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.00	12,070,390	264.00	202.41 oc	---	---	---	202.40 s	---	---	---	---	---	202.40
3.00	18,191,680	265.00	230.90 ic	---	---	---	230.87 s	---	---	---	---	---	230.87

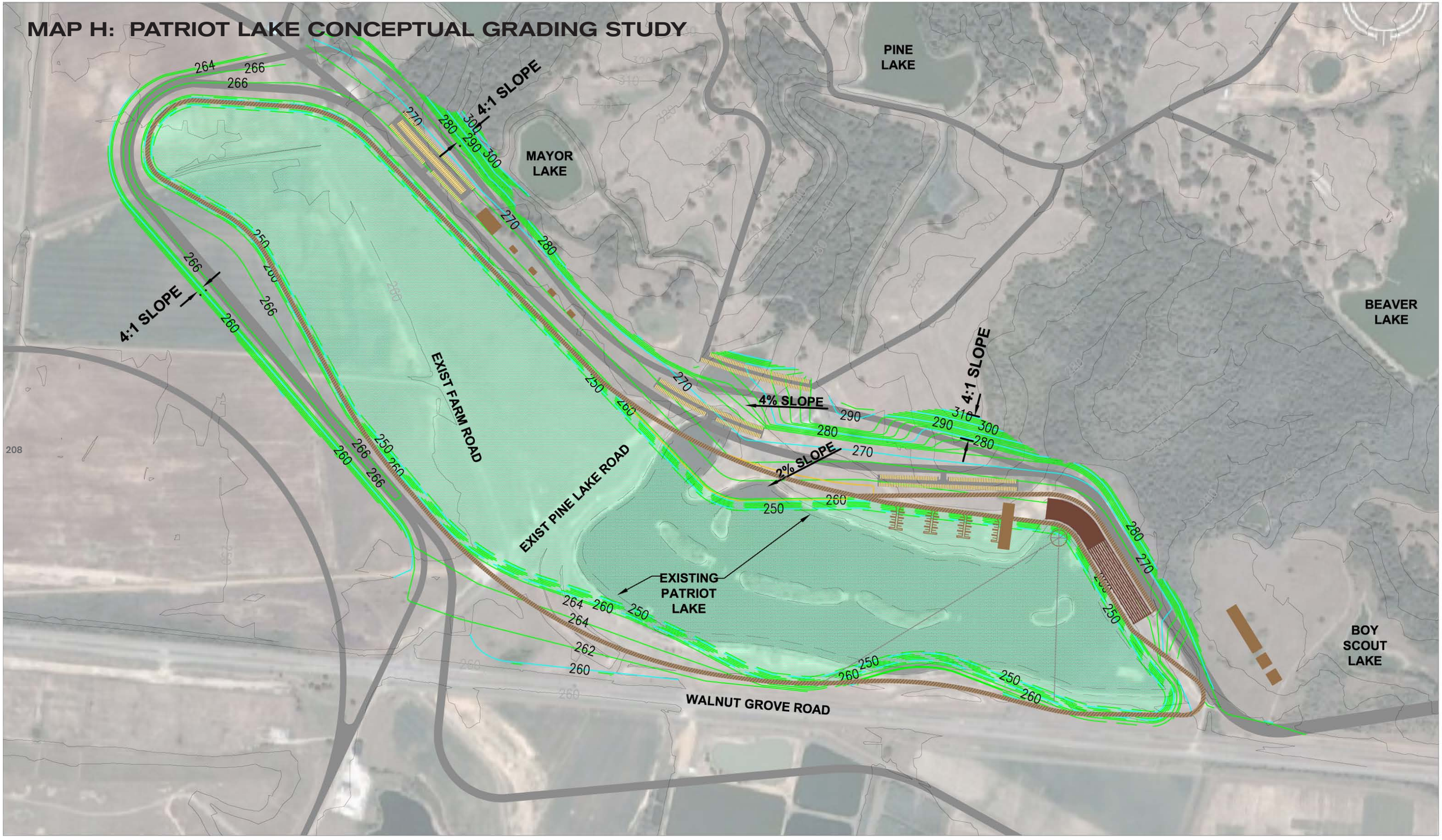


NORTH

0 1000

1 INCH = 1000 FEET

MAP H: PATRIOT LAKE CONCEPTUAL GRADING STUDY



NORTH

0 500

1 INCH = 500 FEET

APPENDIX D

ECOLOGICAL MANAGEMENT + INTERPRETIVE OPPORTUNITIES

D.1 ECOLOGICAL MANAGEMENT, ENHANCEMENT, and RESTORATION Ö

Prepared by the Ecological Research Center, University of Memphis

Management Objective

Sustain for future generations the native natural resources that occur at Shelby Farms Park and provide visitors to the park an opportunity for a valuable interaction with animals and plants that is safe and enjoyable, while ecologically friendly to resident biota, and couples with the long-term mission of the park.

Accomplishment of the management objective is through a proactive management philosophy that recognizes the complexities of the biological world and the challenges of responsible stewardship.

Outline of Key Management Steps

1. Assemble an integrated-planning team (committee) from a broad spectrum of people in professional fields relating to natural resources (e.g., Shelby Farms Park, academic institutions, Ducks Unlimited, Agricenter International, Tennessee Wildlife Resources Agency, U. S. Fish and Wildlife Service; Tennessee Department of Environment and Conservation; City of Memphis and Shelby Co.) with a charge of forming an Integrated Natural Resources Management Plan.

2. Create an integrated plan that incorporates goals of all aspects of park development and growth will be necessary for successful-park advancement.

3. The integrated-planning team defines a mission and charts a course for natural-resource management; in drawing from existing databases, it determines the state-of-the-state in relation to the understanding of natural resources on the site at this time; additionally, the planning team provides a means (research) for assembling the databases needed to meet the park's objective relating to natural resources for the future.

4. Because databases for all aspects of management of natural resources on the park are incomplete or lacking, a first priority should be to inventory the status and distribution of the biota on the site; this should be done by knowledgeable individuals to determine if vulnerable species and communities exist on the site.

5. Once the status and distribution of natural resources are known, management plans can be developed to direct actions (e.g., sustain, restore, enhance, remove species).

6. While the detailed ecological state of SFP is yet to be determined, some actions that seem likely to be recommended are:

    1. integrity of bottomland and upland forest improved through the removal of exotic species (especially, Chinese privet and kudzu) and planting of numerous trees Ö
    2. restore native grasslands to the park
    3. improve stream drainages
    4. establish additional and improved wetland habitat
    5. enhance richness of aquatic and terrestrial species on the site
    6. improve existing ponds and lakes
    7. establish ecological corridors that link habitat patches
    8. habitat edges made more wildlife friendly
    9. promotion of the Wolf River as part of the "ecological crown" of SFP

7. Monitoring of status and distribution of species as well as the overall ecological health and integrity of SFP should be included as part of the long-term management plan; a continuing understanding of the status of ecological conditions on the site are critical for long-term sustainability of natural resources on the site.

8. The strategy developed by the planning team should foster efforts to connect SFP with other green space in the region; thus, the plans prevent SFP from becoming an isolated island ecologically and suffering from the biological ills (e.g., inbreeding within species, increased human/wildlife encounters, greater potential for significant impact of wildlife diseases) associated with isolation.

9. Management plans are integrated to foster all aspects of park activities and adaptive to incorporate new understandings as they develop.

Outline
Integrated Planning Team, Integrated Natural Resource Management Plan, Research (status and distribution of natural resources determined), Decisions made as to actions , Management plans implemented, Status and distribution of species and ecological health and integrity of the landscape at SFP are monitored (Research), Integrated and adaptive management plans practiced.

Management reflects a dedication to managing, researching, regulating, preserving, and outreaching.

The Ecological Research Center (The University of Memphis) could play a key role in organization and

implementation of natural-resource management at SFP

-

Identify a Hierarchy of Management Zones

1. Identification of a hierarchy of management zones for SFP is difficult until a detailed inventory of the natural resources have been completed and a potential network of corridors and linkages developed. At this time, it is probably most productive to think of management zones in relation to habitat types. Thus, management zones could include: (1) bottomland forest; (2) upland forest; (3) grassland; (4) wetland; (5) habitat edges; (6) maintained areas; (7) agricultural areas; (8) pasture; (9) lakes and ponds; and (10) Wolf River and drainages

2. Such a hierarchy allows for focus on species classified as habitat specialist as well as habitat generalist.

3. Such a hierarchy allows for assessing overall patch size as well as amount and connectivity of similar habitats

4. Such a hierarchy allows for assessing quality of similar habitats and a later ranking of areas as to need for restoration or protection

Managing Public Access

Public access can be managed at different levels:

1. *No Restriction*: visitors welcome regardless of mode of transportation

2. *Limited Restriction:* no motorized vehicles; visitors welcome only on foot, horseback, or other selected means; visitors welcome only during selected seasons; selected number of visitors welcome at one time.

3. *No Access:* access by park personnel only

Without detailed knowledge of the status and distribution of species and connectivity and linkage of habitats, it is difficult to present specifics about public access other than to imply that is should vary with sensitivity of species and potential negative impact that visitors can have on the habitat.

Sampling fish using drag seines

Future Monitoring Protocols

Protocols adopted to monitor animal and plant species on SFP will follow those recommended by various disciplines within the scientific community and, therefore, will vary depending upon the group of animals or plants to be studied; additionally, where appropriate, protocols utilized for monitoring animal species will follow guidelines of animal care and welfare committees at institutions directing the work; an example for the study of mammals would be as follows:

Mammals

Protocols adapted from: Measuring and monitoring biological diversity: standard methods for mammals (Wilson et al. 1996) The citation is:
Wilson, D. E, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster. 1996. Measuring and monitoring biological diversity: standard methods for mammals. Smithsonian Institution Press, Washington, D. C., USA.
Techniques for studying diversity, distribution, density, and abundance (techniques are numerous and depends on the task; selected examples follow; some techniques apply to more than one group of vertebrates)

1. *Live traps* (size depends on target species): frequently used to study mammals in urban areas

D.1 ECOLOGICAL MANAGEMENT, ENHANCEMENT, and RESTORATION (continued)

2. *Bat detectors:* used to study bats; echolocation calls are measured

3. *Mist nets:* used to study bats and birds

4. *Time area counts:* used for mammals (e.g., gray squirrels)

5. *Hair sampling tubes:* used for small mammals

6. *Nest boxes:* used for birds and mammals

7. *Infrared video cameras:* used for most animals

8. *Aerial surveys:* a fixed-wing aircraft or helicopter is used to obtain total or sample counts of animals that are fairly easily detectable (e.g., deer in a field; ducks and geese on a lake)

9. *Thermal imagery:* a high-speed scanning mirror reflects the infrared radiation from animals based on body temperature (used for white-tailed deer and other selected, large mammals and birds; e.g., eastern turkey on the roost); technique provides a total count

10. *Infrared triggered cameras:* passive infrared monitors that trigger automatic cameras are used; provides a count based on photographs; can be used for selected species of birds and mammals

11. *Call playbacks:* species-specific calls that cause animals to react in predictable ways may be broadcast in an area as a means of increasing the visibility of the animal for counting; measures trends in populations as to being up or down compared to another time periods; can be used for selected species of birds and mammals

12. Ultrasonic bat detection can be used to census bats

13. *Mark and recapture techniques:* animals (techniques is utilized for any species) are captured and marked (using a tag or band) and released at site of capture; based on the total number of animals captured and the number of recaptures, an estimate of population density is determined

14. *Sight-capture/sight recapture techniques:* procedure where animals are sighted and recognized individually; therefore, can be treated like mark/recapture technique; used primarily for selected bird and mammal populations

15. *Drive counts:* animals occupying an area are completely surrounded by people and counted as they are forced to leave the area; can be used for deer and other large mammals as well as selected species of birds

16. *Road counts:* an investigator counts all animals within a specified distance on either side of a road or all animals seen from the road on both sides; used primarily for selected species of mammals

17. *Quadrat sampling:* quadrat (typically square sample plots) all animals within a plot are counted (appropriate for small organisms, especially invertebrates)

18. *Spotlight counts:* using a spotlight from a vehicle, route are traveled at selected speeds and target species counted; can be used for selected species of mammals

19. *Strip transects census:* Where birds within a measured boundary are counted

Bat houses provide roosting sites

20. *Point counts:* Number of birds observed per time unit (e.g., selected number of minutes) at selected points

Birds

Adams et al. (2005) note three techniques have been used most commonly to study distribution, abundance, and composition of bird communities: belt transects, point counts, and territorial mapping.

1. *Belt transects:* observer generally walks slowly along the centerline of the transect counting birds seen or heard on either side to a given distance

2. *Point counts:* differs from belt transects in that the observer remains stationary at a point and counts birds seen or heard, generally within a selected distance from the point

3. *Territorial mapping:* the number of territorial males or breeding pairs are counted for all species within a defined area

Amphibians and Reptiles

Amphibians may be monitored by a number of techniques (e.g., visual encounters, egg surveys, calling censuses, dip nets, seines, aquatic funnel traps, terrestrial pitfall traps)

1. *Cover boards:* large boards (e.g., plywood) are placed on the ground in suitable habitat and checked (lifted up and observed for the presence of
amphibians and reptiles on the ground under the boards) at selected intervals; can be used to monitor population trends in amphibians and reptiles

2. Nighttime tape playback calls

Fish

The American Fisheries Society has developed guidelines for the collection and use of fish (Murphy, B. R. and D. W. Willis, editors. 1996. Fisheries Techniques, American Fisheries Society, Bethesda, MD). Standardized techniques have been developed for collection of fish to compensate for biases associated with type of gear, season and location-related conditions. Effective gear must be chosen for the expected species to be sampled at favorable times of the year in standard locations available for subsequent years, e.g. http://www.usbr.gov/pmts/fish/Equipment.html.

1. Passive techniques most useful in standing waters include various types of entanglement gear (experimental gill nets, trammel nets or fyke nets with various mesh sizes).

2. Capture gear for fish in flowing waters include hoop nets, slat traps, and weirs

3. Active capture methods are applicable to various types of waters, and include dragged or towed nets, surrounding or encircling nets (beach seines, purse seines and lampara nets).

4. Techniques useful in various habitat types and for different life stages include push nets, lift nets, dip nets, cast nets drop nets, angling, spears, detonating cords and fish toxicants such as rotenone and antimycin.

5. Electrofishing via boats or small backpack units enables sampling in a variety of habitats often not suitable for other techniques.

6. Fish eggs and larvae may be collected with ichthyoplankton nets of different mesh sizes drawn at different speeds, through the use of pumps to move water through sampling nets, as well as emergence traps and light traps

Plants

Plants may be monitored by a number of techniques (e.g., quadrat sampling techniques; plotless sampling techniques):

1. *Protocol for problem situations:* successful resource management may lead to overabundance of selected species and to nuisance wildlife; protocols for handling problematic individuals or overabundance should be determined a priori; this reduces potential for conflict among stake holders.

2. *Wildlife Programs*: well-rounded wildlife programs should include strong efforts in inventory, research and monitoring, planning and management, education and extension services, habitat development, preservation, restoration , and conservation

D.1 ECOLOGICAL MANAGEMENT, ENHANCEMENT, and RESTORATION (continued)

A Park of the Future

Monitoring wildlife in a 21st century park should reflect state of the art technology; such monitoring should be adaptive as new technology becomes available; examples of state of the art technology that could be employed today:

1. Animal movements (e.g., coyotes) should be studied employing satellite telemetry and GPS technology.

2. Animal abundance and location (e.g., white-tailed deer) should be studied employing thermal imaging procedures from a helicopter or other aircraft

3. Animal behavior studies (e.g., predators) should be conducted utilizing infrared video cameras

Management of the Future

Ecological management, restoration, and enhancement of natural resources recognizes the complex ecological, socioeconomic, and institutional matrix in which natural-resource management functions:

1. Management fosters cooperation rather than confrontation

2. Management leads (proactive) rather than follows

3. Recognizes that the urban environment is a frontier for understanding and applying ecological, conservation, and other principles in resource management

4. Presents an overall strategy which integrates conservation and development planning for long-term maintenance of environmental quality and sustainability of natural resources

5. Works with the cumulative effect of human population growth, urbanization, and land use changes associated with SFP and recognizes the role of human dimensions in management of wildlife

6. Visionary management will foster a “Memphis Model” for sustaining natural resources for the future

Bat collection using mist net

D.2 ECOLOGICAL INTERPRETIVE OPPORTUNITIES Ö

Inventory of Potential Institutional Linkages

Linkages between SFP and other institutions within the Greater Memphis Region are numerous and represent stakeholders in the academic, public, and private sectors of the community. Examples of potential institutional linkages follow:

1. Colleges and Universities

The University of Memphis, Rhodes College (Memphis, TN), Christian Brothers University (Memphis, TN), LeMoyne Owen College (Memphis, TN), Southwest Tennessee Community College (Memphis, TN), Lane College (Jackson, TN), Union University (Jackson, TN), Lambuth University (Jackson, TN), Dyersburg Community College (Dyersburg, TN), Freed-Hardeman University (Henderson, TN) Bethel College (McKenzie, TN); Northwest Mississippi Community College (Senatobia, MS), Northeast Mississippi Community College (Booneville, MS), Blue Mountain College (Blue Mountain, MS), Delta State University (Cleveland, MS), University of Mississippi (Oxford, MS), Rust College (Holly Springs, MS); Arkansas State University (Jonesboro, AR), Mid-South Community College (West Memphis, AR), Phillips Community College (Helena, AR), East Arkansas Community College (Forest City, AR)

2. Nature centers and Museums

Lichteman Nature Center (Memphis, TN), Coon Creek Science Center (Adamsville, TN), Memphis Botanic Garden (Memphis, TN), Memphis Zoo (Memphis, TN), Meeman-Shelby Forest State Park (Millington, TN), Meeman Biological Station (Millington, TN), Cypress Grove Nature Park (Jackson, TN), Strawberry Plains Audubon Center (Holly Springs, MS), Forest L. Wood Crowley's Ridge Nature Center (Jonesboro, AR); Chucalissa Archaeological Museum (Memphis, TN), Pink Palace Museum (Memphis, TN), National Ornamental Metal Museum (Memphis, TN), Mississippi River Museum (Memphis, TN), Cotton Museum (Memphis, TN), The National Bird Dog Museum (Grand Junction, TN); Tunica Museum (Tunica, MS), Tunica RiverPark Museum (Tunica, MS); Southern Tenant Farmers Museum (Tyronza, AR)

3. Greenways

Greater Memphis Greenline, Wolf River Greenway, Chickasaw Bluffs Conservancy, Tennessee Parks and Greenways

4. Private organizations

Agricenter International, Wolf River Conservancy, Sierra Club, Ducks Unlimited, Tennessee Ornithological Society, Audubon Society, Tennessee Parks and Greenways, The Nature Conservancy, Tennessee Wildlife Federation's Great Outdoors University, Ames Plantation., National Wild Turkey Federation, Quail Unlimited, Mississippi Fish and Wildlife Foundation, Arkansas Wildlife Federation

5. State and Federal Agencies

Tennessee Wildlife Resources Agency, Tennessee Department of Environment and Conservation, Tennessee Urban Forestry Council, Mississippi Wildlife, Fisheries and Parks, Arkansas Game and Fish Commission, Arkansas Department of Parks and Tourism, US Department of Agriculture Wildlife Services, US Fish and Wildlife Service, US Corp of Engineers, US Forest Service, US Geological Survey, National Park Service

Regional Examples of Potential Interpretive Programs, Events, Features and Activities

State Parks

1. *T. O. Fuller State Park, TN:* diverse plant and animal life make the 6-mile Discovery Trail a popular spot for birdwatchers and outdoor enthusiasts –inside the city limits of Memphis. The trail features scenic points of interest, including the Chucalissa Indian Village and unique wetlands of the Mississippi River floodplains

2. *Meeman-Shelby Forest State Park, TN:* borders the Mississippi and offers hiking trails, camping sites, mature forest, and a nature center

3. *Ft. Pillow State Park, TN:* (Owl Prowls (seasonal); Nature Walks (seasonal)

4. *Reelfoot Lake State Park, TN:* Discover the cypress swamps and famed bald eagles of Reelfoot Lake to find out what makes the northwest corner of Tennessee so special. Reelfoot Lake encompasses 25,000 acres and harbors almost every kind of shore and wading bird, as well as the golden and American bald eagles. Summer brings back the always popular Scenic Pontoon Boat Tour. This cruise explores the fascinating habitat and unique beauty of Reelfoot Lake. Guest accommodations include the Airpark Inn with rooms situated over the lake, each with its own balcony. Swimming pool, tennis court and a nature trail are adjacent to the inn. The park also provides two campgrounds and a five-unit motel

5. *Chickasaw State Park:* Tall pines and nearby Lake Placid create a rustic backdrop for a wide

range of accommodations and fun family activities; other parks in western Tennessee offer an array of features and activities (e.g., *Big Cypress Tree, Big Hill Pond, Fort Pillow, Natchez Trace, Pickwick Landing, Pinson Mounds*)

6. *Wall Doxey State Park, MS:* Offers an abundance of outdoor recreation opportunities in a setting rich in natural beauty

7. *John W. Kyle State Park, MS* offers numerous outdoor activities

8. *Parkin Archeological State Park* in eastern Arkansas preserves and interprets the site on the St. Francis River where a 17-acre Mississippi Period American Indian village was located from A.D. 1000 to 1550. A large platform mound on the river bank remains. The site is important for understanding the history and prehistory of northeast Arkansas.

9 *Village Creek State Park, AR*, the unique geology of Crowley's Ridge, a landform of rolling hills in eastern Arkansas's Mississippi Alluvial Plain. A geologic anomaly, the ridge is covered with a lush climax Beech-Maple forest featuring oak, sugar maple, beech, butternut and tulip poplar. Park interpretive programs and exhibits share the story of the natural and cultural heritage of Crowley's Ridge. Five park trails totaling seven miles allow hikers the opportunity to explore this forest on their own, or on guided trail walks. The park also includes 15 miles of horse trails. Anglers can fish for bass, bream, catfish, and crappie at the park's two lakes, Lake Austell and Lake Dunn. Launch ramps, boat docks, bait, fishing boats, electric motors and pedal boats are available late-spring through Labor Day. Ö

State Wildlife Management Areas Ö
These areas are numerous in the Greater Memphis Region and include opportunities for sport fishing, hunting, wildlife observation, photography, and other outdoor activities.

1. *Tennessee: Shelby Forest, Wolf River, John Tulley, Presidents Island, Cold Creek,* and *Eagle Lake*
2. *Mississippi: Tuscumbia, Hell Creek, Divide Section, Sardis Waterfowl,* and *Hamer*
3. *Arkansas: Big Lake. Big Creek, Pine Tree, St. Franjcis,* and *Whitehall*

National Wildlife Refuges
1. *Hatchie National Wildlife Refuge* lies along 23.5 miles of the Hatchie Scenic River, the last unchannelized river of its type in the Lower Mississippi River Valley. The refuge provides an excellent remnant example of the 25 million acres of bottomland hardwood forest once dominating this majestic river valley, includes educational programs, wildlife observation, and auto tour route, other national

An ecoclassroom

wildlife refuges in the region include: Lake Isom, Reelfoot, Chickasaw, and Lower Hatchie; these refuges offer sport fishing, hunting, wildlife observation and wildlife photography

2. *Wapanocca National Wildlife Refuge*, Turrell, AR is a wildlife oasis in an agricultural sea. An excellent diversity of habitat exists comprised on mainly agricultural land, bottomland hardwood forest, early stage reforested hardwoods, open water and flooded cypress/willow swamp. Thirty small field impoundments totaling 190 acres have been developed for waterfowl in the agricultural area. Because of its strategic location in the heart of the Mississippi Flyway and the diverse habitat, the refuge is a prime wintering area for migratory waterfowl and a major stopping place for migrating warblers. Bald eagles, great blue herons, great egrets and anhinga nest on the refuge

3. *Cache River National Wildlife Refuge* was established in 1986 to protect significant wetland

habitats and provide feeding and resting areas for migrating waterfowl. As one of the few remaining areas in the Lower Mississippi River Valley not drastically altered by channelization and drainage, the Cache River basin contains a variety of wetland communities including some of the most intact and least disturbed bottomland hardwood forests in the Mississippi Valley region. The RAMSAR Convention has protected these unique and valuable wetlands as Wetlands of International Importance. At present the refuge currently encompasses over 56,000 acres located in numerous non-contiguous tracts in Jackson, Woodruff, Monroe and Prairie counties in east central Arkansas

4. *Holly Springs National Forest, MS* is a 147,000-acre mix of public and private land. Located in northern central Mississippi, is only an hour's drive south of Memphis, Tennessee, and attracts many of its citizens escaping for the weekend. The park's 50 or so lakes (dug by the Soil Conservation Service) were originally intended for flood prevention and erosion control, but are today also used for warm-water fishing, boating, swimming, and more.

5. *Mud Island Park* in Memphis provides a recreation of the geography and hydrologic flow of the Mississippi River, from its headwaters in Minnesota to its terminus in Louisiana.

6. *The Ghost River* section of the Wolf River is an example of what the lower Wolf River could be for an excellent canoeing experience.

Potential Interpretive Programs and Events

Programs and events are drawn from institutions and events in the greater Memphis region:

Audio/Visual/Films, Auto Tour, Audio Tour, Ranger Programs (interpretive), Living History Programs (interpretive), Junior Ranger Programs (interpretive), Scuba Diving, Nature Walks, Wildlife Programs (interpretive), Plant Sales, Festivals, Biodiversity Surveys, Bicycling, Camping, Fishing, Hiking, Hunting, Horseback Riding, Boating, Picnicking, Swimming, Wildflower Pilgrimage, Wildlife Viewing, Workshops and Classes, Children's Nature Programs, Bird Watching, Fitness Walks, After School Science Programs, Junior Astronomers-Planetary Travelers, Bluebird Box and Birdhouse Workshop, Full Moon Nite and Owl Prowl, Herbs and Herbology for Beginners, Creating a Backyard Habitat, Fossil Programs (interpretive), Tree Identification, Wildlife Identification, Fall Color Hikes, Park History Programs (interpretive), Outdoor Cooking, Outdoor Education, Archery Programs, Boating Education, Outdoor Photography, Kayaking, Canoeing, Aquatic Resources Education, Boating Safety Education, Professional Development Workshops for Teachers, Science Fair Projects, Fishing Rodeos, High School Environmental Studies Programs, Landscaping for Wildlife Programs, Workshops for Developing Educational Materials for Wildlife, Lunch and Learn Programs, Dutch Oven Cooking, Programs in Reading the Woods, Fly Fishing Programs, Nature Photography Programs, Film Library, Programs in Urban Wildlife, Volunteer Opportunities, Internships, How to Recycle, Programs in Urban Gardening, Programs in Energy Conservation, Programs in Composting, Programs in Wildlife Conservation, Meet the Naturalist Programs, Programs in Art and Nature, Television Show

Shelby Farms Park Opportunities

Providing opportunities, events and activities unique to Shelby Farms is critical. Activities for consideration follow:

1. *Establish Signature Event* (day, week end/week). Most parks and nature centers have a signature day (e.g., Ducks Unlimited, Great Outdoor Festival; Lichterman Nature Center, Earthfest; Pink Palace Museum, Arts and Crafts Festival)

2. Interpretive information could demonstrate vertical diversity in the park.
- *Terrestrial*: develop observational tower in forested areas with an associated arboreal canopy walk. Different environmental conditions and biological communities would be evident for the upper stories compared to ground level.
- *Aquatic:* Enable viewing of Patriot Lake from surface to bottom via the use of video cameras placed in clear vertical tubes. Organisms (surface dwellers such as water striders, top minnows, pelagic fish and benthic organisms) vary significantly with depth. Environmental monitoring equipment could demonstrate the consequences of mixing or lake stratification in which temperature and dissolved oxygen may differ dramatically in different strata within the lake.
- *Soil:* Trenches lined with clear panels in different terrestrial areas of SFP could demonstrate vertical changes in biotic and abiotic features.

3. Integrate activities of Agricenter International with other aspects of SFP. Demonstrate how biofuels can be generated from local materials utilizing an onsite facility such as one developed by the Mechanical Engineering Department at U of M. Provide "how to" interpretive sessions on gardening. A Master Gardener could have demonstration plots of various crops with detailed log of activities that accomplish desired outcome. Demonstrate how compact gardens can be developed and applicable to urban landscapes; e.g. use of buckets to raise tomatoes, use of a trellis for vertical growth of vegetable vines; integrate vegetables among bushes and other landscaped areas around homes. Interpretive information at Farmers Market could enhance the gardening experience. Establish interpretive plots that demonstrate the effectiveness of agricultural management strategies, i.e. use

of chemical and biological control of weeds and pests, consequences of till/no-till practices, models demonstrating effectiveness of different irrigation procedures (and other cutting edge technology identified by Agricenter International). Identify values of herbs and medicinal plants.

4. Organize trips along Wolf River with interpretive stations demonstrating aquatic/riparian habitats.

5. Provide plantings to concentrate seasonally migrating animals, such as butterflies and hummingbirds, and feature special events associated with their arrival in large numbers.

6. Incorporate recycling in all aspects of the operation of SFP. Provide interpretive information of recycling procedures and how they can be applied to other situations. Demonstrate how recycled products can be used and incorporated into operations of the park, not the least of which would be composting.

7. Provide interpretive information and demonstration for aquaculture production, and how it may be applied at different scales. Include seasonal demonstration of hatchery operation.

8. Establish a constructed wetland to demonstrate their function. Inflow and outflow characteristics could be compared via interpretive information.

9. Provide real time views of different habitats in SFP. Include projected images of microscopic life found in adjacent lake; view of nesting area of quail, rodent runways,

Ecologically Managed Landscapes

Site in the Greater Memphis Area that might serve as models for the restoration, management and enhancement projects proposed in the Master Plan.

1. Overton Park Old Growth Forest Tail
2. Wolf River Conservancy Ghost River
3. Reelfoot Lake State Park
4. Reelfoot National Wildlife Refuge
5. Ames Plantation
6. Big Hill Pond State Natural Area
7. Hatchie Scenic River
8. Chickasaw State Park
9. Meeman-Shelby Forest State Park
10. Milan Army Ammunition Plant
11. Shiloh National Military Park
12. Holly Springs National Forest

Additional Educational Opportunities

SFP shares with other parks, nature centers, wildlife management areas, and refuges many of the same educational opportunities. This list is long and verifies a commitment by institutions in the Greater Memphis to education. An educated public will be critical to reaching goals of a sustainable future and a high quality of life for people of the Greater Memphis Region. *Shelby Farms Park has an opportunity to play a significant role in environmental and ecological education in the region.* Ö

Proposed Environmental Education Center

This facility provides the means through which lofty goals relating to education can be achieved. Educational planning and other activities best comes from this unit. Our recommendation is to make this part of Phase I of development for SFP. Ö

Outline of key steps Ö

1. Identify a Director of Education for SFP
2. Assemble a planning team to identify the mission and develop the program
3. Develop the Environmental Education Center and programs
4. Put programs into action
5. Develop system for evaluating success of programs
6. Be proactive and lead rather than follow

An ecoclassroom

D.2 ECOLOGICAL INTERPRETIVE OPPORTUNITIES (continued) Ö

Resources for Unparalleled Programs in Education

1. Urban setting of SFP
2. Presence of one of the largest K-12 educational systems in the nation
3. Presence of one of the largest urban parks in the nation
4. Presence of Agricenter International on the site (agricultural education)
5. Presence of Ducks Unlimited on the site (waterfowl and conservation education)
6. Presence of The University of Memphis' Ecological Research Center in proximity (ecological education)
7. Presence of Southwest Tennessee Community College in proximity (outreach opportunities)
8. Presence of numerous interdisciplinary departments within academic institutions in the Greater Memphis Region allowing for education focused on the complexities of the urban environment
9. Presence of numerous partners with the private sector for support in educational programs
10. Presence of Baptist Memorial Hospital adjacent to the site (fitness education)
11. Presence of Christian Brothers High School adjacent to the site (outreach opportunities)
12. Presence of a Shelby County government committed to a Sustainable Shelby
13. Presence of a Shelby Farms Park Conservancy committed to a Sustainable Shelby Farms Park

Education Considerations

1. The feasibility of building a new school on SFP property may be a long- term option and should be explored as a means of providing the Memphis Region with an opportunity for a one of a kind (optional) school that provides students with an unparalleled occasion for learning about nature, sustainability, and environmental issues in an urban environment involving the complexities of the region.

2. A short-term alternative to a new building for an optional school would be to explore a partnership between the Environmental Education Center and Agricenter International where they provide space that could be used for day, overnight, weekend, or weeklong educational extension programs. Agricenter space could potentially be converted to dormitories and a kitchen. Great Outdoors University, an environmental education program of the Tennessee Wildlife Federation that targets urban youth is looking for a local partner where they could bring children to natural areas and learn about the environment. Currently, GOU must go long distances to places like Land Between the Lakes and Reelfoot Lake to obtain this experience, but they are looking for a closer solution. The proximity of agricultural and natural environments at SFP and the Agricenter would provide the perfect match for this education program.

3. Environmental Education Exchange Programs where SFP personnel or affiliates go out to interested groups in the region and present information about SFP programs and the reverse.

4. Environmental Education Outreach programs for international students and international sites. The need for environmental education is worldwide.

5. Environmental Education Distance Learning Program where portals can be established on the internet to document the progress of establishing the "Park of the 21st Century", where other organizations and individuals can go to learn from the "Memphis Model" for sustaining natural resources in an urban environment.

6. Environmental Education Marketing Program where SFP could develop its own television and/or radio programs.

7. Opportunity for a Bookstore located in the Environmental Education Center or SFP Visitors Center to provide educational material to the public.

8. Opportunity for Unique Classroom Experiences where students and visitors are located in the outdoors (e.g., in a cypress swamp, old field, or on a boat traveling down the Wolf River). EcoClassrooms scattered throughout SFP.

9. Opportunity for BioBlitz with a goal of identifying as many species as possible within a 24-hour period; provide opportunities for interested members of the general public to hear first-hand about the techniques used by scientists to study the natural world.

10. Opportunity for Programs Relating to "Leave No Child Inside" where unstructured, nature-based time is fostered outside.

11. Opportunity for Programs Relating to "People with Special Needs" where special programs relating to nature are developed for handicapped individuals.

12. Together Green, an Audubon program focused on inspiration, leadership, and cooperation that inspires people to take action at home, in their communities and beyond, to improve the health of the environment.

Shelby Farms Park, as the "Great Outdoors Park of the 21st Century" should be a showcase for environmental responsibility and sustainability. It also should be a showcase of how technology can be used to integrate learning about stewardship of our natural resources. Advanced technologies should be exploited at every opportunity to seamlessly blend educational ventures with the past and future park. For example, interactive listening experiences (the sounds of a wetland, the sounds of a bottomland hardwood forest, the sounds of a river) could be integrated into walkways, boardwalks, and trails. Additionally, educational and research efforts should be multidisciplinary to provide a holistic approach that involves issues from all stakeholders.

Incorporation of a high level of technology will be required to capture the curiosity of tomorrow's young people. With the presence of Agricultural International and Ducks Unlimited on the site, and The University of Memphis' Ecological Research Center in proximity, great opportunities await for educational programs relating to agriculture, conservation, wildlife, and ecology. Additionally, a 21st century park in a large urban area has great potential for educating urban residents about rural issues and sustainability of natural resources. However, as urban sprawl changes the landscape from rural to urban, there is the opportunity and need for educating rural residents to urban issues and the means for sustaining natural resources for the future.

Our educational programs should emphasize the complex ecological, socioeconomic, and institutional interactions that drive resource management. Success in resolving natural-resource issues and in sustaining natural resources for future generations will come from an Educated Public.

An ecoclassroom

field operations
475 tenth ave, 10th floor
new york, new york 10018
www.fieldoperations.net

Shelby Farms Parkway Advisory Team

* The Shelby Farms Parkway Advisory Team dedicates their efforts to create a great parkway and environment to the memory of Charlie Rond.

Laura Adams
Friends of Shelby Farms Park

Larry Brown
County Commission, Shelby Farms Advisory Committee

Brad Corey
Mid South Trails Association

John Dudas
Memphis Regional Chamber, Major Roads Committee

Gregg Elliott FOR GREGG ELLIOTT
North Community Representative

Randy Graves
Ducks Unlimited

Richard Hollis
Agricenter

Larry Jensen NOT IN ATTENDANCE
Memphis Tomorrow

Dan Johnson NOT IN ATTENDANCE
Commuter Through Shelby Farms

Keith Kirkland
Wolf River Conservancy

Marty Lipinski
University of Memphis, Traffic Engineering

Steve Reynolds BY BILL TUTTLE
Baptist Healthcare

Charlie Rond (Deceased)*
Don Richardson
Sierra Club

Ritchie Smith
Park Planner / Landscape Architect

Mark Stansbury
Shelby Farms Park Board

David Stevens
Accredo Health

Barry White
Brierwood Neighborhood Association

SHELBY FARMS PARKWAY ADVISORY TEAM

TEAM RECOMMENDATIONS

Team and Project Goals

The goals for the Shelby Farms Parkway Advisory Team were grouped into two categories: Team Goals and Project Goals. Team goals provided guiding principles for team deliberations and activities throughout the CSS process. Project goals were more specifically related to the characteristics of the proposed roadway and the Team's vision and expectations for the project.

Team Goals

- Achieve Community consensus and build public trust.
- Reach consensus for a context sensitive solution in a timely fashion.
- Adhere to a continuous and responsive public involvement process.
- Maintain the spirit of teamwork throughout the project.
- Create an atmosphere of good communication among the team, government, and the community.

Project Goals

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

Chronology and Process

Six meetings of the Shelby Farms Parkway Advisory Team were held between February 2005 and February 2006. Two Public Workshops were held during the same time period.

The first team meeting (February 10, 2005) was a partnering meeting that concluded with the development of "Team and Project Goals" and outlining key steps in working toward the first public meeting/workshop.

The first Public Workshop (March 24, 2005) was a "blank page" concept. An aerial photograph of the study area was provided and the public was afforded the opportunity to provide their thoughts and concerns for constructing a north-south road through Shelby Farms.

The Team next met on April 28, 2005 to discuss the results from the Public Workshop. The Team discussed the purpose and need for the project, traffic forecasting activities, and similar projects. They concluded their meeting with a "brainstorming session" relating to design criteria and the range of alternatives to be considered. Team members developed sketches of potential alignments.

The Team met on August 18, 2005 to review and discuss five alternative concepts. Alternatives included 4 and 6 lane alternatives, 35, 40, 45, and 50 mph design speeds, and a range of median widths including an independent roadway design concept. Information from the August 18, 2005 meeting was used to develop two refined alternatives.

The Team met again on October 6, 2006. Following a "field walk through" and additional team discussions, these two alternatives were further refined for presentation at the second Public Workshop on November 15, 2005.

Both alternatives presented at the second Public Workshop were 4 lanes and included a curvilinear alignment along the western boundary of the study area. One was developed on the basis of a 40 mph design speed and the other using criteria for a 45 mph design speed. One alternative included a 40-foot common median and the other involved an independent roadway concept. At grade intersections were proposed at Sycamore View and Mullins Station. Two interchange configurations were proposed at Walnut Grove.

The results of the November 15, 2006 meeting were reviewed at the next meeting of the Shelby Farms Parkway Advisory Team on January 11, 2006. The team discussed further opportunities for refinements to alternatives and discussed the development of "team recommendations." The Team met again on February 16, 2006. The focus of this meeting was to finalize the Team Recommendations presented herein.

Team Recommendations

Final team recommendations are grouped into three general categories: (1) Design Features, (2) Interchange Configuration at Walnut Grove, and (3) Other Considerations. It is the Team's vision that these recommendations provide a basic framework for advancing this project to final design with recognition that access and aesthetic elements will be added later per these recommendations and that refinements may be appropriate as additional information and engineering data becomes available.

Recommended Design Features

- 40 mph design speed
- 4 lanes (12-foot lane width)
- Stabilized grass shoulders where feasible
- Independent roadway concept
- Curvilinear alignment (recommended "plan view" to right)
- At-grade intersections at Sycamore View and at Mullins Station
- Grade separation at Walnut Grove
- Tractor Trailers will not be permitted

Interchange Configuration at Walnut Grove

- The recommended configuration for the interchange at Walnut Grove is a "trumpet" configuration that provides for free-flowing traffic for all movements through the interchange.
- The interchange will feature a separate dedicated exit lane from southbound Shelby Farms Parkway to westbound Humphreys Boulevard.
- The interchange will include a single lane exit from southbound Shelby Farms Parkway to westbound Walnut Grove in addition to the dedicated exit lane to Humphreys Boulevard.
- Curvature within the interchange will meet 35mph design criteria with the exception of the loop ramp which shall meet 25mph design criteria.
- With additional geotechnical information, shift the location of the interchange further to the south provided that geotechnical analyses indicate that construction of embankment material over the landfill is prudent and feasible.

Other Considerations

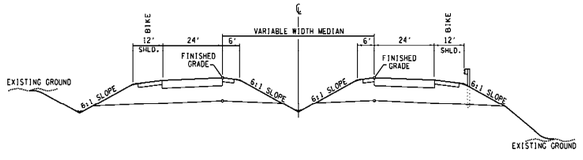
The Shelby County Government is involved in the development of a Master Plan for Shelby Farms. One of this project's goals is to "create a road that enhances and embraces the park." The Team's vision for the Shelby Farms Parkway is a road that blends into the natural and topographic setting of Shelby Farms. The Master Plan for Shelby Farms will provide a fundamental framework for future development and enhancement 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 for Shelby Farms and has thus deferred development of recommendations to the Shelby Farms Master Plan. More specific issues that should be considered in the development of the Master Plan include the following:

- Provisions for a "signature" entrance or entrances for Shelby Farms Park, including the bridge over Walnut Grove,
- Provisions for aesthetically appropriate materials (such as stone facing) and landscaping in the construction of the parkway,
- Provisions for safe, easy and convenient connectivity and non-vehicular access to Shelby Farms from surrounding residential areas and greenways on all sides of Shelby Farms,
- Provisions for multi-use paths for walkers, joggers, and recreational bicyclists,
- Provisions for equestrian trails to facilitate movement from one area of Shelby Farms to another,
- Provisions for safe, easy, and convenient connectivity within the park for pedestrians, bicycles and horses,
- Coordination and accommodation for rails to trails and/or future light rail in the vicinity of Mullins Station.
- Provisions for the continued involvement of the SFPAT in the final design,

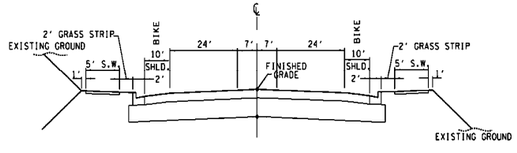
The Team also recommends that authorities from Shelby County, the City of Memphis, and TDOT provide adequate funding for the connectivity, access, and aesthetic features. The Team recommends that design and funding of such features be incorporated into this project included but not limited to access under the Wolf River Bridge north and south.

Typical Sections

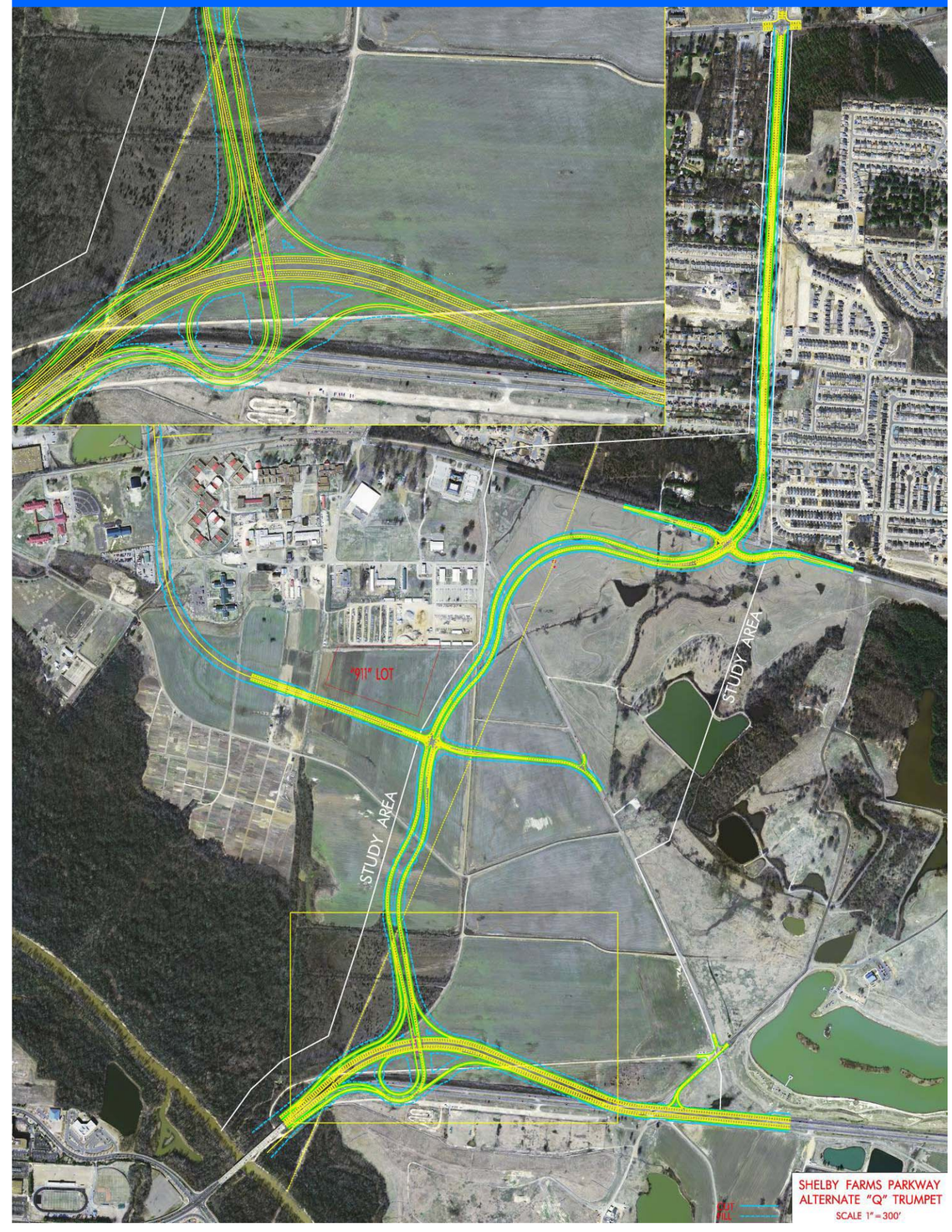
Walnut Grove to Mullins Station



Mullins Station to Macon Road



Plan View



FY 2009 TRANSPORTATION ENHANCEMENT PROGRAM

APPLICATION

Shelby Farms Park looking south from Mullins Station Road

Proposal for Construction of Bicycle, Pedestrian, and Equine Trails

March 27, 2009

TENNESSEE DEPARTMENT OF TRANSPORTATION
ENHANCEMENT PROGRAM APPLICATION
FY 2009

☐ **Check box if this application is a re-submittal.**

Project Title: **Shelby Farms Bicycle, Pedestrian, and Equine Trails**
Project Location (City and County): **Please include detailed driving directions to the project site from 505 Deaderick Street, Nashville for the necessary field reviews.** Take I-40 West to Exit 14. Take Whitten Road South for 1.6 miles to Mullins Station Road at the north end of Shelby Farms.
Grand Total of All Project Costs (including preliminary engineering/design, right-of-way, and construction): $ 2,743,165 (project is segmented and prioritized for partial funding opportunities)

1. **Total Construction Costs (excluding preliminary engineering/design and right-of-way expenses):**

   $ 2,417,165 (100%)

2. **Federal Construction Funds Requested:**
   $ 1,933,732 (80% of number 1)

3. Local Match of Construction Funds:
   $ 483,433 (20% of number 1)

Name of City/County or State Agency Applicant: **Shelby County Government**
Address: **160 North Main Street, Suite 801 Memphis, TN 38103**
Local Government Contact Person, Phone Number and E-mail Address for **Application Process**: **Ted Fox, Director, Public Works Division, (901) 545-4266, Ted.Fox@shelbycountytn.gov**
Local Government Contact Person, Phone Number and E-mail Address for **Project if Awarded**: **Ted Fox, Director, Public Works Division, (901) 545-4266, Ted.Fox@shelbycountytn.gov**

I hereby certify that, to the best of my knowledge, the information submitted with this application is accurate, all rules and regulations contained in TDOT's Local Government Guidelines for the Management of Federal and State Funded Transportation Projects will be adhered to, and that funds are available for the completion of the project as described herein.

Signature: _____ Date _____
County Mayor

Printed Name and Title of elected official: A.C. Wharton, Mayor, Shelby County

NOTE: THE HIGHEST ELECTED OFFICIAL OF A STATE OR LOCAL GOVERNMENT MUST SIGN THIS APPLICATION.

SECTION 1 ENHANCEMENT ACTIVITIES

Check all that apply. Complete explanation of each activity can be found beginning on Page 3 of the instruction booklet.

■	**Facilities for pedestrians or bicycles** All facilities must be hard-surfaced. All work must be at least 51% new construction for approval.	☐	**Rehabilitation and operation of historic transportation buildings, structures or facilities (including historic railroad facilities and canals)**
☐	**Safety and educational activities for pedestrians and bicyclists**	☐	**Preservation of abandoned railway corridors**
☐	**Acquisition of scenic easements and scenic or historic sites (including historic battlefields).** **TDOT does not accept applications from local agencies for this activity.**	☐	**Inventory, control and removal of outdoor advertising.**
☐	**Scenic or historic highway programs (including visitor centers)** (Visitor Centers must have an elevation and floor plan included in the application with all areas labeled per use.)	☐	**Archaeological planning and research**
■	**Landscaping or other scenic beautification** (All landscaping needs to be broken out and detailed in the budget.)	☐	**Environmental mitigation:** **1. due to highway runoff** (verification is required)**; or** **2. Reduce vehicle-caused wildlife mortality**
☐	**Historic preservation**	☐	**Establishment of transportation museums**

SECTION 2 PROJECT DESCRIPTION

In February 2006, the Shelby Farms Parkway Advisory Team (SFPAT) reached consensus on the location of a new four-lane Parkway alignment running through the western edge of Shelby Farms. For many years, previous planning efforts had run into public opposition to this segment of what has been known as the Kirby Parkway. As part of their recommendations to Shelby County, the City of Memphis, and TDOT, the SFPAT proposed that during further design phase of the Parkway that consideration be given to:

- Provisions for safe, easy, and convenient connectivity and non-vehicular access to Shelby Farms from surrounding residential areas and greenways on all sides of Shelby Farms.
- Provisions for multi-use paths for walkers, joggers, and recreational bicyclists.
- Provisions for equestrian trails to facilitate movement from one area of Shelby Farms to another.
- Provisions for safe, easy, and convenient connectivity within the park for pedestrians, bicycles, and horses.

The Team also recommended that design and funding of such features be incorporated into the project (see attached). In 2008, the Shelby Farms Conservancy finalized the preparation of the *Shelby Farms Master Plan* which utilized extensive community involvement to develop an overarching vision for the future of this large and unique urban park. The Master Plan lays the groundwork for the development of non-vehicular facilities within the Farms and has been used as the basis for the recommendations contained herewith. TDOT, the City of Memphis, and the Shelby Farms Conservancy have worked closely to ensure that elements and principles of the Master Plan are included in the development of the Shelby Farms Parkway.

In 2005, TDOT began construction of the Wolf River Bridge as part of the Humphreys Blvd interchange improvement project. While the improvement of the interchange allowed for better access to Shelby Farms for visitors from the west, it was originally not designed with dedicated pedestrian and bicycle facilities. Prior to construction, TDOT met with local stakeholders to discuss concerns with access across the bridges. Through a series of discussion, without changing the bridge size or location, all parties reached agreement on revisions that incorporated a shared use bicycle and pedestrian path across the westbound ramp bridge that was protected from traffic and incorporated some aesthetic features. One goal of this project is to connect this shared use path (pictured at right) with the rest of Shelby Farms.

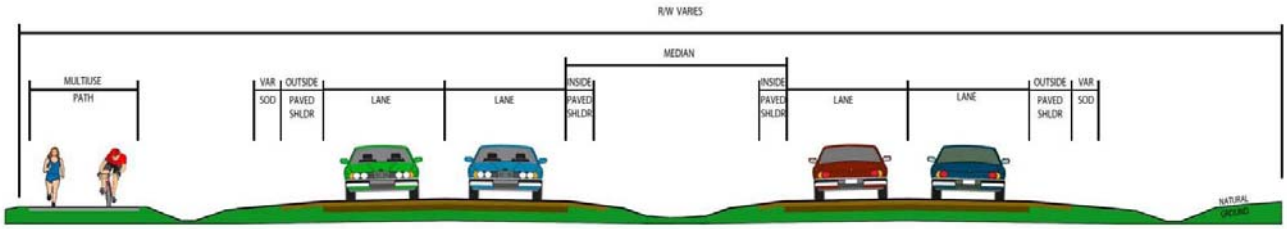
While the Shelby Farms Parkway design is advancing, it has not advanced to a point where ARRA stimulus funding could be used for Parkway construction. This proposal for the:

Shelby Farms Bicycle, Pedestrian, and Equine Trails

seeks to obtain enhancement funding to construct as much of the initial trail system as funding will allow. This enhancement grant will create a much more bicycle and pedestrian friendly "greenspace" in Shelby Farms. Additional recreational uses of Shelby Farms will be encouraged by the addition of these facilities which will result in a healthier Memphis.

All work to be constructed under this proposal will be coordinated so that it is compatible with future design plans for the roadway. The cost estimates in this proposal are separated into buildable segments (see attached exhibit) so that construction can be advanced on each segment as enhancement funding levels allow.

Cost estimates are based on a 13 foot meandering shared use path striped with eight feet for bicyclists and five feet for pedestrians or joggers. Although a 10 foot shared use path is the minimum required, the anticipated volume of pedestrians and bicyclists along with the availability of open space to provide a wider, safer, and more children friendly path led to the proposal for a wider path. The bicycle path standards provided by TDOT will be used to develop a typical section. Equestrian paths are planned to be 10 feet wide but will not be hard surfaced.



Descriptions of each segment in order of their priority for funding are as follows:

Segment A ($177,840) – Bicycle and Pedestrian shared-use path connecting the Wolf River westbound ramp bridge shared path to the proposed Park Circle Trail. The portion of the Park Circle Trail west of the new Shelby Farms parkway would be constructed to a point where the new Parkway will ultimately bridge over the Park Circle Trail. This segment will also include a short connection to the parking area along the Wolf River below the bridges.

Segment B ($130,455) – 2,300 feet of Bicycle and Pedestrian trail running north from the Park Circle Trail to a proposed connection with the Sycamore View Road extension.

Segment C ($257,400) – 4,300 feet of Bicycle and Pedestrian trail running north from the proposed connection to the Sycamore View Road extension to the proposed intersection of the Shelby Farms Parkway and Mullins Station Road.

Segment D ($173,160) – 3,100 feet of Bicycle and Pedestrian trail (Park Circle Trail) passing under the location of the future Shelby Farms parkway and proceeding east to a local access to the Kite Flying Field.

Segment E ($444,600) – 1,200 feet of Bicycle and Pedestrian trail (Park Circle Trail) approach and overpassing Walnut Grove Road to a tie down point south of Walnut Grove Road. This includes a bicycle and pedestrian overpass structure and short connections to existing roads serving the BMX track, soccer fields, and Farm Road south of Walnut Grove Road.

Segment F ($157,950) – 2,000 feet of Bicycle, Pedestrian, and Equine trail connecting Segments B and C to the west with Farm Road to the east. Separation will be provided between the Bicycle and Pedestrian portion of the trail and the Equine portion.

Segment G ($180,180) – 3,100 feet of Bicycle and Pedestrian trail connecting the end of Segment F at Farm Road to the access road leading to the Shelby Farms Visitors Center. This segment follows the north edge of a future planned expansion of Patriot Lake.

Segment H ($140,400) – 1,900 feet of Bicycle and Pedestrian trail connecting the end of Segment C at Mullins Station Road to the parking area along Mullins Station at the north termini of the existing Chickasaw Trail.

Segment I ($112,320) – 2,500 feet of Equestrian trail running south to north between the Park Circle Trail underpass and proposed intersection location of the planned Sycamore View Road extension and the Shelby Farms Parkway.

Segment J ($324,960) – 5,700 feet of Bicycle and Pedestrian trail (Park Circle Trail) running around the south side of the existing landfill from the south end of Segment E to the new Walnut Grove Road bridge over the Wolf River. Includes a trail under the bridge connecting to Segment A completing the Park Circle Trail.

Segment K ($317,900) – 5,000 feet of Bicycle and Pedestrian trail running along the south side of the proposed Sycamore View Road Extension. This segment would tie to Segments B, C, and F and would link the proposed Rails to Trails project on the CSX line near Mullins Station Road to park facilities.

The total construction cost included in this grant application is $2,417,165 excluding preliminary engineering costs. Cost estimates for segment include cost for planting small trees along these greenways. No right of way or utilities impacts are anticipated. Budget sheets for each segment follow in Section 3.

SECTION 3 PROJECT BUDGET

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment A

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 10,000		
SUBTOTAL				$ 20,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	4,000	$5.00	$20,000	$16,000	$4,000
Curb and Gutter						
Concrete/Asphalt	LF	2,300	$14.80	$34,000	$27,200	$6,800
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$38,000	$38,000	$30,400	$7,600
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$12,000	$12,000	$9,600	$2,400
Traffic Control						
CNST. Survey & Layout	LS	1	$4,000	$4,000	$3,200	$800
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$15,200	$12,160	$3,040
TDOT Dept. Oversight	2%	of construction		$3,040	$2,432	$608
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$7,600	$6,080	$1,520
SUBTOTAL				$177,840	$142,272	$35,568

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment B

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 8,000		
SUBTOTAL				$ 18,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	1,000	$5.00	$5,000	$4,000	$1,000
Curb and Gutter						
Concrete/Asphalt	LF	2,200	$14.80	$32,500	$26,000	$6,500
Culvert Extensions/Erosion Control	LS	1	$10,000	$10,000	$8,000	$2,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$28,000	$28,000	$22,400	$5,600
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$9,000	$9,000	$7,200	$1,800
Traffic Control						
CNST. Survey & Layout	LS	1	$3,000	$3,000	$2,400	$600
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$11,150	$8,920	$2,230
TDOT Dept. Oversight	2%	of construction		$2,230	$1,784	$446
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$5,575	$4,460	$1,115
SUBTOTAL				$ 130,455	$104,364	$26,091

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment C

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 10,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 15,000		
SUBTOTAL				$ 30,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$3,000	$3,000	$2,400	$600
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	2,000	$5.00	$10,000	$8,000	$2,000
Curb and Gutter						
Concrete/Asphalt	LF	4,300	$14.80	$63,600	$50,880	$12,720
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$57,400	$57,400	$45,920	$11,480
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$10,000	$10,000	$8,000	$2,000
Seeding/Sod	LS	1	$20,000	$20,000	$16,000	$4,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$10,000	$10,000	$8,000	$2,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$17,000	$17,000	$13,600	$3,400
Traffic Control						
CNST. Survey & Layout	LS	1	$6,000	$6,000	$4,800	$1,200
Construction Administration	LS	1	$3,000	$3,000	$2,400	$600
Construction Contingency	10%	of construction		$22,000	$17,600	$4,400
TDOT Dept. Oversight	2%	of construction		$4,400	$3,520	$880
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$11,000	$8,800	$2,200
SUBTOTAL				$ 257,400	$205,920	$51,480

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment D

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 15,000		
SUBTOTAL				$ 25,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	1,000	$5.00	$5,000	$4,000	$1,000
Curb and Gutter						
Concrete/Asphalt	LF	3,100	$14.80	$45,900	$36,720	$9,180
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$37,100	$37,100	$29,680	$7,420
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$12,000	$12,000	$9,600	$2,400
Traffic Control						
CNST. Survey & Layout	LS	1	$4,000	$4,000	$3,200	$800
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$14,800	$11,840	$2,960
TDOT Dept. Oversight	2%	of construction		$2,960	$2,368	$592
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$7,400	$5,920	$1,480
SUBTOTAL				$ 173,160	$138,528	$34,632

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment E

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 10,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 60,000		
SUBTOTAL				$ 75,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$1,000	$1,000	$800	$200
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	2,000	$5.00	$10,000	$8,000	$2,000
Curb and Gutter						
Concrete/Asphalt	LF	1,200	$14.80	$17,800	$14,240	$3,560
Culvert Extensions/Erosion Control	LS	1	$10,000	$10,000	$8,000	$2,000
Pedestrian Bridges	LS	1	$241,000	$241,000		
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$43,200	$43,200	$34,560	$8,640
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$29,000	$29,000	$23,200	$5,800
Traffic Control						
CNST. Survey & Layout	LS	1	$4,000	$4,000	$3,200	$800
Construction Administration	LS	1	$4,000	$4,000	$3,200	$800
Construction Contingency	10%	of construction		$38,000	$30,400	$7,600
TDOT Dept. Oversight	2%	of construction		$7,600	$6,080	$1,520
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$19,000	$15,200	$3,800
SUBTOTAL				$ 444,600	$162,880	$40,720

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment F

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 10,000		
SUBTOTAL				$ 20,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	1,000	$5.00	$5,000	$4,000	$1,000
Curb and Gutter						
Concrete/Asphalt	LF	2,000	$14.80	$29,600	$23,680	$5,920
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$31,400	$31,400	$25,120	$6,280
Shrubs						
Mulch	LS	1	10,000	$10,000		
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$11,000	$11,000	$8,800	$2,200
Traffic Control						
CNST. Survey & Layout	LS	1	$4,000	$4,000	$3,200	$800
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$13,500	$10,800	$2,700
TDOT Dept. Oversight	2%	of construction		$2,700	$2,160	$540
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$6,750	$5,400	$1,350
SUBTOTAL				$ 157,950	$118,360	$29,590

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment G

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 10,000		
SUBTOTAL				$ 20,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	2,000	$5.00	$10,000	$8,000	$2,000
Curb and Gutter						
Concrete/Asphalt	LF	3,100	$14.80	$45,900	$36,720	$9,180
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$39,100	$39,100	$31,280	$7,820
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$10,000	$10,000	$8,000	$2,000
Traffic Control						
CNST. Survey & Layout	LS	1	$5,000	$5,000	$4,000	$1,000
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$15,400	$12,320	$3,080
TDOT Dept. Oversight	2%	of construction		$3,080	$2,464	$616
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$7,700	$6,160	$1,540
SUBTOTAL				$ 180,180	$144,144	$36,036

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment H

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 8,000		
SUBTOTAL				$ 18,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	1,000	$5.00	$5,000	$4,000	$1,000
Curb and Gutter						
Concrete/Asphalt	LF	1,900	$14.80	$28,100	$22,480	$5,620
Culvert Extensions/Erosion Control	LS	1	$20,000	$20,000	$16,000	$4,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$29,900	$29,900	$23,920	$5,980
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$10,000	$10,000	$8,000	$2,000
Traffic Control						
CNST. Survey & Layout	LS	1	$3,000	$3,000	$2,400	$600
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$12,000	$9,600	$2,400
TDOT Dept. Oversight	2%	of construction		$2,400	$1,920	$480
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$6,000	$4,800	$1,200
SUBTOTAL				$ 140,400	$112,320	$28,080

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment I

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 5,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 5,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 5,000		
SUBTOTAL				$ 15,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$2,000	$2,000	$1,600	$400
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	1,000	$5.00	$5,000	$4,000	$1,000
Curb and Gutter						
Concrete/Asphalt					$0	$0
Culvert Extensions/Erosion Control	LS	1	$5,000	$5,000	$4,000	$1,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$38,000	$38,000	$30,400	$7,600
Shrubs						
Mulch	LS	1	10,000	10,000		
Native Species Plantings						
Topsoil	LS	1	$5,000	$5,000	$4,000	$1,000
Seeding/Sod	LS	1	$10,000	$10,000	$8,000	$2,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$5,000	$5,000	$4,000	$1,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$10,000	$10,000	$8,000	$2,000
Traffic Control						
CNST. Survey & Layout	LS	1	$4,000	$4,000	$3,200	$800
Construction Administration	LS	1	$2,000	$2,000	$1,600	$400
Construction Contingency	10%	of construction		$9,600	$7,680	$1,920
TDOT Dept. Oversight	2%	of construction		$1,920	$1,536	$384
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$4,800	$3,840	$960
SUBTOTAL				$ 112,320	$81,856	$20,464

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment J

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 10,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 10,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 20,000		
SUBTOTAL				$ 40,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$3,000	$3,000	$2,400	$600
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	5,000	$5.00	$25,000	$20,000	$5,000
Curb and Gutter						
Concrete/Asphalt	LF	5,700	$14.80	$84,360	$67,488	$16,872
Culvert Extensions/Erosion Control	LS	1	$25,000	$25,000	$20,000	$5,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$65,000	$65,000	$52,000	$13,000
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$15,000	$15,000	$12,000	$3,000
Seeding/Sod	LS	1	$25,000	$25,000	$20,000	$5,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$10,000	$10,000	$8,000	$2,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$20,000	$20,000	$16,000	$4,000
Traffic Control						
CNST. Survey & Layout	LS	1	$6,000	$6,000	$4,800	$1,200
Construction Administration	LS	1	$4,000	$4,000	$3,200	$800
Construction Contingency	10%	of construction		$25,000	$20,000	$5,000
TDOT Dept. Oversight	2%	of construction		$5,000	$4,000	$1,000
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$12,600	$10,080	$2,520
SUBTOTAL				$ 324,960	$259,968	$64,992

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

Estimated Project Costs

Shelby Farms Bicycle, Pedestrian, and Equine Trails

Segment K

INSTRUCTIONS: *List all items necessary to develop and construct your project. The applicant is responsible for verifying costs and their accuracy. Construction cost overruns will be the responsibility of the Local Government.*

LOCAL PROJECTS: Please note that the Stage I and II Costs shown below are to be funded by the Local Government and are not eligible for Federal Reimbursement.

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%

Stage I – Preliminary Engineering/Design (PE)

Preliminary Engineering/Design: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Environmental Phase of Preliminary Engineering/Design (PE), and the agency follows TDOT's Consultant Selection Procedures, the costs can be applied toward the Local Government's 20% match.

Preliminary Design Plans (enough to obtain the necessary environmental clearances)	LS	1		$ 15,000		Local Match calculated by TDOT prior to Construction funding authorization
Local, State and Federal Permits	LS	1		$ 10,000		
Plans, Specs, & Estimates (PS&E) Document Completion	LS	1		$ 20,000		
SUBTOTAL				$ 45,000		

Stage II – Right-of-Way/Utilities

Right-of-Way/Utilities: Costs cannot be reimbursed with federal funds. However, if the costs are incurred after receipt of the Notice to Proceed with the Right-of-Way Phase (ROW), the costs can be applied toward the Local Government's 20% match.

ROW Design Plans	LS	0		$		
ROW Acquisition (Applicable for the acquisition of Scenic or Historic Sites applied by State Agencies ONLY)	LS	0		$		
License Agreements, Easements, Recording Fees	LS	0		$		
Utility Relocation and Certifications (Only if not affected as a direct result of the enhancement project)	LS	0		$		
SUBTOTAL				$		

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	FEDERAL TE FUNDS @ 80%	LOCAL GOVERNMENT MATCHING FUNDS @ 20%
Stage III – Construction (CNST.)						
ROW Acquisition (State Agencies Only)						
Site Preparation & Demolition:						
Clearing and Grubbing	LS	1	$3,000	$3,000	$2,400	$600
Removal of Obstructions						
Removal of concrete sidewalks						
Removal of asphaltic concrete pavement						
Construction Items:						
**Utility Relocation						
Retaining Wall						
Earthwork (including general, drainage and structural excavation and backfill)	CY	5,000	$5.00	$25,000	$20,000	$5,000
Curb and Gutter						
Concrete/Asphalt	LF	5,000	$14.80	$74,000	$59,200	$14,800
Culvert Extensions/Erosion Control	LS	1	$25,000	$25,000	$20,000	$5,000
Pedestrian Bridges						
Pedestrian ADA Ramp						
Bricked Stamp Pavers						
Striping						
Crosswalk Signals						
Landscaping						
Trees	LS	1	$65,000	$65,000	$52,000	$13,000
Shrubs						
Mulch						
Native Species Plantings						
Topsoil	LS	1	$15,000	$15,000	$12,000	$3,000
Seeding/Sod	LS	1	$25,000	$25,000	$20,000	$5,000
Irrigation Systems						
Pedestrian Amenities						
Pedestrian Lighting						
Benches						
Bike Racks						
Trash Receptacles						
Signage	LS	1	$10,000	$10,000	$8,000	$2,000
Comfort Stations						
Mobilization and Administration Costs						
Contractor Mobilization	LS	1	$20,000	$20,000	$16,000	$4,000
Traffic Control						
CNST. Survey & Layout	LS	1	$7,000	$7,000	$5,600	$1,400
Construction Administration	LS	1	$3,000	$3,000	$2,400	$600
Construction Contingency	10%	of construction		$27,000	$21,600	$5,400
TDOT Dept. Oversight	2%	of construction		$5,400	$4,320	$1,080
*Construction Engineering Inspection (CEI)	5%	*See page 12 of the instruction booklet		$13,500	$10,800	$2,700
SUBTOTAL				$ 317,900	$254,320	$63,580

**Only the costs of utilities needing relocation as a direct result of the enhancement project are eligible for federal reimbursement. Because of the costs involved, the undergrounding of overhead utilities is limited to 33% of the total project cost and the project scope must include additional eligible activities beyond utility relocation.

SECTION 4 OPERATION AND MAINTENANCE COST

Is the Local Government willing to be a party to a maintenance agreement for this project? ■ Yes ☐ no

The facility on which this project is being developed shall remain open to the public for a sufficient time based upon the federal investment as shown below:

Federal Amount	Lease
$1.00 - $200,000	5 years from Federal close-out date
>$200,000 - $500,000	10 years from Federal close-out date
>$500,000 - $1,000,000	20 years from Federal close-out date

Projects over $1,000,000 carry a minimum 25 year lease and will be subject to individual review.

SECTION 5 SUPPORT AND COMMITMENT

Include the local, statewide, and legislative support for the proposed project and attach any available documentation.

METROPOLITAN AREAS

Are you in a Metropolitan Area over 50,000 population? ■ yes ☐ no

If yes, please provide a copy of this application to the appropriate MPO/TPO/RPO coordinator.

NOTE: If the project is selected for funding you must have MPO/TPO project endorsement and amendment into the applicable Transportation Improvement Plan (TIP)

Please provide the legislative districts that correspond to the project location.

House District No. 83/96 **Senate District No.** 28 **U.S. Congressional Representative District No.** 9

SECTION 6 PROPERTY OWNERSHIP/ACQUISITIONS

Does all land necessary for the Project fall within public ownership or lease? ■ yes ☐ no

Is any part of the project to be constructed inside State or Federal highway right-of-way? ☐ yes ■ no

Does any part of your project lie within 200 feet of a rail line? ☐ yes ■ no

Does the project include a pedestrian/bike overpass or underpass? ■ yes ☐ no

Is the project along or adjacent to a State or Federal Highway? ☐ yes ■ no

SECTION 7 RELATIONSHIP AND NEED

1. **Relationship to Surface Transportation**

   a. What service or function will this project, or has this project, provided for the traveling public?

   This project will provide opportunities for residential areas both to the north and the west of Shelby Farms to travel both to destinations within Shelby Farms but also through the Farms to destinations on each side. The project will connect the new dedicated bicycle and pedestrian path crossing the Wolf River ramp bridge to a network of trails within Shelby Farms.

   b. How will it impact surface transportation?

   This project will have some impact on congestion within Shelby Farms as residents from the surrounding neighborhoods will be able to access the park with non-vehicular means. This should reduce the number of trips generated by these residents having to drive into the park and park at the Visitors Center or at any of the parking lots by lakes. This will also have a positive impact on air quality for park visitors.

Please refer to www.fhwa.dot.gov/environment/th/relate.htm for more information pertaining to surface transportation relationships.

2. **Demonstrated Need**

   a. What need(s) will this project fulfill within the community?

   Through the Public Involvement aspect of the Shelby Farms Parkway project and the Master Plan development process, there was considerable input regarding the need for non-vehicular facilities that complement the addition of the Shelby Farms Parkway and other new park features.

3. **Historical Impact**

   a. What is the impact of the project to existing or eligible National Register of Historic Sites?

   There are no existing or eligible National Register of Historic Sites resources impacted by the project.

4. **Project Resources**

   a. Is this a continuation of an existing project? If so, include the applicable Project Identification Number (PIN) project description, current status and estimated completion date.

   This project is related to the Shelby Farms Parkway (Kirby Parkway) project in that these facilities were planned to be constructed as part of that project. The Shelby Farms Parkway Environmental Impact Statement covers the majority of the footprint of these proposed improvements. Any segments that fall outside of the environmental footprint of the EIS will be covered in a separate Categorical Exclusion document.

TDOT will accept applications electronically at tdot.enhancements@state.tn.us. By submitting electronically, you eliminate the need to send in additional hard copies of the application. However, the electronic submission must still include the scanned signature of the applicable Mayor or State Agency Head as well as all necessary detailed maps, photographs, preliminary sketches, plans and support letters. **Please note that only Word, PDF and JPG documents will be accepted for electronic submissions.** If you choose not to submit electronically you must send one (1) complete bound application, in a hard cover 3-ring binder, and four (4) stapled copies of your application (these extra four (4) copies **SHOULD NOT** be bound):

The original application and the extra four (4) copies should be submitted to:

Tennessee Department of Transportation
Transportation Enhancement Office
505 Deaderick Street
Suite 600, James K. Polk Building
Nashville, Tennessee 37243-0341

Project Area Photos

Former Wolf River Bridge Entering Shelby Farms with Bicyclists Restricted in 2005

New Wolf River Ramp Bridge Entering Shelby Farms with Protected Multi-Use Path

Project Area Photos

Bicyclists Passing the Shelby Farms Visitors Center

Meeting of the Shelby Farms Parkway Advisory Team

Project Area Photos

Intersection of Whitten Road with Mullins Station Road at North End of Project

View of Project Corridor from South End at Walnut Grove Road

DESIGN CRITERIA

DESIGN SPEED 40 MPH
4 LANE TYPICAL SECTION
VARIABLE MEDIAN WIDTH

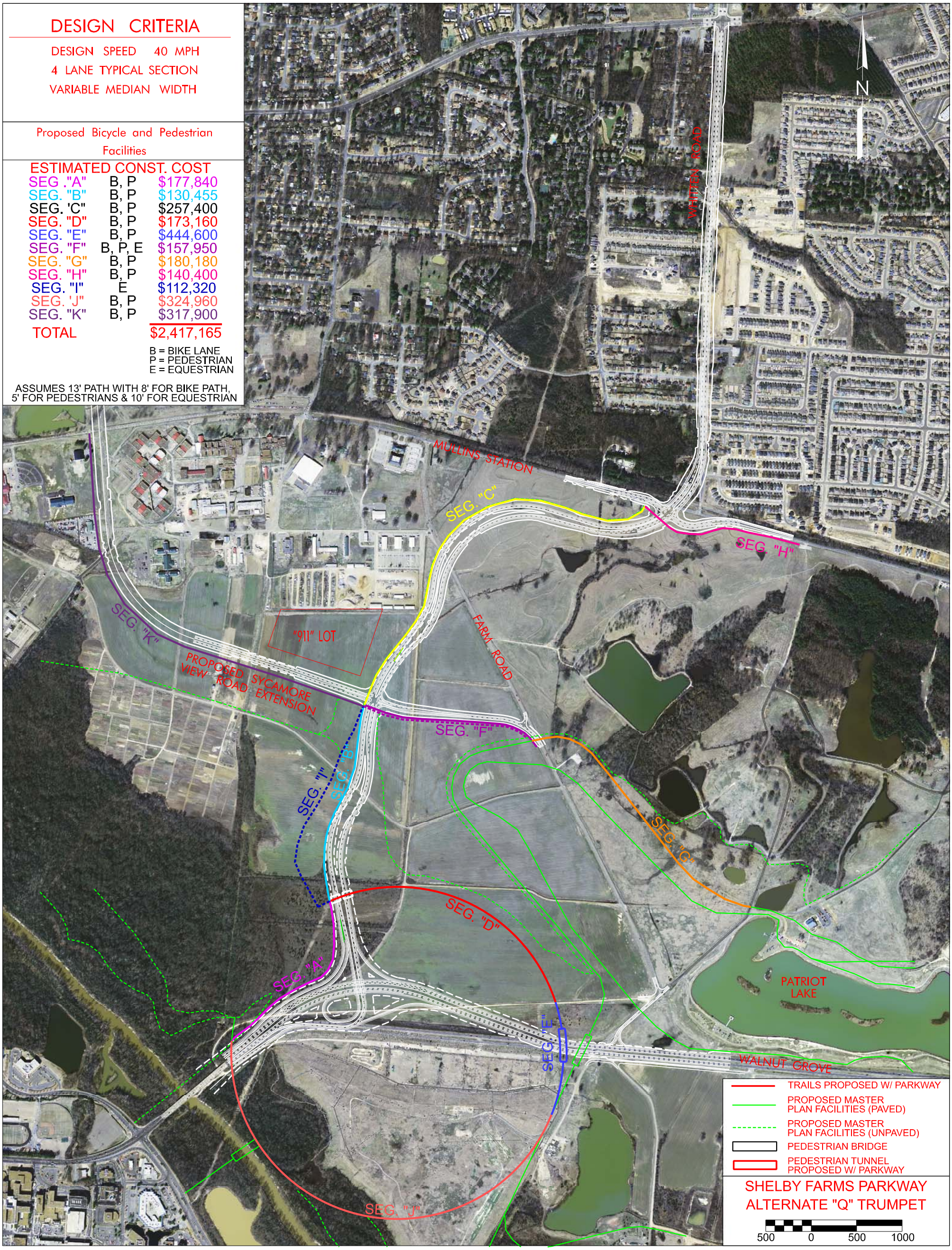
Proposed Bicycle and Pedestrian Facilities

ESTIMATED CONST. COST

SEG ."A"	B, P	$177,840
SEG. "B"	B, P	$130,455
SEG. 'C"	B, P	$257,400
SEG. "D"	B, P	$173,160
SEG. "E"	B, P	$444,600
SEG. "F"	B, P, E	$157,950
SEG. "G"	B, P	$180,180
SEG. "H"	B, P	$140,400
SEG. "I"	E	$112,320
SEG. 'J"	B, P	$324,960
SEG. "K"	B, P	$317,900
TOTAL		$2,417,165

B = BIKE LANE
P = PEDESTRIAN
E = EQUESTRIAN

ASSUMES 13' PATH WITH 8' FOR BIKE PATH, 5' FOR PEDESTRIANS & 10' FOR EQUESTRIAN



SHELBY FARMS PARKWAY
ALTERNATE "Q" TRUMPET

Shelby Farms Parkway Advisory Team

* The Shelby Farms Parkway Advisory Team dedicates their efforts to create a great parkway and environment to the memory of Charlie Rond.

Laura Adams
Friends of Shelby Farms Park

Larry Brown
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 FOR GREGG ELLIOTT

Randy Graves
Ducks Unlimited

Richard Hollis
Agricenter

Larry Jensen NOT IN ATTENDANCE
Memphis Tomorrow

Dan Johnson NOT IN ATTENDANCE
Commuter Through Shelby Farms

Keith Kirkland
Wolf River Conservancy

Marty Lipinski
University of Memphis, Traffic Engineering

Steve Reynolds BY BILL TUTTLE
Baptist Healthcare

Charlie Rond (Deceased)*
Don Richardson
Sierra Club

Ritchie Smith
Park Planner / Landscape Architect

Mark Stansbury
Shelby Farms Park Board

David Stevens
Accredo Health

Barry White
Brierwood Neighborhood Association

SHELBY FARMS PARKWAY ADVISORY TEAM

TEAM RECOMMENDATIONS

Team and Project Goals

The goals for the Shelby Farms Parkway Advisory Team were grouped into two categories: Team Goals and Project Goals. Team goals provided guiding principles for team deliberations and activities throughout the CSS process. Project goals were more specifically related to the characteristics of the proposed roadway and the Team's vision and expectations for the project.

Team Goals

- Achieve Community consensus and build public trust.
- Reach consensus for a context sensitive solution in a timely fashion.
- Adhere to a continuous and responsive public involvement process.
- Maintain the spirit of teamwork throughout the project.
- Create an atmosphere of good communication among the team, government, and the community.

Project Goals

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

Chronology and Process

Six meetings of the Shelby Farms Parkway Advisory Team were held between February 2005 and February 2006. Two Public Workshops were held during the same time period.

The first team meeting (February 10, 2005) was a partnering meeting that concluded with the development of "Team and Project Goals" and outlining key steps in working toward the first public meeting/workshop.

The first Public Workshop (March 24, 2005) was a "blank page" concept. An aerial photograph of the study area was provided and the public was afforded the opportunity to provide their thoughts and concerns for constructing a north-south road through Shelby Farms.

The Team next met on April 28, 2005 to discuss the results from the Public Workshop. The Team discussed the purpose and need for the project, traffic forecasting activities, and similar projects. They concluded their meeting with a "brainstorming session" relating to design criteria and the range of alternatives to be considered. Team members developed sketches of potential alignments.

The Team met on August 18, 2005 to review and discuss five alternative concepts. Alternatives included 4 and 6 lane alternatives, 35, 40, 45, and 50 mph design speeds, and a range of median widths including an independent roadway design concept. Information from the August 18, 2005 meeting was used to develop two refined alternatives.

The Team met again on October 6, 2006. Following a "field walk through" and additional team discussions, these two alternatives were further refined for presentation at the second Public Workshop on November 15, 2005.

Both alternatives presented at the second Public Workshop were 4 lanes and included a curvilinear alignment along the western boundary of the study area. One was developed on the basis of a 40 mph design speed and the other using criteria for a 45 mph design speed. One alternative included a 40-foot common median and the other involved an independent roadway concept. At grade intersections were proposed at Sycamore View and Mullins Station. Two interchange configurations were proposed at Walnut Grove.

The results of the November 15, 2006 meeting were reviewed at the next meeting of the Shelby Farms Parkway Advisory Team on January 11, 2006. The team discussed further opportunities for refinements to alternatives and discussed the development of "team recommendations." The Team met again on February 16, 2006. The focus of this meeting was to finalize the Team Recommendations presented herein.

Team Recommendations

Final team recommendations are grouped into three general categories: (1) Design Features, (2) Interchange Configuration at Walnut Grove, and (3) Other Considerations. It is the Team's vision that these recommendations provide a basic framework for advancing this project to final design with recognition that access and aesthetic elements will be added later per these recommendations and that refinements may be appropriate as additional information and engineering data becomes available.

Recommended Design Features

- 40 mph design speed
- 4 lanes (12-foot lane width)
- Stabilized grass shoulders where feasible
- Independent roadway concept
- Curvilinear alignment (recommended "plan view" to right)
- At-grade intersections at Sycamore View and at Mullins Station
- Grade separation at Walnut Grove
- Tractor Trailers will not be permitted

Interchange Configuration at Walnut Grove

- The recommended configuration for the interchange at Walnut Grove is a "trumpet" configuration that provides for free-flowing traffic for all movements through the interchange.
- The interchange will feature a separate dedicated exit lane from southbound Shelby Farms Parkway to westbound Humphreys Boulevard.
- The interchange will include a single lane exit from southbound Shelby Farms Parkway to westbound Walnut Grove in addition to the dedicated exit lane to Humphreys Boulevard.
- Curvature within the interchange will meet 35mph design criteria with the exception of the loop ramp which shall meet 25mph design criteria.
- With additional geotechnical information, shift the location of the interchange further to the south provided that geotechnical analyses indicate that construction of embankment material over the landfill is prudent and feasible.

Other Considerations

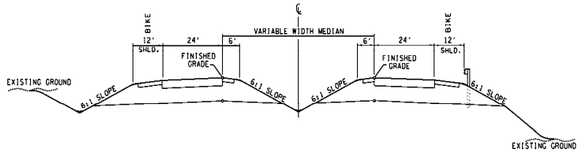
The Shelby County Government is involved in the development of a Master Plan for Shelby Farms. One of this project's goals is to "create a road that enhances and embraces the park." The Team's vision for the Shelby Farms Parkway is a road that blends into the natural and topographic setting of Shelby Farms. The Master Plan for Shelby Farms will provide a fundamental framework for future development and enhancement 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 for Shelby Farms and has thus deferred development of recommendations to the Shelby Farms Master Plan. More specific issues that should be considered in the development of the Master Plan include the following:

- Provisions for a "signature" entrance or entrances for Shelby Farms Park, including the bridge over Walnut Grove,
- Provisions for aesthetically appropriate materials (such as stone facing) and landscaping in the construction of the parkway,
- Provisions for safe, easy and convenient connectivity and non-vehicular access to Shelby Farms from surrounding residential areas and greenways on all sides of Shelby Farms,
- Provisions for multi-use paths for walkers, joggers, and recreational bicyclists,
- Provisions for equestrian trails to facilitate movement from one area of Shelby Farms to another,
- Provisions for safe, easy, and convenient connectivity within the park for pedestrians, bicycles and horses,
- Coordination and accommodation for rails to trails and/or future light rail in the vicinity of Mullins Station.
- Provisions for the continued involvement of the SFPAT in the final design,

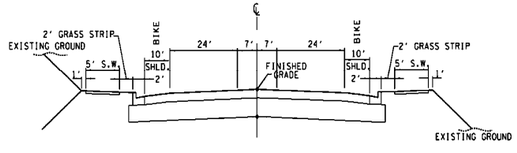
The Team also recommends that authorities from Shelby County, the City of Memphis, and TDOT provide adequate funding for the connectivity, access, and aesthetic features. The Team recommends that design and funding of such features be incorporated into this project included but not limited to access under the Wolf River Bridge north and south.

Typical Sections

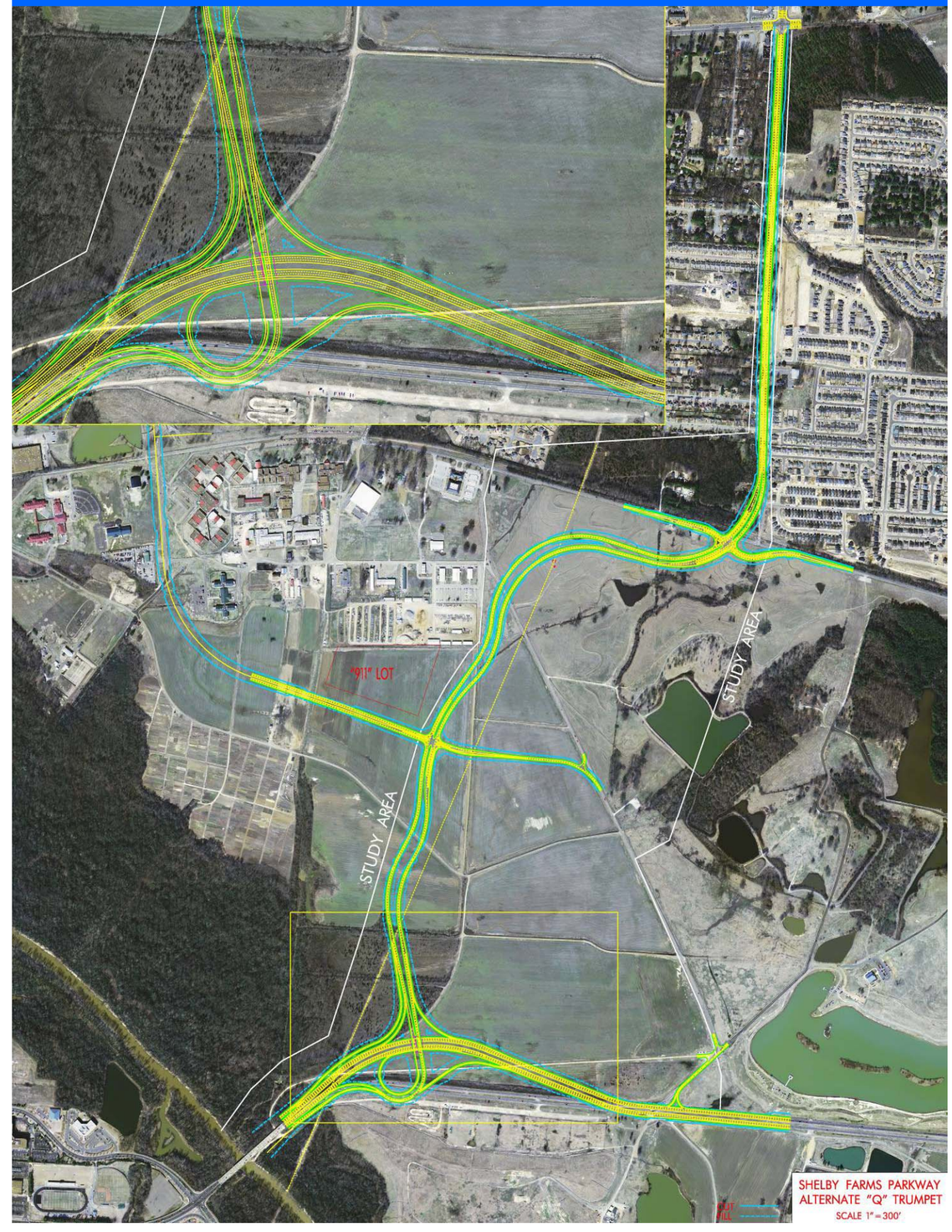
Walnut Grove to Mullins Station



Mullins Station to Macon Road



Plan View



APPENDIX B

NATIONAL WETLAND INVENTORY MAP

PFOIA
PSSIF
ROAD
BM 265
Whitten Mem Ch
POWHh
MACON
BM 282
PFOIA
POWHh
Mullins Sta Ch
County Hospital
Radio Tower
Shelby Farms
MULLINS
WHITTEN
ROAD
Hill Chapel
RALEIGH
NASHVILLE
COUNTY
PENAL FARM
POWHx
PEMIA
PEMIF
PEM
SS
1A
PSSICh
PFOIF
PEMIA
PFOIC
PIPELINE
4 LANE
23
Christian Brothers College
R4SBc
PEMIF
RIVER
LIOWHh
PEMIAh

APPENDIX C

US FISH AND WILDLIFE SERVICE CORRESPONDENCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

June 24, 2011

Mr. Matt Richards
Tennessee Department of Transportation
Environmental Planning and Permits
James K. Polk Building, Suite 900
505 Deaderick Street
Nashville, Tennessee 37243-0334

Subject: Proposed Kirby Whitten Parkway from Walnut Grove Road to Macon Road; P.E. 79960-0583-54, PIN# 109182.00, Shelby County, Tennessee. (Re: FWS# 11-CPA-0612).

Dear Mr. Richards:

Thank you for your letter dated June 1, 2011, regarding potential Indiana bat (*Myotis sodalis*) impacts as a result of the proposed construction of Kirby Whitten Parkway from Walnut Grove Road to Macon Road in Shelby County, Tennessee. The Tennessee Department of Transportation (TDOT) has determined that this project is "not likely to adversely affect" the Indiana bat because there are no State records of Indiana bat hibernacula west of the Tennessee River and the project would require removal of relatively few trees. Personnel of the U.S. Fish and Wildlife Service have reviewed the subject proposal and offer the following comments.

Upon review of the information provided and our database, we concur with TDOT's determination of "not likely to adversely affect" for the Indiana bat due to a lack of suitable habitat within the project area. Therefore, based on the best information available at this time, we believe that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the proposed action that may affect listed species or critical habitat in a manner not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

If you have any questions regarding our comments, please contact John Griffith of my staff at 931/525-4995 or by email at john_griffith@fws.gov.

Sincerely,

Brad Bingham

Acting for Mary E. Jennings
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

RECEIVED
JUN 2 4 2005
PALMER
ENGINEERING

June 21, 2005

Mr. Jeffrey H. Schwierjohann
Senior Environmental Biologist
Palmer Engineering
400 Shoppers Drive
P.O. Box 747
Winchester, Kentucky 40392-0747

Re: FWS #05-1274

Dear Schwierjohann:

Thank you for your correspondence of May 31, 2005, regarding the proposed Kirby Parkway Project in Shelby County, Tennessee. The proposed project entails the construction of approximately 2.6 miles of new highway from Macon Road to Walnut Grove as shown on the attachment to your correspondence. Fish and Wildlife Service (Service) personnel have reviewed the information submitted and we offer the following comments.

Information available to the Service indicates that wetlands exist in the vicinity of the proposed project. Enclosed is a copy of a portion of the National Wetlands Inventory's Ellendale, Tennessee, quadrangle with the referenced wetlands highlighted. This information is provided for your convenience. Our wetlands determination has been made in the absence of a field inspection and does not constitute a wetlands delineation for the purposes of Section 404 of the Clean Water Act. The Corps of Engineers and Tennessee Department of Environment and Conservation should be contacted regarding the presence of regulatory wetlands and the requirements of wetlands protection statutes.

Since the proposed project will involve construction activities over creeks, we recommend that silt barriers be put in place to prevent runoff of sediment. Perennial streams should be bridged rather than culverted. Construction within or adjacent to the streams should be accomplished during low-flow periods, and the streambanks reseeded with native vegetation beneficial to wildlife immediately following disturbance.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the impact area of the project. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and

resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the proposed action that may affect listed species or critical habitat in a manner not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

Thank you for the opportunity to comment on this proposed action. If you have any questions regarding the information which we have provided, please contact Wally Brines of my staff at 931/528-6481, extension 222.

Sincerely,

Lee A. Barclay, Ph.D.
Field Supervisor

Enclosure

APPENDIX D

CULTURAL HISTORIC RESOURCES CORRESPONDENCE

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

November 20, 2006

Mr. Gerald Kline
Tennessee Department of Transportation
Environmental Planning and Permits Division
Suite 900, James K. Polk Building
505 Deaderick Street
Nashville, Tennessee 37243-0334

RE: FHWA, ARCHAEOLOGICAL ASSESSMENT, KIRBY PARKWAY ALTERNATE Q, UNINCORPORATED, SHELBY COUNTY, TN

Dear Mr. Kline:

At your request, our office has reviewed the above-referenced archaeological survey report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). Based on the information provided, we find that the project area contains no archaeological resources eligible for listing in the National Register of Historic Places.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your cooperation is appreciated.

Sincerely,

Richard G. Tune
Deputy State Historic
Preservation Officer

RGT/jmb

TENNESSEE HISTORICAL COMMISSION
701 BROADWAY, B-30
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0442
(615) 532-1550

August 8, 1994

Mr. Raymond Brisson
Environmental Planning
TDOT, 9th. Floor Polk Bldg
Nashville, Tennessee 37219

RE: FHWA, PENAL FARM/KIRBY PARKWAY PROJECT, UNINCORPORATED, SHELBY COUNTY

Dear Mr. Brisson:

Pursuant to the request of Mr. Chris Fales, representing Memphis Heritage, this office has reviewed documentation relative to the above-referenced undertaking which was submitted to our office for Section 106 review in October, 1984, and our previous determination dated October 16, 1994, and additional documentation submitted by Mr. Fales.

Based on the recently-submitted information from Mr. Fales plus other documentation, we now find that the passage of time warrants a revision in our previous finding of "no cultural resources". We now find that the Kirby Parkway project as currently proposed will adversely affect the Shelby County Penal Farm which has been determined by our office to be eligible for listing in the National Register of Historic Places under Criteria "A" and "C" (please see enclosed letter to Mr. Fales and the accompanying National Register boundary map). Therefore, this office now has an objection to the implementation of this project until such time as you have consulted with us concerning ways in which the project adverse effect caused by the introduction of out-of-character elements and the alteration of the historic property called for in this project may be avoided or minimized. You are now obliged to inform the Advisory Council on Historic Preservation of this adverse effect determination and begin immediate consultation with our office. Please enclose a copy of this determination in your notification to the Council as delineated at 36 CFR Part 800. **Until such time as this office has rendered a final comment on this project, your Section 106 obligation under federal law has not been met.** Questions and comments may be directed to Joe Garrison (615)532-1559. Your cooperation is appreciated.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

JWL/jyg

APPENDIX F

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

October 22, 1997

Ms. Rebecca Rogers
Advisory Council on Historic Preservation/Suite 809
1100 Pennsylvania Ave. NW
Washington, DC 20004

RE: FHWA, KIRBY PARKWAY, SHELBY FARMS ELIGIBILITY DETERMINATION., MEMPHIS, SHELBY COUNTY

Dear Ms. Rogers:

Pursuant to your request, this office has reviewed its record of consultation with the Federal Highways Administration and the Tennessee Department of Transportation concerning the above-referenced undertaking. This review of consultation is a consequence of questions raised by Ms. Lois Kulkin, President of the Friends of Shelby Farms, in a letter to Ms. Catherine Slater, Chairman, Advisory Council on Historic Preservation, dated July 19, 1997. Our consultation in this matter is a requirement of our responsibility under Section 106 of the National Historic Preservation Act for compliance by participating federal agencies and applicants for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (51 FR 31115, September 2, 1986).

On September 11, 1984, the Tennessee Department of Transportation submitted an archaeological/historical survey report to this office for review and comment relative to the Kirby Parkway project. At the time of this survey, Shelby Penal Farm, which is within the undertaking's area of potential effect, had not been identified as a property eligible for listing in the National Register of Historic Places. Therefore, on October 16, 1984, our office concurred with TDOT's finding that there were no historic properties affected by the project.

In late spring 1994, our office became aware that Memphis Heritage, a preservation association based in Memphis, was in the process of evaluating the Shelby Penal Farm for National Register eligibility. Members of our office's National Register staff met on site with Mr. Chris Fales representing Memphis Heritage and concluded that various elements within the expanded boundary of the original Shelby Penal Farm were National Register eligible. In a letter dated July 8, 1994, our office informed Mr. Fales of this determination. We also informed Mr. Fales that since there was a Section 106 case ongoing which would affect this resource, that his documentation of the eligibility of the Penal Farm should be of a level suitable for National Register nomination.

Central to this office's review of Mr. Fales' material would be our desire to establish correct boundaries for the National Register eligible property. This was especially true as there was an ongoing Section 106 case involving the property. We also had reason to believe that archaeological resources potentially eligible for listing in the National Register were located within the Kirby Parkway APE, but subsequent survey by the office of the State Archaeologist proved to us that no such resources existed. After determining that some portion of the Shelby Penal Farm was National Register eligible, our office informed the Tennessee Department of Transportation of this change in our determination of eligibility relative to the Kirby Parkway project.

On August 3, 1994, this office sent correspondence to Mr. Fales following our review of his proposed National Register boundaries for the Penal Farm. We also communicated our findings to TDOT. Throughout our review of this case, the key issue relative to determining correct boundaries for the historic area was traditional versus more modern land use within the original and expanded boundaries of the Shelby Penal Farm. We were aware that since 1946, significant portions of the original penal farm had been converted to other uses, thus forfeiting their National Register integrity. We also were aware that inmate farming at the facility, which was the reason for its institution in the first place, had been discontinued for a number of years. Because of these issues, finalizing correct boundaries proved to be more time consuming than usual.

On March 28, 1995, staff from our office met with a number of persons representing Shelby County and TDOT in an effort to resolve our concerns. Non penal farm use such as parkland, gardens, a college campus, a firing range, maintenance shops, an impound lot, and numerous newer buildings had significantly intruded on the 1946 boundary. After protracted discussion, we determined that because of the loss of integrity of a significant portion of the Shelby Penal Farm, correct boundaries would be somewhat less than the 1946 plat which itself had been a significant increase over the original 1928 boundary. This revised boundary was concurred in by the Tennessee Department of Transportation representing the Federal Highways Administration at the consensus level. We also informed TDOT that the current alignment of the proposed Kirby Parkway would traverse a portion of the area within the eligible boundary and would therefore constitute an adverse effect under 36 CFR Part 800. We are currently awaiting TDOT's determination concerning avoidance, minimization, or mitigation of this effect. Pursuant to requests from Ms. Kulken, we communicated with her on August 26, 1996, discussing

our findings and we forwarded a map indicating the correct boundary of the Shelby Penal Farm to her on April 14, 1997.

Ms. Kulkin's assertion to Ms. Slater of July 19, 1997 that our determination of eligible boundaries for the Shelby Penal Farm was arbitrary and established for the convenience of TDOT is untrue. The boundary determination resulted from a thoughtful evaluation of the integrity of the site and on its face is inconvenient to TDOT because of the adverse effect determination with its obvious Section 4(f) implications. Her further charge that eligibility determinations relative to FHWA projects in Knoxville were also arbitrary is also false. As for her request that the Advisory Council initiate a formal determination of eligibility from the Keeper of the National Register, the Council certainly does have that option under 36 CFR Part 800.4(c)(4). We would, however, recommend that the Council not exercise its option in this case. We have concurred with the federal agency in an appropriate boundary for the Shelby Penal Farm. We have come to this consensus determination after a protracted consultation which has included Ms. Kulkin, Mr. Fales, and representatives of TDOT and Shelby County. We have made a determination which circumscribes that portion of the Shelby Penal Farm which has retained its integrity from the inception of the facility in 1926. We have determined that Kirby Parkway will take a portion of the historic property sufficient to warrant an adverse effect determination. We are now in consultation relative to avoidance, minimization, and mitigation.

Throughout the review of this case, our office has found that TDOT and FHWA have acted in compliance with Section 106 of the National Historic Preservation Act. Contrary to Ms. Kulkin's assertions, there has been no collusion between this office and TDOT to "rig" the Shelby Penal Farm boundary to preclude an adverse effect determination or obviate Section 4(f) review of this project by FHWA. As you are no doubt aware, while this office has no jurisdiction over Section 4(f) review, we do know that such review within the southeast region of the Federal Highways Administration is extremely stringent. We feel that such review will compel TDOT to ensure that the proposed route of Kirby Parkway is prudent and feasible, or if not, to alter the route appropriately.

Thank you for the opportunity to comment on this inquiry. Please direct questions and comments to Joe Garrison (615)532-1559. We appreciate your cooperation.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

May 27, 1998

Martha Carver
Historic Preservation Supervisor
Tennessee Department of Transportation
500 Deaderick Street
J.K. Polk Building - Suite 900
Nashville, Tennessee 37243

Dear Ms. Carver:

Thank you for the opportunity to comment on the draft determination of eligibility for the Shelby County Penal Farm. Several members of my staff have reviewed the documentation and/or visited the site. Although our offices agreed in 1994 that the property was eligible for listing, since the initial review of the property, some important changes have occurred on the site. Today, the consensus of the staff is that the Shelby County Penal Farm no longer retains sufficient integrity to be eligible for listing in the National Register.

Your report and site visits by members of my staff have documented that new buildings have been constructed and historic farm buildings have been demolished. Some of the former penal farm land is still used as farm land or still reflects its historic use in appearance. Yet there are other sections of the land that were historically associated with the penal farm which now have new buildings and, as a result of this, new use of the land. Part of the former penal farm is now used as a park and/or as grazing land for bison and Longhorn cattle. My office does not believe that the land used for grazing has lost its integrity. It is merely the animals that have changed, not the land itself. Stating this in the determination of eligibility may weaken the case you are trying to make. If the bison and Longhorn cattle were removed and other farm animals introduced, how would the land be assessed? The animals are a temporary use of the land, not a change in historic landscape.

Much more important to the eligibility of the Shelby County Penal Farm is the fact that a large part of the significance of the farm was based on the interrelationship between the prison buildings, farm buildings and the land. The loss of the farm buildings and introduction of new buildings on the site has diminished the integrity of setting and feeling. The changes in the remaining historic buildings has resulted in a loss of integrity of design, workmanship and materials.

None of the buildings in the Shelby County Penal Farm appear to meet the National Register criteria as good examples of a particular style of architecture. The Shelby

County Health Care Center (former Shelby County Hospital) does retain integrity of design, workmanship and materials. It is a good example of classical architecture and meets National Register criterion C. (Additional information could support the eligibility of the hospital as eligible under National Register criterion A.)

If you have any questions about my comments, please contact Claudette Stager.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Deputy State Historic Preservation Officer

HLH/cs

pc: Joe Garrison

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

May 7, 1999

Ms. Martha Carver
Environmental Planning
TDOT, 9th. Floor Polk Bldg
Nashville, Tennessee 37219

RE: FHWA, EFFECT DOCUMENTATION, KIRBY PKWY./SYCAMORE VIEW EXT., WALNUT GROVE ROAD TO NORTH OF MACON ROAD, UNINCORPORATED, SHELBY COUNTY,

Dear Ms. Carver:

Pursuant to your request, our office has reviewed the above-referenced document in accordance with regulations codified at 36 CFR 800 (51 FR 31115, September 2, 1986. Based on the information provided, we find that the project area contains a cultural resource eligible for listing in the National Register of Historic Places: the Shelby County Health Care Center. We further find that the project as currently proposed will not affect this resource.

Unless project plans change, this office has no objection to the implementation of this project.. Should project plans change, please contact this office to determine what additional action, if any, is necessary. Questions and comments may be directed to Joe Garrison (615)742-6720. Your cooperation is appreciated.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

APPENDIX E

SECTION 4(f) DOCUMENTATION

FHWA SECTION 4(f) *de minimis* DETERMINATION

SECTION 4(f) REGULATIONS

In general, under Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. Section 303 and 23 CFR Part 774), the Federal Highway Administration (FHWA) "may not approve the use of land from a significant publicly owned park or recreation area; wildlife and waterfowl refuge; or significant historic site unless a determination is made that: (i) there is no feasible and prudent alternative to the use of land from the property; and (ii) the action includes all possible planning to minimize harm to the property resulting from such use." A "use" under Section 4(f) can be any of the following:

- a direct use - property is permanently incorporated into the transportation project;
- a temporary use - property is temporarily occupied in a way that is adverse to the property's purpose; or
- a constructive use - occurs when "the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the property are substantially diminished." (23 CFR Section 774.15(a))

Section 6009(a) of SAFTETEA-LU, Public Law 109-59, amended existing Section 4(f) legislation, at 23 United States Code (USC) 138 and 49 USC 303, in order to simplify the processing and approval of projects that have only *de minimis* impacts on lands protected by Section 4(f). This revision of Section 4(f) legislation provides that once FHWA determines that a transportation use of Section 4(f) property, after consideration of any impact avoidance, minimization, and mitigation or enhancement measures, results in a *de minimis* impact on that property, an analysis of avoidance alternatives is not required, and the Section 4(f) evaluation process is complete. In other words, although some impacts may be unavoidable (and would be minimized or mitigated), avoidance alternatives would not need to be developed if a *de minimis* impact determination is made.

In order to implement this legislation, FHWA issued guidance for making findings of *de minimis* impact and also amended its Section 4(f) regulations to provide for these findings (23 CFR 774.3(b), 774.5(b), 774.17)(*Guidance for Determining De Minimis Impacts for Section 4(f) Resources*, FHWA Web site, www.fhwa.dot.gov/hep/qasdeminimis.htm). An impact to a park, recreation area, or wildlife refuge may be determined *de minimis* if:

1. The transportation use of the Section 4(f) resource, together with any impact avoidance, minimization, and mitigation or enhancement measures incorporated into the project, does not adversely affect the activities, features, and attributes that qualify the resource for protection under Section 4(f);

2. The official(s) with jurisdiction over the property are informed of FHWA's intent to make the *de minimis* impact finding based on their written concurrence that the project will not adversely affect the activities, features, and attributes that qualify the property for protection under Section 4(f); and

3. The public has been afforded an opportunity to review and comment on the effects of the project on the protected activities, features, and attributes of the Section 4(f) resource (FHWA Web site, www.fhwa.dot.gov/hep/qasdeminimis/htm).

Once the FHWA determines that a transportation use of Section 4(f) property results in a *de minimis* impact, analysis of avoidance alternatives is not required, and the Section 4(f) evaluation process is complete (FHWA Web site, www.fhwa.dot.gov/hep/guidedeminimis.htm).

Section A of this Section 4(f) *De Minimis* Impact Analysis provides a brief description of existing Shelby Farms Park. Section B provides a brief history of the land comprising Shelby Farms Park, and Section C provides background information on the project, including the history of a proposed roadway through the area and an overview of Section 4(f) property in the project area. Section D describes the specific path of the proposed project in relation to the various facilities within Shelby Farms Park and impacts upon the Section 4(f) property. Section E describes mitigation measures developed to minimize harm to the contributing elements and activities of Shelby Farms Park. Section F introduces the process proposed for review and comment of this *de minimis* impact analysis. Section G contains TDOT's *de minimis* determination checklist.

A. SHELBY FARMS PARK AT PRESENT

Located 12 miles east of Memphis, Tennessee, Shelby Farms Park consists of 4,500 acres, which is five times the size of New York City's Central Park, of scenic fields, meadows, woodlands, lakes, pathways, and trails. However, not all of the land within the boundaries of the park is devoted to recreational uses. Within the park there are large land areas devoted to non-recreational purposes: a complex of government offices, occupying a plot of 511 acres designated as Area 10; a closed landfill, occupying 178 acres; and Agri-Center International, occupying 1,000 acres. See Figure 1 and Figure 2.7 on page 22 of the FSEIS. There are also a number of roads passing through the park, including Walnut Grove Road, which bisects the proposed road from east to west. See Figure 1 and Figure 2.7 on page 22 of the FSEIS. Finally, there is a 1,000-foot corridor for the Shelby Farms Parkway that was reserved as early as 1983. See Figure 1 and Figure 2.7 on page 22 of the FSEIS. The Shelby Farms Park Master Plan, which is located in Appendix E, refers to the park as being divided into six regions:

- Tier 1, Shelby Farms Park, which encompasses the northeaster section of the property and includes most of the features and attributes that qualify the property for protection under Section 4(f);
- Tier 2, Agricenter Campus Area, which is located within the southeastern section of the property;
- Tier 3, Agricenter Crop and Recreation Area, which is located within the southeastern section of the property and features fields devoted to agricultural use;
- Tier 4, Agricenter Showplace Arena Area, which is located at the eastern end of the property;
- Area 10, which is located within the northwestern section of the property and houses various county government buildings; and
- Lucius E. Burch State Natural Area, which is separated into two sections along Wolf River, one along the western boundary of the property and the second along the south boundary of the property. See Figure 2 (taken from the Shelby Farms Master Plan). See also Exhibit B attached to the Grant of Conservation Easement.

Beyond the bounds of the 1,000 acres devoted to and managed by Agricenter International, additional agricultural fields are located in Tier 1. A buffalo grazing range is also located in Tier

1. See Figure 3. There are also a number of roads passing through the park, including Walnut Grove Road, which essentially bisects Shelby Farms from east to west, and Farm Road, which runs from Walnut Grove Road to Mullins Station Road from south to north. See Figure 4.

The land Shelby Farms Park occupies is owned by Shelby County but managed in part by the Shelby Farms Park Conservancy, a 501(c)3, non-profit organization pursuant to a July 2007 agreement signed with the Shelby County government. Shelby County manages Area 10, which contains a number of government buildings, including the Shelby County jail and a proposed new 911 call center. Agri-Center International manages its own land, and Shelby Farms Park Conservancy manages the day-to-day administration of all Shelby Farms parkland outside Area 10 and Agri-Center International property. The land comprising Shelby Farms Park is zoned for agricultural, heavy industrial, and residential use. See Figure 6 (Zoning map and key). Although land within Shelby Farms Park is devoted to Recreation Vehicle (RV) use, there are not residences within the park. Much of the park is actually used for agricultural purposes. See Figure 5.

Since the 1990s, local government officials have referred to Shelby Farms as a mixed-use facility containing discrete parcels of land devoted to recreational use. (See attached letter dated July 30, 2007 from Shelby County Government located after Exhibit B attached to the Grant of Conservation Easement.) 23 CFR 774.11(d) provides that where public land holdings are administered under statutes permitting management for multiple uses and are in fact managed for multiple uses, Section 4(f) applies only to those portions of such lands which function for, or are designated in the plans of the administering agency as being for, significant park, recreation, or wildlife and waterfowl refuge purposes. However, according to the conservation easement, the entire park, with the exception of those lands specifically exempted from the conservation easement, has been set aside as recreation or parkland. These park and or recreation lands are presumed to be significant. See 23 CFR 774.11(c).

The 2006 conservation easement and the associated Shelby Farms Park Master Plan arguably have altered the nature of the property. Shelby Farms Park Master Plan repeatedly refers to the property as a whole as an urban park; in fact, it refers to it as the largest urban park in the United States. This development casts a shadow over the reasonableness of characterizing Shelby Farms Park as a mixed-use property containing some areas devoted to recreational use. It is also true that significant tracts of land within Shelby Farms Park are devoted to non-recreational uses, to which Section 4(f) does not apply. However, even if Shelby Farms Park is considered a Section 4(f) property as a whole, a *de minimis* finding is appropriate for the following reasons:

- The proposed pathway of the road does not directly or constructively use any of the features and attributes that would qualify Shelby Farms Park for protection under Section 4(f). Instead, the proposed pathway passes almost exclusively through actively farmed and fallow agricultural fields and Area 10, which houses various county government buildings;
- The alignment of Kirby Parkway has been shifted outside its contemplated corridor for the express purpose of minimizing any impacts to any features and attributes that qualify the resource for protection under Section 4(f);
- The number of acres used for Kirby Parkway in relation to the overall acreage of the park is minimal; and
- Development of Kirby Parkway is anticipated to enhance access to the park.

As a result, no Section 4(f) analysis is required for this project, because even assuming the exemptions for joint planning and multiple uses do not apply, any use of Section 4(f) land is *de minimis* in light of the proposed mitigating measures associated with the proposed implementation of Kirby Parkway.

B. SHELBY FARMS HISTORY

In December 2006, Shelby County government and the Shelby County Agri-Center Commission (Agri-Center) signed a deed granting a conservation easement over the majority of the land comprising Shelby Farms to The Land Trust of Tennessee. Expressly exempted from the conservation easement were the plots of land devoted to the agribusiness in the southeast segment of the park; the plot of land designated Area 10 devoted to county government buildings, including a 911 call center; and a 1,000-foot corridor for the Shelby Farms Parkway. Shelby Farms has not always been a park. Over the past eighty years, it has evolved from a model penal farm into the mixed-land use Park. In 1928, Shelby County acquired 1,600 acres of land for use as a model penal farm. (Previously this land had been in use since the mid-nineteenth century as the location of the Nashoba Experiment, a commune created by humanist reformer Frances Wright with the intention of preparing slaves for future freedom.) In years that followed, the farm was expanded to approximately 5,000 acres. Deeds on record show that the property transferred to the County had been used as agricultural land. See Figure 6. During the 1960s Shelby County closed the penal farm. For a period of time the land, still owned by Shelby County but no longer actively farmed, went through a period of transition in which Shelby County contemplated an appropriate use for the land.

Beginning in the early 1970s, the county considered options for protecting the land from housing and industrial development as a means of preserving this large expanse of land as a resource for the people of the greater Memphis area. This rumination and intention to preserve the land is perhaps best captured in the Eckbo plan introduced to the Shelby Farms Planning Board in 1975. The plan presented a report recommending best alternative future land uses for Shelby Farms over short, intermediate, and long-range time periods. While a large pastoral park figured prominently into the Eckbo report and plan for Shelby Farms, the report contemplated from the beginning several roads passing through Shelby Farms, including a north-south road designated “Kirby Road,” in the vicinity of the presently proposed Kirby Parkway. See Figure 7.

C. NORTH-SOUTH CORRIDOR FOR SHELBY FARMS PARK

Several roads have passed through the area as long as it has been known as Shelby Farms. Among these is Farm Road, which runs essentially from north to south in the northeast quadrant of Shelby Farms near where the proposed Kirby Parkway would be situated. Figure 1 shows the proposed roadway in relation to Shelby Farms and its features. Maps dating from as early as 1975 (Figure 7) and 1983 (Figure 5) clearly show plans for a north-south road approximately where Kirby Parkway would lie. These maps which date from a time period prior to any official designation of Shelby Farms as a park or recreation area strongly suggest the joint-planning exception to Section 4(f) applies to the proposed Kirby Parkway. See 23 CFR 774.11(i)(1).

“When a property is formally reserved for a future transportation facility before or at the same time a park, recreation area, or wildlife and waterfowl refuge is established and concurrent or joint planning or development of the transportation facility and the Section 4(f) resource occurs, then any resulting impacts of the transportation facility will not be considered a use” of Section 4(f) land (23 CFR §774.11(i)). One such example of concurrent planning occurs when the entity with jurisdiction over the property designates or donates the property for development of both a

potential transportation facility and a Section 4(f) property. Here, the maps from 1975 and 1983, demonstrate Shelby County, which owned and exercised jurisdiction over Shelby Farms contemplated joint development of a north-south roadway and recreational features for the property long before the conservation easement was established in July 2007. Furthermore, the conservation easement establishing present-day Shelby Farms Park contained an express exception for the right-of-way to be used for construction of Shelby Farms Parkway and widening of Walnut Grove Road. See Conservation Easement p. 2 and Exhibit A-1 in Appendix E of SFEIS. Neither the text of the easement nor the attachment specifically identify the location of the right-of-way, either with a plat map or with a metes and bounds description. As a result, Section 4(f) does not apply to this project under the exception for joint planning; however, the intent to include a north-south roadway in the general location of the proposed Kirby Parkway is clear.

In the wake of litigation challenging this project in 2000, state and local government officials met with members of the Plaintiff organization Friends of Shelby Farms Park. As a result, the Shelby Farms Parkway Advisory Team was later formed. This group, consisting of 17 individuals representing Shelby County Government, Friends of Shelby Farms Park, the Sierra Club, local residents and commuters, and various other interested parties, met on six occasions from March 2005 to August 2008 to define and resolve critical project issues as part of TDOT's Context Sensitive Solutions (CSS) process. These meetings are discussed in detail on pages 73 through 78 of the SFEIS. The group ultimately devised a series of recommendations that influenced the selection of Alternative Q as the preferred pathway for the project. The group's recommendations are included in their entirety at Appendix A of the SFEIS.

Alternative Q features a pathway for Kirby Parkway that lies approximately 2,750 feet west of the corridor envisioned in 1983. See Figure 1. The relocation moves the project pathway closer to the government buildings located in Area 10 and away from the activities, features, and attributes that qualify the resource for protection under Section 4(f). These include Plough Park, Patriot Lake, the Arboretum, and the visitor's center. See Figure 1. In addition, Alternative Q uses 58% fewer acres than were designated for right-of-way in 1983. The original 1,000-foot corridor consisted of 282.63 acres. The total right-of-way for the project as currently contemplated consists of 116.99 acres – a reduction of 165.64 acres. In light of the conservation easement's very general and unrestrictive language describing the right-of-way for Kirby Parkway, the pathway for Alternative Q, Section 4(f) would not apply under the exception for joint planning, even though it lies largely outside the 1983 corridor. However, even if the joint planning exception did not apply, Section 4(f) still does not apply to the project, because any impacts to the features and attributes that qualify Shelby Farms Park for protection under Section 4(f) are *de minimis*.

D. DESCRIPTION OF SECTION 4(f) PROPERTIES AND IMPACTS TO SHELBY FARMS PARK

The proposed route for Kirby Parkway traverses the northeast portion of Shelby Farms Park to the east of Shelby County government buildings in Area 10 and to the west of areas of the park devoted specifically to recreational activities, including the park's visitor's center, Chickasaw Trail, Plough Park, and Patriot Lake. See Figure 1. The project begins by heading east from Wolf River. A trumpet interchange is planned west of existing Farm Road; an eastern segment of the interchange proceeds east through Fields 12 and 17. Heading north from Field 12, the proposed road passes through forested land, which is not within the bounds of Lucius E. Burch State Natural Area, and into Field 10 and other agricultural lands not used for crop production. From there, the road passes through Field 8; agricultural land not used for crop production; and

into Fields 19 and 20, which are used for grazing by buffalo. The proposed road exits Shelby Farms Park as it crosses Mullins Station Road. See Figure 1.

The trumpet interchange where Kirby Parkway would connect to Walnut Grove Road is close to both a BMX track and the Lucius E. Burch SNA, which are within Shelby Farms Park; the project would not directly use the track or the SNA. See Figure 8. These recreational areas will experience some noise-related impacts from the proposed project, but the impact does not rise to the level of constructive use.

Constructive use of a Section 4(f) resources occurs when a transportation project does not permanently incorporate land from the resource, but the proximity of the project results in impacts (i.e., noise, vibration, visual, access, ecological) so severe that the protected activities, features, or attributes that qualify the resource for protection under Section 4(f) are substantially impaired (23 CFR §774.15(a)). Substantial impairment occurs only if the protected activities, features, or attributes of the resource are substantially diminished. The determination is made through the following practices:

- Identification of the current activities, features, or attributes of the resource which may be sensitive to proximity impacts;
- Analysis of the potential proximity impacts on the resource; and
- Consultation with the appropriate officials having jurisdiction over the resource.

The BMX track is not considered a noise-sensitive resource given the nature of the activity, which includes cheering by spectators and commentary and announcements via loudspeakers. While the Lucius E. Burch SNA could be a noise-sensitive resource, no substantial impairment would occur given the distance from the proposed project. The SNA is approximately 300 feet from the proposed changes to Walnut Grove Road and approximately 1,200 feet from the proposed path of the north-south section of the project. This area of the SNA and its periphery are highly vegetated, which could reduce noise impacts. For example, as a person moves away from a highway, traffic noise levels are reduced by distance, terrain, vegetation, meteorological conditions, and natural and man-made obstacles. Traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads. Vegetation, if it is tall enough, wide enough, and dense enough that it cannot be seen through, can decrease highway traffic noise. One 200-foot-deep swath of dense vegetation can reduce noise by 10 decibels, which cuts the loudness of traffic noise in half. Since the SNA has at least a 200-foot-deep buffer of vegetation between its boundary and the proposed improvements to Walnut Grove Road, constructive use of the SNA is unlikely.

Other activities, features, and attributes that qualify the property for protection under Section 4(f) include Plough Park, Patriot Lake, the Arboretum, and the Visitor's Center. See Figure 1. All of these features lie far to the east of the proposed pathway and are consequently not used directly or constructively. A soccer field is located south of Walnut Grove Road and is also not used directly or constructively.

E. MINIMIZATION AND MITIGATION MEASURES

Measures to minimize impacts to any Section 4(f) resources were considered throughout project development, even though it has appeared no direct use of Section 4(f) resources would be required. The foremost example is the relocation of the 1,000-foot corridor for the build alternative. The currently proposed site is located approximately 2,700 feet west of a previously planned corridor for this project. See Figure 1. This shift in alignment moves the path closer to the county government buildings in Area 10 and farther away from designated recreational

areas to the east, including Chickasaw Lake, Mayor Lake, the visitor's center, Plough Park, the Arboretum, a kite flying area, and the soccer fields. In fact, the shift in design puts approximately 1,000 feet of agricultural fields and grazing land between the project and many of these designated recreational areas in the northeastern portion of Shelby Farms Park.

Furthermore, the current design of the proposed Kirby Parkway adopts numerous recommendations from the Shelby Farms Parkway Advisory Team, which effectively constitute measures to minimize any impacts the project would have on the features in Shelby Farms Park that qualify for protection under Section 4(f). These recommendations are described in detail in Appendix A. A few of the more prominent minimizing design features include:

- 4 lanes (previous project plans had contemplated 6 lanes);
- 40 mph design speed (previous project plans had contemplate a design speed of 60 mph);
- A curvilinear alignment (previous corridors had contemplated a straighter north-south pathway) See Figure 1;
- A trumpet interchange configuration where the project joins with Walnut Grove Road, which allows for free-flowing traffic for all movements through the interchange.

In addition, consistent with recommendations from the Shelby Farms Parkway Advisory Team and the Shelby Farms Master Plan, the current design plan for the build alternative is intended to be complemented by bicycle, pedestrian, and equine trails that will provide safe, easy, and convenient connectivity within the park. In fact, the project study area was amended to incorporate these facilities within its boundaries. 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. See Appendix A for the Transportation Enhancement application and Shelby Farms Park Master Plan.

Finally, the current pathway for Alternative Q acquires less land than contemplated in earlier plans. The original 1,000-foot corridor consisted of 282.63 acres. The total right-of-way for the project as currently contemplated consists of 116.99 acres – a reduction of 165.64 acres. As a result, the project would use approximately 58% less acreage than originally provided. Of the 116.99 acres to be used, 101.1 acres fall outside the original 1,000-foot corridor, and 15.89 acres are within the original corridor; however, much of the new alignment passes through or along Area 10, which is occupied by county government buildings not devoted to recreational activities. See Figure 9. The net result is fewer acres to Kirby Parkway than were planned prior to establishment of the conservation easement for Shelby Farms Park.

F. REVIEW AND COMMENT PERIOD

The public will review and comment on this Section 4(f) *de minimis* determination in conjunction with the review and comment period for the Supplemental Final Environmental Impact Statement (SFEIS). Comments will be solicited by advertising in local newspapers and by distributing the SFEIS to all parties on the project mailing list. A 30-day comment period will

follow. Any comments received will be addressed in the Record of Decision (ROD), and, at that time, a *de minimis* determination will be made.

G. TDOT de minimis DETERMINATION CHECKLIST

Tennessee Department of Transportation
On Behalf of the Federal Highway Administration – Tennessee Division Office

Determination of
Section 4(f) De Minimis Use

PARK ☒
RECREATION AREA ☐
WILDLIFE AND/OR ☐
WATERFOWL REFUGE

County: Shelby City: Memphis Route: Shelby Farms Parkway

Termini: Walnut Grove Road to Macon Road

Project Numbers: Federal #: _____ State #: 79LPLM-FO-052

Pin Number: 109182

Document Type: EIS: ☒ EA: ☐ CE: ☐

IDENTIFICATION OF SECTION 4(F) RESOURCE(S):

Maps/Graphics: Attached: ☒ Not Attached: ☐

Description of resource:

Located 12 miles east of Memphis, Tennessee, Shelby Farms Park is 4,500 acres of scenic fields, meadow, woodlands, lakes, pathways, and trails. Shelby Farms Park is an urban park approximately five times the size of New York City's Central Park; however, not all of the land within the boundaries of the park is devoted to recreational purposes. Within the park, there are large areas devoted to non-recreational uses: a complex of government offices that occupies a plot of 511 acres, designated as Area 10; a closed landfill that occupies 178 acres; and Agri-Center International, which occupies 1,000 acres. A number of roads pass though the park, including Walnut Grove Road, which crosses the proposed road from east to west. Finally, there is a 1,000-foot corridor reserved for Shelby Farms Parkway. Shelby County Government owns the land occupied by Shelby Farms Park. Pursuant to a July 2007 agreement the park is managed by Shelby Farms Park Conservancy, a 501(c)3, non-profit organization.

BRIEF DESCRIPTION OF PROJECT SCOPE:

Shelby County Government, in conjunction with the Federal Highway Administration, and the Tennessee Department of Transportation, is proposing to construct 2.5 miles of Kirby Parkway from Walnut Grove Road through Shelby Farms Park to the intersection of Whitten Road and Macon Road in Memphis, Tennessee. The road is proposed to be a four-lane, median-divided, access-controlled highway.

Tennessee Department of Transportation
On Behalf of the Federal Highway Administration – Tennessee Division Office

Determination of
Section 4(f) De Minimis Use

County: Shelby City: Memphis Route: Shelby Farms Parkway Termini: Walnut Grove Road to Macon Road

Document Type: EIS: ☒ EA: ☐ CE: ☐

APPLICABILITY DETERMINATION:
(to be applicable answers to all statements must be "true")

For publicly owned parks, recreation areas, and wildlife and/or waterfowl refuges:

1. The project involves a minor take of land from the resource. ☒ True ☐ False
   Identify the total acreage of the resource: 4,500 acres

   Describe the use of land from the resource (include the acreage of the resource to be used):

The project is expected to convert approximately 119 acres of Shelby Farms Park to transportation right of way. The current land uses/land covers of the land to be occupied by the project are forest, agriculture, and transportation. Agri-Center International leases a portion of the project area. No recreational resources will be directly affected by the proposed project, and any impacts to recreational resources are expected to be beneficial by improving accessibility.

2. The project does not adversely affect the qualities, activities, features, or attributes of the resource that qualify it for protection under Section 4(f). ☒ True ☐ False
3. The agency with jurisdiction over the resource has concurred in writing ☒ True ☐ False with FHWA's and/or TDOT's determination that the project will not adversely affect the resource.

   If true, identify agency with jurisdiction and date of concurrence and attach written concurrence: Shelby County Government Date: Sept. 13, 2010
4. The agency with jurisdiction over the resource has been informed of ☒ True ☐ False
   FHWA's and/or TDOT's intent to make a de minimis finding.

   If true, attach correspondence.
5. The public will be informed or afforded an opportunity to review ☒ True ☐ False
   and comment on the effects of the project on the protected activities, features, and attributes of the resource.

   a. Describe how the public will be notified.

This de minimis use determination will be made available in the FEIS. The public will be afforded the opportunity to comment on this finding during the FEIS comment period.

Tennessee Department of Transportation
On Behalf of the Federal Highway Administration – Tennessee Division Office

Determination of
Section 4(f) De Minimis Use

County: Shelby **City:** Memphis **Route: Shelby Farms Parkway Termini:** Walnut Grove Road to Macon Road

Document Type: EIS: ☒ **EA:** ☐ **CE:** ☐

ALTERNATIVES ANALYSIS

1. Summarize why the use of property from the resource cannot be avoided.

☒ **Project Needs would not be met. Explain.**

Kirby Parkway is a 10-mile-long north-to-south corridor in eastern Shelby County. Portions of the corridor have been constructed; in the immediate project area, Kirby Parkway has been constructed from I-240 to east of Wolf River and north of Macon Road. Not only would the proposed project serve as a link between two sections of existing Kirby Parkway, but it would also improve mobility, reduce congestion, lessen travel time, improve efficiency and safety, and provide for growth in east Memphis. If Kirby Parkway through Shelby Farms were not constructed, none of these project needs would be met.

☐ **Substantial impacts to other environmental/cultural/social resources would result. Explain.**

☐ **Project complexity would increase resulting in greater construction and maintenance cost.**

Explain.

☐ **Other. Explain.**

2. Summarize the measures taken to minimize harm. This would include, if applicable, design shifts to minimize impacts, use of retaining walls, and other mitigation measures.

The original FEIS, approved in 1991, showed a 1,000-foot corridor reserved for Kirby Parkway through Shelby Farms Park. The 1,000-foot corridor originally abutted the Arboretum. In the FEIS Reevaluation, which was written in 2001, additional alternatives were evaluated to increase the distance of the proposed road from contributing, recreational elements of the Park, such as Patriot Lake, the Visitors Center, Plough Park, and Chickasaw Lake. In the Reevaluation, the typical cross section was revised from six lanes with a raised median to four lanes with a fixed-width, landscaped median. The proposed total right-of-way width through Shelby Farms Park was approximately 150 feet. Since that time, an Advisory Team formed, which consisted of public, local officials, and state and federal agencies, and following the Context Sensitive Solutions process, multiple alternatives were considered. Although the proposed total right-of-way width through Shelby Farms Park was increased from 150 to 200 feet, the preferred alternative, Alternative Q, uses an independent roadway concept, wherein the grade and alignment of the Parkway would vary to blend the roadway into the natural topography, and it is approximately 2,750 feet west of the original 1,000-foot corridor, meeting the goals of the Advisory Team.

Tennessee Department of Transportation
On Behalf of the Federal Highway Administration – Tennessee Division Office

Determination of
Section 4(f) De Minimis Use

County: Shelby City: Memphis Route: Shelby Farms Parkway Termini: Walnut Grove Road to Macon Road

Document Type: EIS: ☒ EA: ☐ CE: ☐

SUMMARY AND DETERMINATION

The project involves a de minimis impact on the Section 4(f) property as evidenced through the minimization of harm to a park, recreation area, or wildlife or waterfowl refuge, and as a result of mitigation to or avoidance of impacts to the qualifying characteristics and/or the functions of the resource.

Based on the scope of the undertaking; the fact that the undertaking does not adversely affect the functions/qualities of the Section 4(f) resource on a permanent or temporary basis; and with agreement from the official with jurisdiction, the proposed action constitutes a De Minimis finding.

Environmental Director: _____ Date: _____

FHWA: _____ Date: _____

Figure 1

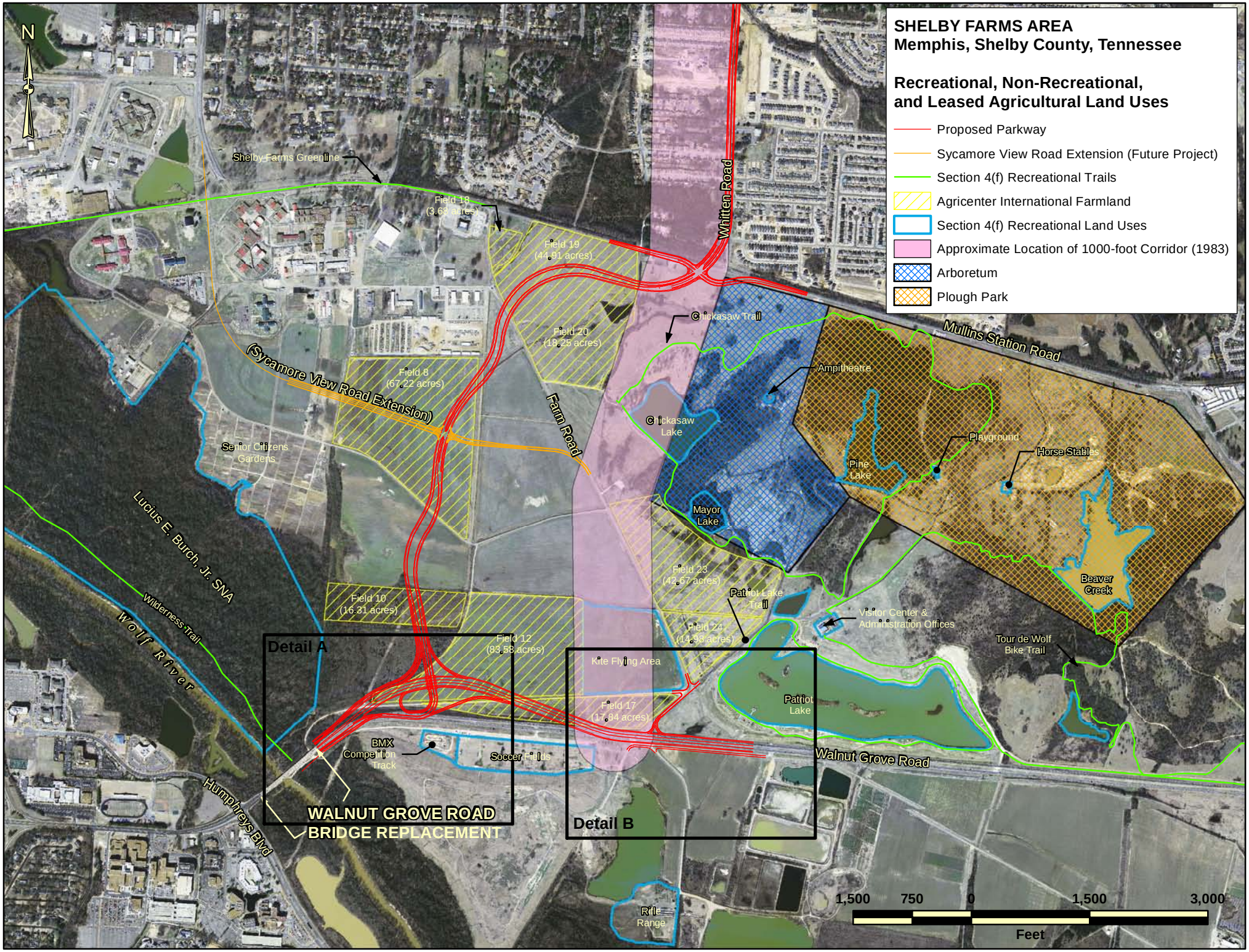

SHELBY FARMS AREA
Memphis, Shelby County, Tennessee
Recreational, Non-Recreational, and Leased Agricultural Land Uses
Proposed Parkway
Sycamore View Road Extension (Future Project)
Section 4(f) Recreational Trails
Agricenter International Farmland
Section 4(f) Recreational Land Uses
Approximate Location of 1000-foot Corridor (1983)
Arboretum
Plough Park
N
Shelby Farms Greenline
Field 18 (3.63 acres)
Field 19 (44.91 acres)
Field 20 (18.25 acres)
Field 8 (67.22 acres)
Field 10 (16.31 acres)
Field 12 (83.58 acres)
Field 23 (42.57 acres)
Field 24 (14.38 acres)
Field 17 (17.84 acres)
Whitten Road
Farm Road
(Sycamore View Road Extension)
Chickasaw Trail
Mullins Station Road
Ampitheatre
Chickasaw Lake
Playground
Horse Stables
Pine Lake
Mayor Lake
Beaver Creek
Senior Citizens Gardens
Lucius E. Burch, Jr. SNA
Wilderness Trail
Wolf River
Patriot Lake Trail
Visitor Center & Administration Offices
Tour de Wolf Bike Trail
Kite Flying Area
Patriot Lake
BMX Competition Track
Soccer Fields
Walnut Grove Road
Humphreys Blvd
Rifle Range
Detail A
Detail B
WALNUT GROVE ROAD BRIDGE REPLACEMENT
1,500 750 0 1,500 3,000
Feet

Figure 2

CONSERVATION EASEMENT

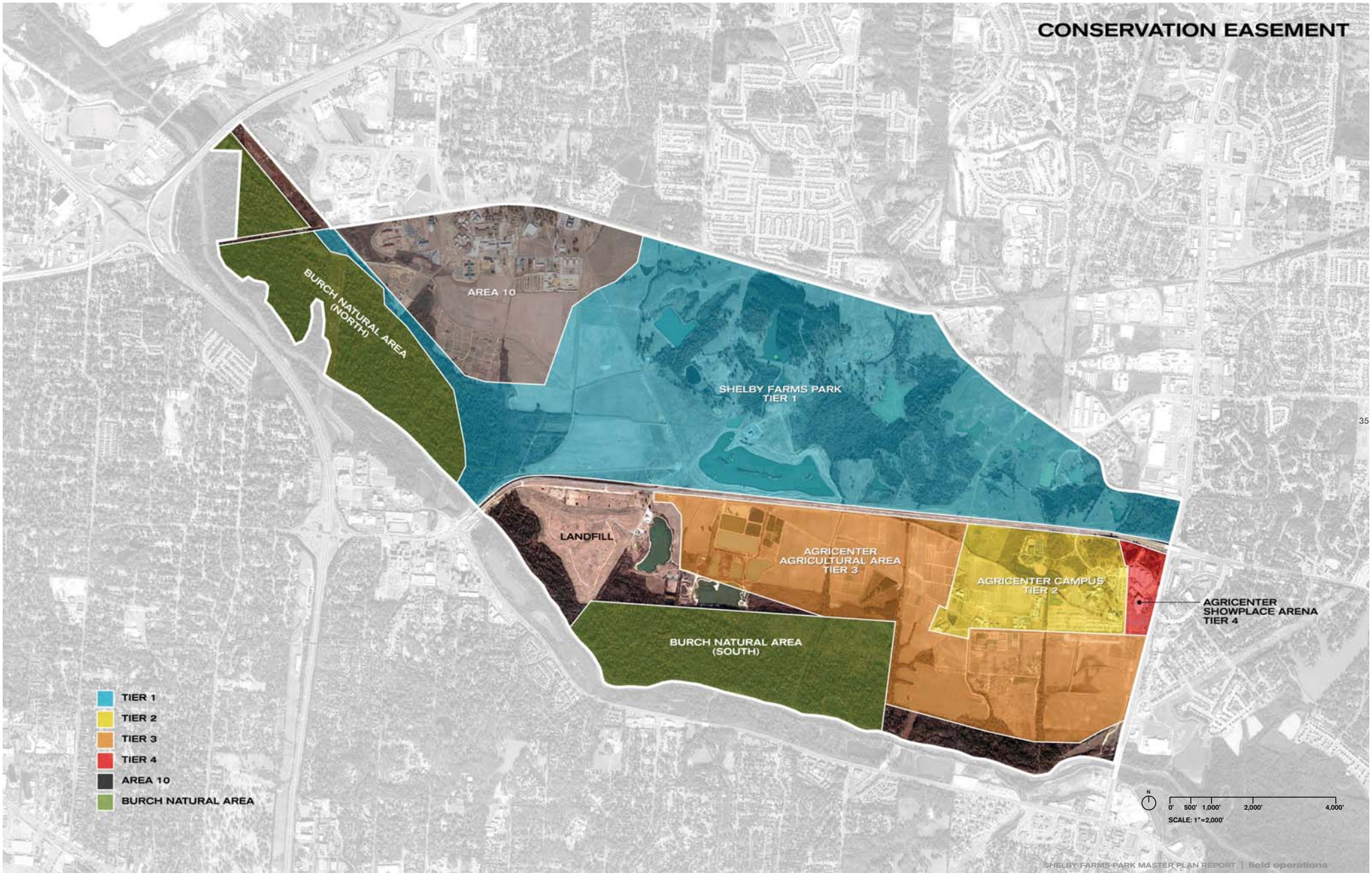


Figure 3

12 LANDSCAPE ROOMS

1 PATRIOT LAKE
2 PLOUGH PARK
3 THE RANGE + ARBORETUM
4 THE PUBLIC GARDENS *
5 COMMUNITY CENTER + SPORTS FIELDS *
6 THE OUTBACK
7 THE ART MOUND + PARK CIRCLE
8 CATCH 'EM LAKES
9 THE REFUGE
10 THE ORCHARDS + BERRY FIELDS
11 CROP + RESEARCH FIELDS
12 THE AGRICENTER

* pending area 10 approval

LANDSCAPE ROOMS
MAJOR WATER BODIES

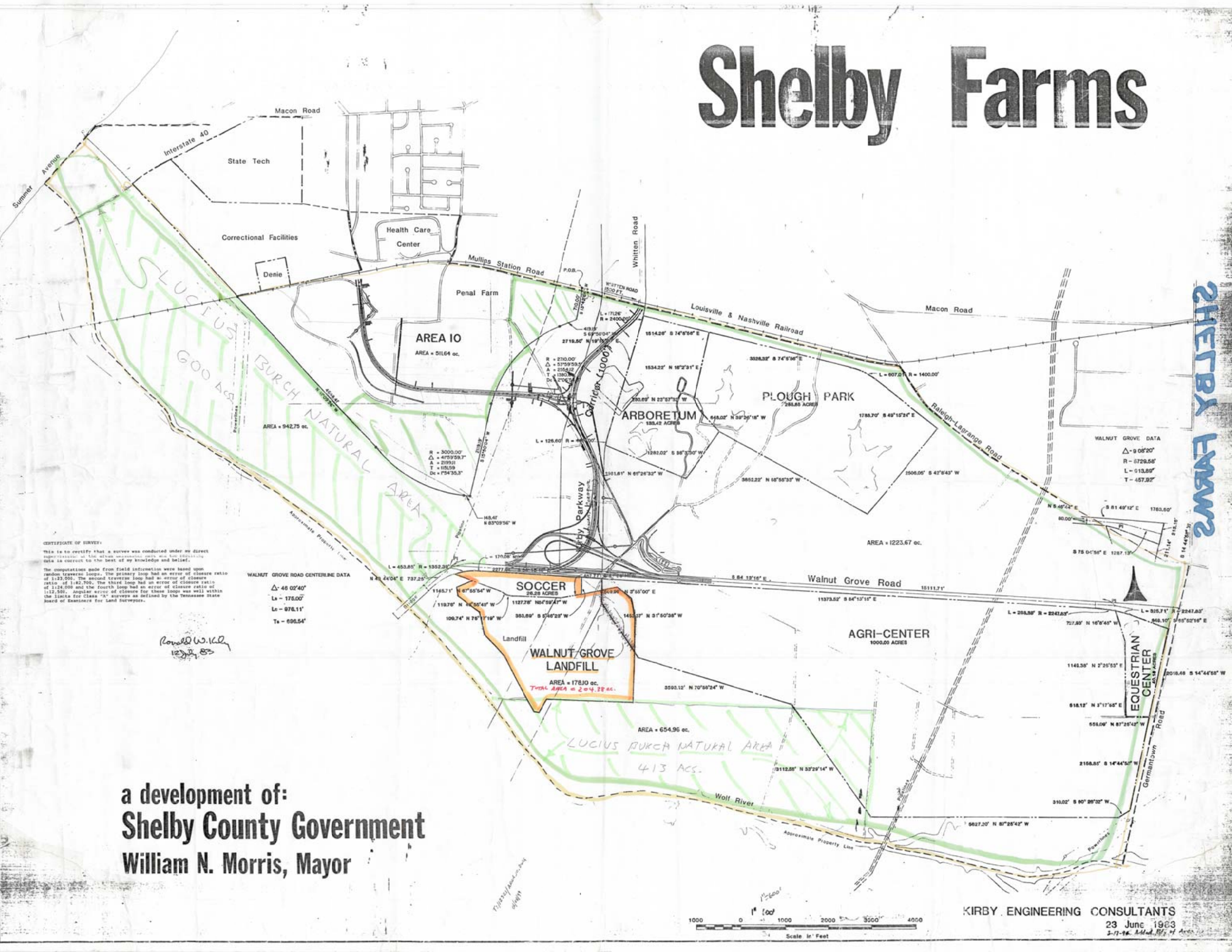
N
0' 500' 1,000' 2,000' 4,000'
SCALE: 1"=2,000'

Figure 4

IDENTITY + ACCESS

Figure 5

Shelby Farms

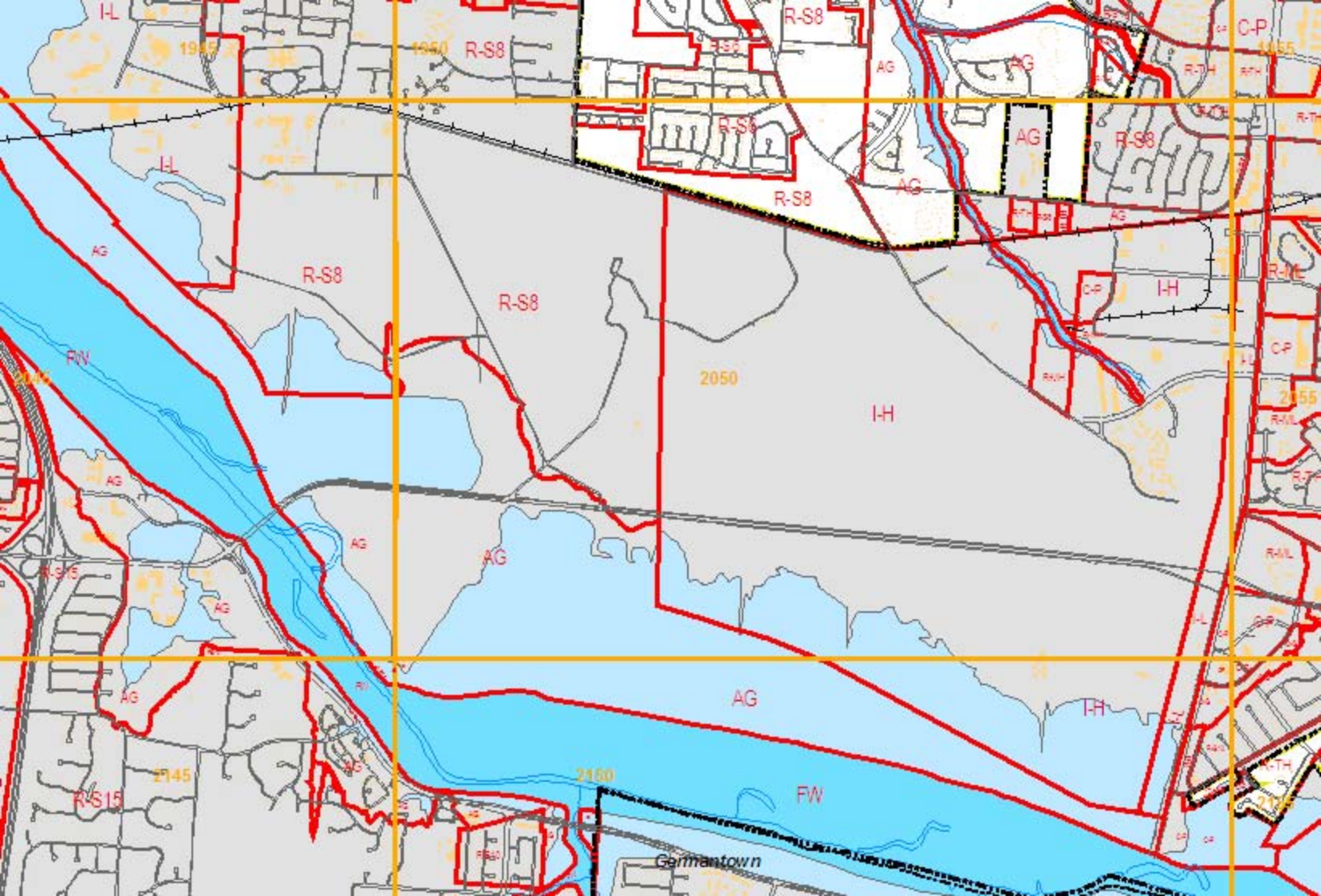


a development of:

Shelby County Government

William N. Morris, Mayor

Figure 6


I-L
R-S8
AG
C-P
R-TH
I-H
FW
2050
2160
2145
R-S15
Germantown

AG	Agricultural
Residential Districts	
R-S15	Residential Estate
R-S10	Single Family Residential
R-S8	Single Family Residential
R-S6	Single Family Residential
R-D	Duplex Residential
R-TH	Townhouse Residential
R-ML	Multiple Dwelling Residential
R-MM	Multiple Dwelling Residential
R-MH	Multiple Residential Dwelling
R-MO	Mobile Home
Office Districts	
O-L	Limited Office
O-G	General Office
Industrial Districts	
I-L	Light Industry
I-H	Heavy Industry
Commercial Districts	
C-P	Planned Commercial
C-L	Local Commercial
C-H	Highway Commercial
CBD	Central Business
CN	Neighborhood Commercial
Special Purpose Districts	
H	Hospital
CU	College and University
P	Parking
SMSD	South Main Special District
Historic Districts	
HP	Historic Preservation
HC	Historic Conservation
Flood Plain Districts	
FW	FEMA Floodway
FP	FEMA 100 Year Floodway

Figure 7

VEHICULAR

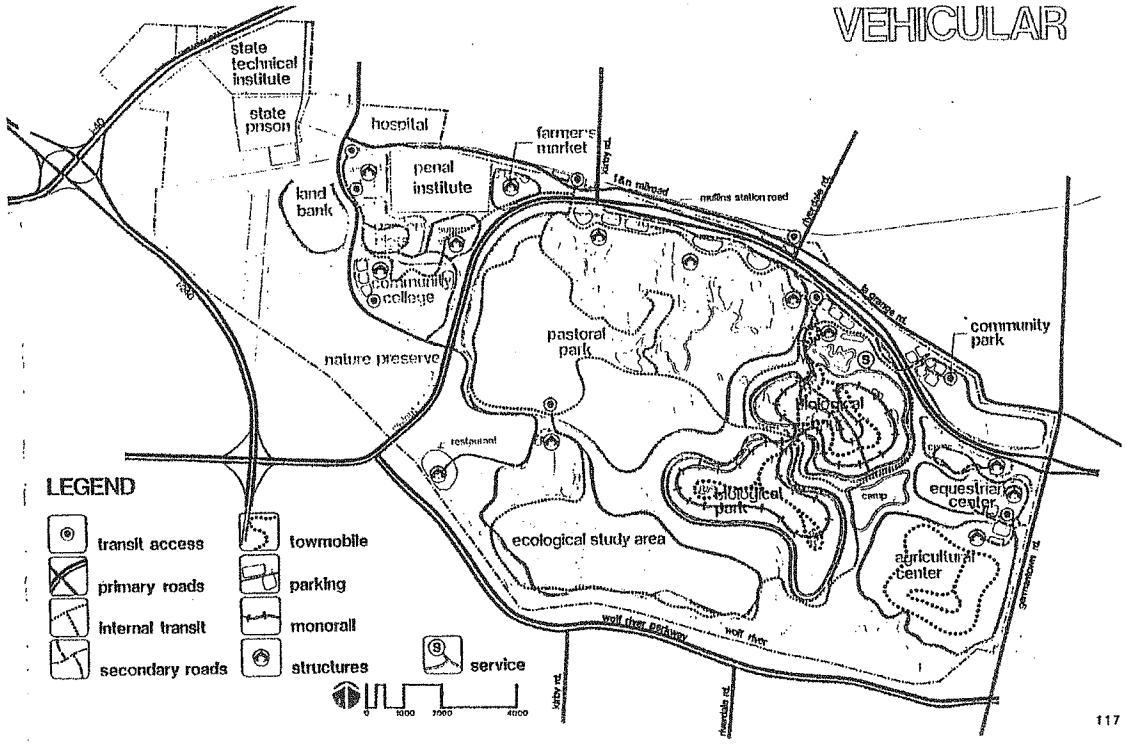

state technical institute
state prison
hospital
farmer's market
penal institute
land bank
community college
nature preserve
pastoral park
restaurant
ecological study area
wolf river parkway
wolf river
community park
equestrian center
agricultural center
camp
LEGEND
transit access
primary roads
internal transit
secondary roads
towmobile
parking
monorail
structures
service
0
1000
2000
4000

Figure 8

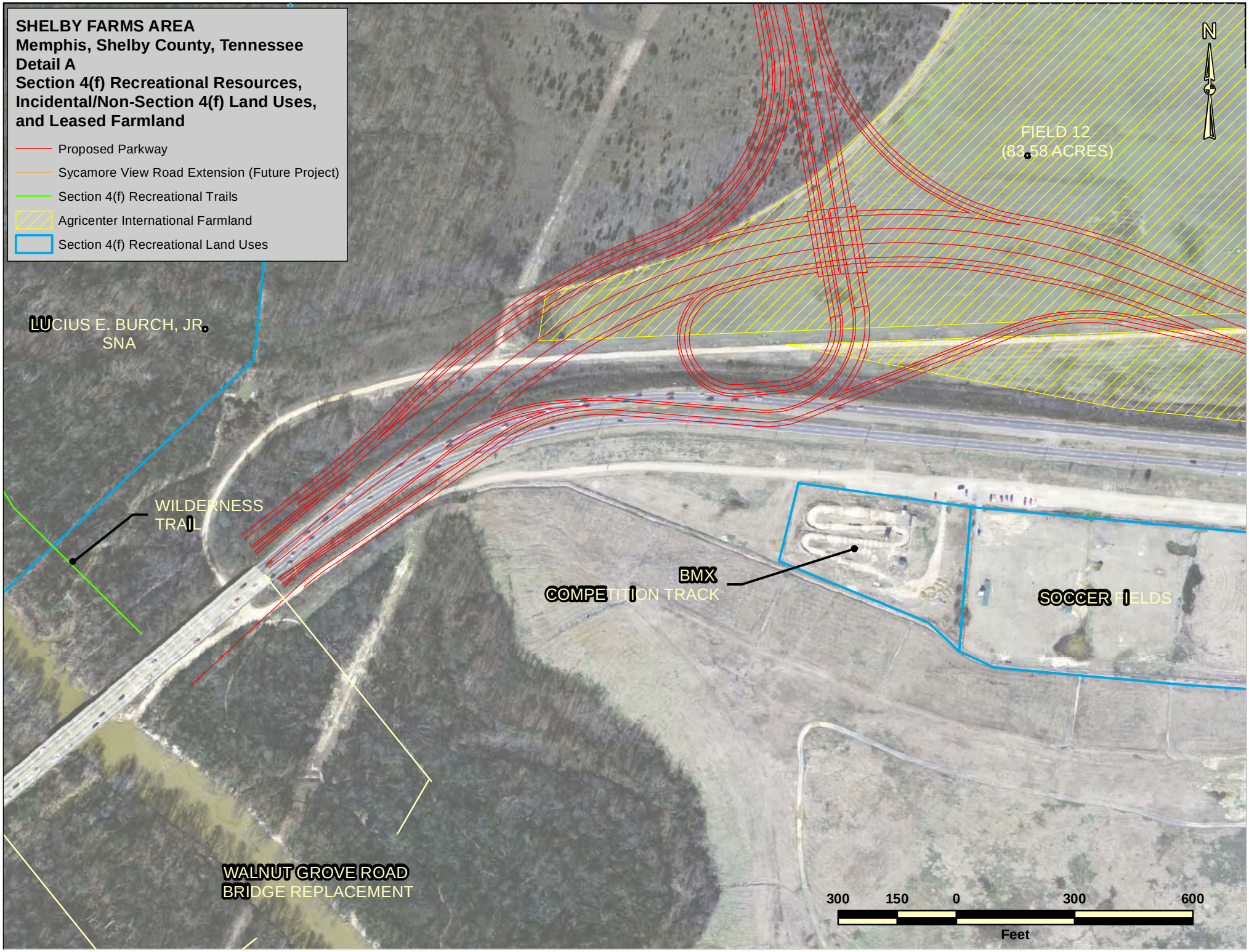

SHELBY FARMS AREA
Memphis, Shelby County, Tennessee
Detail A
Section 4(f) Recreational Resources, Incidental/Non-Section 4(f) Land Uses, and Leased Farmland
Proposed Parkway
Sycamore View Road Extension (Future Project)
Section 4(f) Recreational Trails
Agricenter International Farmland
Section 4(f) Recreational Land Uses
N
FIELD 12
(83.58 ACRES)
LUCIUS E. BURCH, JR. SNA
WILDERNESS TRAIL
BMX COMPETITION TRACK
SOCCER FIELDS
WALNUT GROVE ROAD BRIDGE REPLACEMENT
300 150 0 300 600
Feet

Figure 9

CONCENTRATE PROGRAM + FACILITIES

CONCENTRATED FACILITY + PROGRAM ZONES

N

0' 500' 1,000' 2,000' 4,000'

SCALE: 1"=2,000'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL DIVISION
SUITE 900 - JAMES K. POLK BUILDING
505 DEADERICK STREET
NASHVILLE, TENNESSEE 37243-0334

Theodore C. Fox, III, Director
Division of Public Works
Shelby County Government
160 North Main Street, Suite 801
Memphis, TN 38103

Subject: De minimis impact finding concurrence for Kirby Parkway through Shelby Farms Park

Dear Mr. Fox:

The purpose of this letter is to request your concurrence that the proposed Kirby Parkway will not adversely affect the activities, features, and attributes of Shelby Farms Park, thus allowing the Federal Highway Administration to make a *de minimis* impact finding.

As a facility owned by Shelby County, the Shelby Farms Park is afforded special protections under Section 4(f) of the U.S. Department of Transportation Act (recodified in 49 U.S.C. 303 and 23 U.S.C. 138). Under the provisions of Section 4(f), if the proposed transportation project would result in adverse effects to the park or recreation facility, the transportation agency must conduct an evaluation to demonstrate that there is no prudent and feasible alternative to the use of the 4(f) property. An exemption is provided in cases where the official with jurisdiction over the park or recreation area concurs in a determination that the impacts are not adverse. This concurrence enables the FHWA to make a *de minimis* (minimal impact) finding, which satisfies the requirements of Section 4(f) and precludes the need for a Section 4(f) evaluation. *De minimis* impacts on publicly owned parks, recreation areas, and wildlife and waterfowl refuges are defined as those that do not "adversely affect the activities, features and attributes of the Section 4(f) resource.

For purposes of federal law, including Section 4(f) of the USDOT Act of 1966, the future right of way will be considered transportation right of way, not parkland, and will be purchased from the County. The proposed project would require approximately 119 acres for right of way, as shown in the attached map. The State will compensate the County for any land acquired for the project in accordance with applicable federal and state laws.

If you concur that the acquisition of right of way as shown on the attached figure would not adversely affect the recreational activities, features, and attributes that qualify Shelby Farms Park for protection under Section 4(f), we request that you sign and date this letter in the spaces below. We will maintain a copy of this letter in the project file.

As the official with jurisdiction over Shelby Farms Park, I concur with the determination that the proposed transportation project shown on the accompanying attachment would not adversely affect the activities, features, and attributes that qualify Shelby Farms Park for protection under Section 4(f). I have also been informed that based on my concurrence, the FHWA intends to make a *de minimis* finding regarding impacts to Shelby Farms Park thus satisfying the requirements of Section 4(f).

Signature: Mark H. Luttrell

Printed Name of Official: Mark H. Luttrell

Date: 9-13-10

After signing and dating this letter, please return a copy to me at the address listed above. We appreciate your cooperation.

Sincerely,

Tom Love

Tom Love
Transportation Manager 1

SHELBY FARMS MANAGEMENT AGREEMENT

This Shelby Farms Management Agreement ("Agreement") made and entered into this 13 day of JULY, 2007, by and between Shelby Farms Park Conservancy, a Tennessee nonprofit corporation, ("SFPC"), and Shelby County, Tennessee ("County"). The effective date of this Agreement shall be August 1, 2007 (the "Effective Date").

In consideration of their mutual promises and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

ARTICLE 1. DESCRIPTION AND USE OF THE PARK

For purposes of this agreement, Shelby Farms Park ("Park") shall mean those areas which are described by metes and bounds in Exhibit A, which is attached hereto and incorporated by reference. The Park shall at all times be managed, operated and used for the benefit of the citizens of Shelby County, Tennessee, and shall be used in accordance with the Conservation Easement between the County, The Shelby County Agricenter Commission, and the Land Trust for Tennessee, Inc., recorded as instrument number 07021070 in the Shelby County Register's Office in Shelby County, Tennessee on February 1, 2007, which is hereby incorporated by reference. Furthermore, the parties will work together to develop, adopt, and implement a Master Plan for the Park ("Plan"), and SFPC and the County will carry out their responsibilities in accordance with the Plan.

ARTICLE 2. MANAGEMENT

The County hereby appoints SFPC as Manager of that portion of the Park described by metes and bounds in Exhibit B, which is attached hereto and incorporated herein by reference, ("Managed Area"), with the full and exclusive authority and responsibility to manage, operate, lease, rent, preserve, protect, enhance, and develop that Area, to promote the Park, and to carry out all of its other duties as set forth in more detail herein.

ARTICLE 3. TERM

The initial term of this Agreement shall be ten (10) years and will commence upon the Effective Date and end on July 31, 2017. Either party may terminate this agreement on prior written notice given at least one year prior to the expiration of the initial term or any renewal term. This Agreement shall be automatically extended for additional terms of ten (10) years unless, not less than one year prior to the expiration of any term, either party shall give written notice to the other party electing to terminate this Agreement at the expiration of the then current term. Hereinafter, all references to the "term" of this Agreement shall mean the initial term and any extensions or renewals thereof.

ARTICLE 4. COUNTY FUNDS AND SUPPORT

(a) It is the intention and agreement of the parties that the County will continue to provide to Shelby Farms at least the same levels of financial support and in-kind support that it has provided in the past. Attached hereto as Exhibit C are lists of the amounts expended by the County for the management and operation of Shelby Farms, the revenues received by the County from Shelby Farms, and the in-kind goods and services provided by the County to Shelby Farms. The County will continue, throughout the term of this Agreement and any renewal or extension thereof, to provide to SFPC annual funding in the amount of at least $575,848, to be paid to SFPC in quarterly installments on or before the first day of January, April, July, and October of each year of this agreement. On the Effective Date, the County will pay the first pro-rata quarterly installment to SFPC as adjusted herein. The County will also continue, throughout the term of this Agreement and any renewal or extension thereof, to provide to SFPC the same in-kind goods and services it has provided to Shelby Farms in the past, as described in Exhibit C, including the use of work lines through the Shelby County Correction Center as discussed below. The County represents and warrants that Exhibit C is an accurate and complete description of the financial support and in-kind contributions provided by the County. In addition the County will make all reasonable efforts, at County's cost, to maintain the water level in Patriot Lake at appropriate levels to fully support aquatic and recreational activities.

(b) In accordance with the guidelines provided in County policies and procedures, T.C.A. § 41-2-148 and any other applicable law, the County agrees to continue assignment of two work lines (ranging between six and ten trustees from the Adult Offender Center) to augment and support grounds maintenance operations in the Managed Area through the work week. These services are generally scheduled Monday through Friday from 7:00 a.m. to 5:00 p.m., depending on weather and needs of the park. Additional support for special events may be provided subject to availability of manpower.

(c) The County agrees to coordinate communication with the Memphis City Police Department and/or the Shelby County Sheriff's Department, as appropriate, regarding requests for security for both day-to-day security needs and for large scale events.

(d) SFPC shall reimburse the County the County's cost for all utilities (water, sanitary sewer, electricity, and natural gas) arising from the operation of the Park.

(e) The County, as owner of the Park, including the Managed Area, shall retain responsibility for any environmental conditions on or under the Managed Area, including but not limited to the exclusive responsibility for any necessary monitoring and maintenance of hazardous materials, if any, which may be present under those portions of the Managed Area on the south side of Walnut Grove Road which were previously used as a county landfill, and that additional portion of the Managed Area previously used as a fire arms range, it being understood and agreed that the SFPC shall have no responsibility or authority to investigate, remediate or otherwise deal with any such hazardous materials present anywhere within the Managed Area as of the effective date of this Agreement.

ARTICLE 5. SFPC FUNDS

(a) All revenues generated by or in the Managed Area of the Park, and any activities, facilities, events, or programs in the Managed Area of the Park, by rental, lease, or otherwise, or raised by or donated to or for the SFPC for the Managed Area of the Park, shall be paid to the SFPC for use in carrying out its duties set forth herein.

(b) SFPC will raise and collect, from both private and public sources, all additional funds, (over and above the amounts provided by the County to SFPC as provided in Section 4, above, and the other revenues referred to in elsewhere in this Agreement), necessary to carry out its responsibilities set forth herein, including without limitation the management, operation, protection, enhancement, and development of the Managed Area and the promotion of the Park, the development of the Master Plan for the Park, and the implementation of that Plan.

(c) All funds raised by, or donated to SFPC, or received by it in its role as Manager of the Park, through special events, exhibits, sales of goods or services, memberships, advertising, naming rights, sponsorships, private donations, or otherwise, shall be the sole and exclusive property of SFPC, subject to any restrictions imposed on the use of such funds by the Charter and Bylaws of SFPC and/or the terms of the donation. No such funds will be used in a manner which will cause SFPC to lose its status as a charitable organization under the Internal Revenue Code, and SFPC will engage in no activities which would cause it to lose its status as a charitable organization under the Internal Revenue Code.

ARTICLE 6. AUTHORITY

SFPC intends to operate the Park in a manner that will encourage broad public use of the Park, in accordance with the terms of the Conservation Easement and the Management Agreement. SFPC will have the sole authority to determine what activities, events, programs, projects, concessions, facilities, buildings, construction, improvements, landscaping, and changes therein, shall take place in the Managed Area during the term of this Agreement, and to establish rules and regulations governing same.

ARTICLE 7. FEES

(a) SFPC will have the sole authority to determine the amounts to charge for use of or admission to any facility, event, or activity in the Managed Area and shall have control of all concessions in that Area, with the right to operate any such concessions itself or to contract with independent concessionaires to do so; provided, however, that no fee shall be charged for entrance to the Park.

(b) The County agrees to assign its rights under all existing contracts described in Exhibit D, which is attached hereto and incorporated by reference, to SFPC. SFPC agrees to accept and honor the terms of these contracts. Upon the Effective Date of this Management Agreement,

revenues collected pursuant to the terms of said contracts shall be paid to SFPC regardless of whether the contracts have been assigned to SFPC.

(c) SFPC shall allow the County use of the Managed Area free of charge for one day per year for purposes of holding the annual County picnic, on a date agreed upon by the County and SFPC.

ARTICLE 8. LICENSE TO USE EQUIPMENT; MAINTENANCE

(a) Attached hereto as Exhibit E is a list of Personal Property and Equipment which, at the time of the execution of this Agreement, is used by or in connection with the management, operation, and maintenance of Shelby Farms. The County warrants that this is a complete and accurate list thereof. The County hereby grants and conveys to SFPC licenses to use said Personal Property and Equipment during the term of this Agreement, but ownership of such Personal Property and Equipment shall remain with the County. At the end of the useful life of each piece of equipment, said equipment shall be returned to Shelby County for disposal.

(b) The County shall, during the term of this Agreement, continue to provide maintenance and repair of said Personal Property and Equipment, and shall replace said Personal Property and Equipment, upon the request by SFPC for such replacement, when and if any of it requires replacement due to ordinary wear and tear or for any other reason not the fault of SFPC, its agents or employees to the extent that same is not covered by insurance; provided, that the determination when such replacement is necessary shall be made jointly by SFPC and the County upon a reasonable basis. SFPC shall reimburse the County for any maintenance in accordance with published Fleet Shop rates charged to county agencies and departments within thirty (30) days of invoice.

(c) The County hereby grants a license to SFPC for the term of this agreement for use of the Storage Barn located in Area 10 of the Park and described in greater detail on Exhibit F, which is attached hereto and incorporated by reference, to store the equipment and personal property described herein.

(d) The County hereby grants a license to SFPC for the term of this agreement for use of the structure located at 6489 Mullins Station Road in Area 10 of the Park and described in greater detail on Exhibit F, which is attached hereto and incorporated by reference, to use for office space for park purposes.

(e) SFPC shall be solely responsible for the care and maintenance of the Bison Herd ("livestock"), described on Exhibit G, which is attached hereto and incorporated by reference. SFPC agrees to ensure that said livestock is provided with required veterinary services as well as the appropriate timely disposition of sick or dead animals. The County agrees to provide dead animal pick-up to SFPC on an as-needed basis at no cost to SFPC. SFPC has the authority to carry out appropriate herd management practices to ensure that optimum herd size is maintained for the health and safety of the herd and other animals.

ARTICLE 9. CAPITAL IMPROVEMENTS & MAINTENANCE; SIGNAGE

(a) The Managed Area is and shall remain the property of Shelby County. SFPC shall have the right, at its sole expense, to make such changes in and additions and improvements to the Real Property in the Managed Area as it may deem necessary in order to carry out its duties as Manager; provided, however, that any such changes shall be consistent with the Master Plan and the Conservation Easement. All proposed capital additions to the Real Property in the Managed Area shall be submitted to the County Engineer for review to ensure compliance with applicable state and local regulations relative to public health and safety; provided, however, that approval thereof shall not be unreasonably withheld. All capital additions to the Real Property in the Managed Area paid for in part or in whole by SFPC shall be the property of the County, which accepts ownership of and title to such property.

(b) SFPC shall have the right, at its sole expense, to erect or display, or permit or cause to be erected or displayed, any signs within the Managed Area it may deem appropriate in accordance with the Master Plan, the Conservation Easement, and applicable state and local laws and regulations.

(c) The County agrees to consult and coordinate with SFPC regarding the design and construction of any capital improvements other than those initiated by SFPC as referred to in 9(a).

ARTICLE 10. INTELLECTUAL PROPERTY RIGHTS/SPONSORSHIP AND ADVERTISING

(a) The County hereby grants to SFPC, for the term of this Agreement, an exclusive, worldwide, fully paid up and irrevocable license in and to any and all Intangible Property related to Shelby Farms and owned by the County, including any and all names, trade names, marks, trademarks, and other intellectual property, and all of the goodwill and reputation of Shelby Farms; provided, however, that any use of the name "Shelby County Government" or use of the official seal of Shelby County, Tennessee, requires prior approval of the County. The County agrees to execute and deliver to SFPC such assignments, licenses and other instruments and documents as needed to effectively grant said license in and to all such Intangible Property. SFPC is authorized to grant such sub-licenses in any item of Intangible Property as it deems in the best interest of the Park.

(b) SFPC shall have the right to sell naming rights, sponsorships and advertising relating to the Managed Area or any portion thereof, or facility, activity, or event therein; provided, however, that all any naming rights, sponsorships or advertising relating to tobacco or sexually oriented businesses shall be prohibited and the sale of naming rights related to alcohol shall be prohibited.

ARTICLE 11. PERSONNEL

For a period of no longer than ninety (90) days after the Effective Date (the "Transition Period"), the current County employees assigned to the Park shall continue to be employed by the County but shall be under the joint supervision of the County and SFPC. During the Transition Period, the County shall be responsible for all compensation, benefits and worker's compensation insurance for such employees. The actual amount of such compensation paid during the Transition Period to the County employees assigned to the Park shall be deducted from the quarterly installment(s) to be paid to SFPC during the Transition Period. During the Transition Period, SFPC and the County shall notify the employees who are to be hired by SFPC. SFPC shall have the sole authority, in its sole discretion, to select the persons it chooses to employ and to determine the terms and conditions of their employment, provided however that SFPC shall be an equal opportunity employer and shall not discriminate in its employment practices on the basis of race, sex, age, color, religion, national origin, or disabilities. SFPC shall be solely responsible for all compensation, employee benefits and expenses of its employees after the Transition Period.

ARTICLE 12. COMPLIANCE WITH LAWS

SFPC shall manage the Park in compliance with all applicable laws and regulations.

ARTICLE 13. SUBJECT TO FUNDING

The funding provisions herein are subject to annual appropriation by the County of the funds provided herein. If the County fails to appropriate sufficient funds for the operation of properties, such failure shall not be deemed an event of default but shall entitle SFPC to terminate this Agreement immediately upon notice from the County of the County's failure to appropriate such funds.

ARTICLE 14. CONTRACT AUTHORITY

SFPC shall have full authority to negotiate and execute all contracts, agreements, permits, leases, and licenses as may be necessary for the management and operation of the Managed Area and to carry out its duties as Manager under this Agreement. Such agreements shall include, but not be limited to, contracts, agreements, leases, and licenses, with suppliers, tenants, exhibitors, concessionaires, joint venturers, promoters, advertisers, television and radio media, other media, and other parties.

ARTICLE 15. RELATIONSHIP OF PARTIES

The parties agree that the only relationship created by this Agreement is and shall be that between the County and SFPC and that SFPC is an independent contractor, providing

management, operation, and other services to the County, not an agent, agency, employee, joint venturer, partner, division or department of the County.

ARTICLE 16. INSURANCE

(a) County will continue to carry insurance coverage on existing building structures in the managed area and will carry insurance on future buildings resulting from the implementation of the Master Plan.

(b) As of the Effective Date, SFPC shall purchase and maintain, in a company or companies licensed to do business in the State of Tennessee, such insurance as will protect the parties from claims which may arise out of or result from SFPC's operations under the agreement, whether such operations are performed by SFPC or by anyone directly or indirectly employed by SFPC, or by anyone for whose acts SFPC or subcontractor may be liable. SFPC shall also require insurance coverage as outlined herein of any entity or individual that leases or uses the Managed Area for any event(s).

(c) The insurance required shall be written for not less than any limits of liability specified or required by law, whichever is greater. The County, its elected officials, appointees and employees will be named as additional insured. SFPC will maintain throughout the life of this agreement insurances, through insurers rated A- or better by A.M. Best, in the following minimum requirements:

-Commercial General Liability coverage with minimum limits of $1,000,000.00 per occurrence/$2,000,000.00 annual aggregate premises/operations coverage, $2,000,000.00 annual aggregate products/completed operations.
-Workers Compensation coverage, including coverage for sole proprietors, partners, and officers, regardless of requirement by Tennessee State Statute.
-Commercial Auto Liability with minimum limit of $1,000,000 for all owned, hired and non-owned autos.

SFPC shall provide County with a current copy of the Certificate of Insurance or other acceptable evidence of insurance as of the Effective Date and shall maintain said insurance during the entire agreement as well as provide renewal copies on each anniversary date of the Effective Date. SFPC shall not be required to provide the Workers Compensation coverage until the expiration of the Transition Period.

Upon termination or cancellation of insurance currently in effect under this agreement, SFPC shall purchase an extended reporting endorsement and furnish evidence of the same to the County.

ARTICLE 17. RECORDS/INSPECTION

(a) SFPC will establish and maintain accurate records and accounts which sufficiently and properly reflect all direct and indirect revenues and expenditures in the performance of this Agreement. Such records and accounts shall conform to generally accepted accounting principles. Upon request by the County, SFPC will make available, at SFPC's principal place of business, for inspection and audit, SFPC's books and records relating to the performance of this Agreement.

(b) Within one-hundred and twenty (120) days of the end of each fiscal year (June 30th), SFPC shall submit to the County financial audited financial statements regarding the SFPC's management and operation of the Park, including, without limitation, a statement of income, expenses and surplus (or deficit) and the results of operation during such year, such financial statement to be certified by an officer of the SFPC as true, accurate, and complete and fairly reflecting the results of operations of the Park.

(c) Pursuant to Resolution Number 37, enacted by the Board of County Commissioners of Shelby County, Tennessee on March 26, 2007, and Exhibit A attached to said resolution and incorporated by reference, the SFPC shall submit quarterly reports to the County Administration, and the County Commission's Committee #9-Conservation, Chickasaw Basin and Shelby Farms detailing the progress of implementing the Master Plan and raising the necessary funds to pay for the improvements and ongoing public policy matters regarding the governance of Shelby Farms Park.

ARTICLE 18. DEFAULT

Anything in this Agreement to the contrary notwithstanding, it is understood and agreed that in the event of a default, the non-defaulting party shall give notice of default and the party in default shall have 30 days after receipt of the notice to cure any monetary default and 60 days after receipt of the notice to cure any non-monetary default, provided that as to a non-monetary default, if such default cannot reasonably be cured within said 60 days, the party in default shall have such additional time as is reasonably necessary to cure the default, provided that the party in default begins curing the default within said 60 days and diligently prosecutes to completion the curing of the default. A party shall not exercise any right or remedy for default unless and until such notice has been given and the opportunity to cure default has expired.

ARTICLE 19. WAIVER

No waiver of any term, condition, default, or breach of this Agreement, or of any document executed pursuant hereto, shall be effective unless in writing and executed by the party making such waiver; and no such waiver shall operate as a waiver of either (a) such term, condition, default, or breach on any other occasion or (b) any other term, condition, default, or breach of this Agreement or of such document. No delay or failure to enforce any provision in this Agreement or in any document executed pursuant hereto shall operate as a waiver of such

provision or any other provision herein or in any document related hereto. The enforcement by any party of any right or remedy it may have under this Agreement or applicable law shall not be deemed an election of remedies or otherwise prevent such party from enforcement of one or more other remedies at any time.

ARTICLE 20. CONSTRUCTION

All words used herein shall be construed according to their proper gender and number, as the context shall require. Unless specifically designated otherwise, a reference to "including" shall mean "including, but not limited to."

ARTICLE 21. ENTIRE AGREEMENT

This Agreement sets forth the entire understanding of the parties, replacing any and all prior agreements relating to the subject matter hereof. This Agreement may be changed, amended, or terminated only by similar written instrument executed by the parties.

ARTICLE 22. SUCCESSORS

All of the terms and provisions of this Agreement shall be binding upon, shall inure to the benefit of, and be enforceable by and against, the parties hereto and their respective heirs, executors, administrators, successors, and permitted assigns.

ARTICLE 23. ASSIGNMENT

No party may assign or delegate its rights or duties under this Agreement without the prior written consent of the other parties in each instance.

ARTICLE 24. SEVERABILITY

If any provision of this Agreement is held to be unlawful, invalid, or unenforceable under any present or future laws, such provision shall be fully severable; and this Agreement shall then be construed and enforced as if such unlawful, invalid, or unenforceable provision had not been a part hereof. The remaining provisions of this Agreement shall remain in full force and effect and shall not be affected by such unlawful, invalid, or unenforceable provision or by its severance herefrom. Furthermore, in lieu of such unlawful, invalid, or unenforceable provision, there shall be added automatically as a part of this Agreement a provision as similar in terms to such unlawful, invalid, or unenforceable provision as may be possible, and be legal, valid, and enforceable.

ARTICLE 25. NOTICES

Any and all notices, requests, communications, or demands required or permitted to be given pursuant hereto (a) shall be in writing, (b) shall be delivered either (i) in person or by electronic facsimile, (ii) by an established overnight delivery service, such as Federal Express, or (iii) mailed by registered or certified mail, return receipt requested, and (c) shall be addressed as follows:

Shelby County	Shelby County Public Works Department Attn: Ted Fox, Director 160 N. Main Street Suite 801 Memphis, Tennessee 38103
Copy to:	Shelby County Government Contract Administration 160 N. Main St., Suite 550 Memphis, Tennessee 38103
Shelby Farms Park Conservancy:	Shelby Farms Park Conservancy 130 North Court Avenue Memphis, Tennessee 38103
Copy to:	Burch, Porter & Johnson, PLLC 130 North Court Avenue Memphis, Tennessee 38103 Attention: Charles F. Newman, Esq. and Milton L. Lovell, Esq.

or to such other address or addresses as any party may designate to the others, by notice in writing, given as above provided. Notices delivered in person or by electronic facsimile shall be deemed to have been given on the date of delivery; notices delivered by overnight delivery service shall be deemed to have been given on the business day following the date of deposit with such overnight delivery service; and notices given by mail shall be deemed to have been given three (3) days after the date of mailing.

ARTICLE 26. APPLICABLE LAW

This Agreement has been accepted, executed and delivered, and is intended to be performed, in the State of Tennessee. The rights and duties of the parties, and the validity, construction, enforcement, and interpretation of this Agreement, shall be governed and construed according to the laws of such state.

ARTICLE 27. EXHIBITS

All of the Exhibits attached to this Agreement are a part of this Agreement when so attached, and are incorporated herein by reference as fully as if copied herein verbatim. The County represents and warrants that all such Exhibits are complete and accurate descriptions of the matters referred to therein.

ARTICLE 28. FURTHER ASSURANCES

Each of the parties, at all times and from time to time hereafter, and upon reasonable written request to do so, shall make, do, execute, deliver, or cause to be made, done, executed and delivered, all such further acts, deeds, instruments, assurances, and things as may be required for more effectually implementing and carrying out the true intent and meaning of this Agreement.

(SIGNATURES APPEAR ON THE FOLLOWING PAGE)

IN WITNESS WHEREOF, the parties hereto have set their signatures for the purposes contained herein, on this 13 day of July, 2007.

APPROVED AS TO FORM AND LEGALITY:

Contract Administrator/
Assistant County Attorney

SHELBY COUNTY GOVERNMENT

A C Wharton, Jr., Mayor

SHELBY FARMS PARK CONSERVANCY

BY: Calvin Anderson

TITLE: Chairman | PRESIDENT

CORPORATE ACKNOWLEDGMENT

STATE OF TENNESSEE

COUNTY OF SHELBY

Before me, the undersigned Notary Public, in and for the State and County aforesaid, personally appeared CALVIN ANDERSON with whom I am personally acquainted or proved to me on the basis of satisfactory evidence, and who, upon oath, acknowledged himself/herself to be president or other officer authorized by appropriate Corporate action and/or Resolution to execute the preceding instrument of the SHELBY FARMS ~~PARK CONSERVANCY~~ the within named bargainor, a corporation, and that he as such PRESIDENT, executed the foregoing instrument for the purpose therein contained, by signing the name of the corporation by himself/herself as PRESIDENT.

WITNESS my hand and official seal at office this 6TH day of JULY, 2007.

Theresa D. Estopare
Notary Public
My Commission Expires: MY COMMISSION EXPIRES: March 18, 2009

THERESA D. ESTOPARE
STATE OF TENNESSEE NOTARY PUBLIC
SHELBY COUNTY

AGREEMENT BETWEEN
SHELBY COUNTY GOVERNMENT
AND
AGRICENTER INTERNATIONAL

This Agreement is entered into this 1st day of April, 2006 by and between Shelby County Government, hereinafter referred to as "County" and Agricenter International, hereinafter referred to as "Agricenter."

WHEREAS, the parties hereto acknowledge that certain lands, more specifically known as Farm #783, Section 10, Fields 8, parts of 10 and 12, 17, 18, 19, 20, and parts of 23 and 24, hereinafter referred to as "Lands" and more particularly described on the map attached hereto as Exhibit A, are the property of Shelby County Government and are subject to oversight and control of the Department of Shelby Farms, and;

WHEREAS, the parties hereto are desirous of entering into a relationship to improve the appearance of the Lands and to minimize County's costs of maintaining said property by providing for the production of crops on the Lands.

NOW THEREFORE, in consideration of the mutual covenants stated above, as well as additional consideration, the adequacy and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. SCOPE OF SERVICES

County agrees to grant Agricenter the right to use, maintain and improve the above specified Lands for the production of crops. Said right of use shall include the following:

A. Notwithstanding subsection C. below, Agricenter shall have the right to plant, maintain and harvest crops and make such improvements to the soil as is generally advisable for the production of agricultural crops.

B. Agricenter will assume all production costs and responsibility for maintaining the Lands throughout the term of this agreement.

C. County does not relinquish and hereby expressly retains all rights to control the management of the Lands including, but not limited to, right of access for necessary maintenance of the grounds and existing or proposed roadways or underlying infrastructures and enforcement of necessary and proper rules for the management and operation of same.

GRANT OF CONSERVATION EASEMENT

This Grant of Conservation Easement ("Grant") is made by the County of Shelby, Tennessee ("County") and the Shelby County Agricenter Commission ("Agricenter") (collectively, "Grantors") as of the _____ day of January, 2007, and shall become effective upon being properly recorded in the office of the Shelby County Register ("Effective Date") pursuant to the Conservation Easement Act of 1981, Tenn. Code Ann. 66-9-301 et seq., as amended, and the common law.

Section I - Recitals

Grantors are "public bodies" as defined in Tenn. Code Ann. 66-9-303(5).

County is the owner of the property designated on Exhibit A hereto as "County Property." Agricenter was established by the Tennessee General Assembly, and is the recipient of a grant of the property designated on Exhibit A hereto as "Agricenter Property," said property having been granted to Agricenter pursuant to resolution of the Board of County Commissioners of the County subject to reversion to the County under certain circumstances. All of the property described on Exhibit A, including that designated as "County Property" and that designated as "Agricenter Property," is hereinafter collectively referred to as the "Property."

For purposes of this Grant, four areas of the Property ("Tiers" 1 through 4) have been designated, as reflected and described on Exhibit B hereto.

The Property has significant conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values in the fields, forests, open spaces, vistas, wetlands, ponds, lakes, and streams on the Property, which resources and values are worthy of protection, maintenance, preservation, and enhancement for the benefit of the people of Tennessee. Grantors deem that it is in the public interest to grant a conservation easement with respect to the Property as herein provided and that the public will gain a substantial benefit by the granting of the conservation easement.

For the purpose of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values of the Property and providing for its use in keeping with such protection, maintenance, preservation and enhancement, Grantors desire to grant a conservation easement with respect to the Property, subject to the terms and conditions hereinafter provided. Grantors acknowledge receipt of good, valuable, and sufficient considerations for this Grant.

The Land Trust for Tennessee, Inc., a Tennessee nonprofit corporation ("Grantee"), has received from the Internal Revenue Service an exemption under 501(c)(3) of the Internal Revenue Code, and is therefore an "exempt organization" as defined in Tennessee Code Ann. 66-9-303(2).

Grantors deem Grantee to be qualified and to be an appropriate entity to receive and enforce the conservation easement herein granted.

Grantee desires to accept this Easement, subject to the terms and conditions hereinafter provided.

Section II - Grant and Agreements

NOW THEREFORE, for the benefit of the people of Tennessee, Grantors agree as follows:

1. Grant. Grantors grant to Grantee a conservation easement ("Easement") on, over, under, and across the Property for the purposes of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, agricultural, scientific, recreational, and parkland resources and values of the Property, including without limitation the fields, forests, open spaces, vistas, wetlands, lakes, ponds, and streams of the Property, the biological and ecological integrity and value of the Property, and the use of the Property by the public as an urban park, in keeping with such protection, maintenance, preservation, enhancement, and for other purposes incidental, necessary, and appropriate to the foregoing, such grant being subject to the terms and conditions hereinafter provided.

Included in the Property is property designated as the Lucius Burch Natural Area ("LBNA") by the State of Tennessee. The parties agree that any and all use of the LBNA pursuant to the terms of this Easement shall be consistent with T.C.A. 11-14-101 et seq., as it may hereafter be amended, and all rules and regulations promulgated thereunder, that control the use of the LBNA.

Excluded from the provisions of this Easement is the road right of way property as designated on Exhibit A-1.

Also excluded from the provisions of this Easement is property designated as "Area 10," that is to be reserved for governmental and government-related uses pursuant to a plan to be adopted by the Board of County Commissioners of Shelby County, Tennessee. This Area is described on Exhibit A-2 attached hereto.

2. Declaration of Restriction. Grantors and Grantee declare and agree that the uses of the Property shall be restricted and limited to the uses permitted under this Easement. Such restrictions and limitations shall run with the land and apply to any successive owners of the Property, or any portion thereof, and Grantors shall do all things necessary to ensure that this is the case.

3. Master Plan. It is understood and agreed by Grantors and the Grantee that a Master Plan is to be developed, subject to the provisions of Paragraph 18 herein, for the Property through a planning process to be initiated by the County in the future. Grantors and Grantee agree that Grantee shall become a party to the planning process for said Master Plan, which upon completion shall become incorporated into this Easement as though set out fully herein. Grantors and Grantee hereby declare and agree that, until the completion of said Master Plan and its adoption by the County, or until December 31, 2008, whichever occurs first, no permanent buildings, structures, or infrastructure shall be constructed or placed upon the Property, and no permanent changes shall be made in the topography of the land, except those specific buildings and structures described in Exhibit A-3, it being the intention of the parties that there be a

moratorium on the construction or placement of such buildings, structures, or infrastructure, and on change in the topography of the land, other than those described in Exhibit A-3, until said Master Plan has been adopted or such December 31, 2008 deadline occurs. It is understood and agreed that the Master Plan may increase, but may not decrease, the prohibitions and restrictions on the uses permitted under in this Easement.

If during the moratorium period, a party proposes construction which was not anticipated on the date of this Grant, which is not included on Exhibit A-3, and which is in keeping with the uses and purposes of this Grant, said party may propose an amendment to Exhibit A-3 to permit such construction. The parties will in good faith negotiate the amendment, and consent to the amendment will not be unreasonably withheld, conditioned, or delayed.

4. Permitted Uses. The following uses of the Property are permitted, reserved, and retained, subject to the moratorium set forth in the preceding paragraph, and subject to any restrictions or prohibitions set forth in the Master Plan, and to any restrictions or prohibitions set forth in the 1981 Private Act of the Tennessee Legislature creating the Agricenter Commission (Chapter 141 of the Private Acts of 1981), the 1981 Resolution of the Shelby County Commission adopting and approving said Act, and the 1982 Resolution of the Shelby County Commission granting the property to the Agricenter:

a. pedestrian, bicycle, skating, and equestrian trails and paths, paved and unpaved, and equestrian operations;

b. nature trails, boardwalks and wildlife observation areas and improvements;

c. gardens;

d. recreational sports and uses consistent with the purposes and uses herein provided and in accordance with the approved Master Plan;

e. pavilions, picnic areas, and playgrounds;

f. agronomy and horticulture uses, including but not limited to farming, educational, aquaculture, and nursery uses;

g. scientific purposes, including agricultural, archeological and environmental sciences, which have no material adverse impact on the Property and the uses herein provided and are consistent with the purposes of this grant;

h. dog exercise and training;

i. boating activities consistent with the purposes and uses herein provided; only small electric motors or trolling motors are acceptable; gas powered motors, jet skis, etc. are prohibited;

j. fishing;

k. development and enhancement of wildlife habitat;

l. development and enhancement of forests (including without limitation reforestation), fields, vistas, and open spaces;

m. access by designees of Grantors to the Property at all times in connection with the uses permitted hereunder;

n. short term events not inconsistent with the uses and purposes herein provided, including without limitation outdoor festivals; collection of fees normally associated with the use of park facilities; special events, educational, agronomy and horticultural uses; and food, drink, and merchandise sales incidental to permitted uses. Permanent concessions of permitted uses may be permitted to have food, drink or merchandise sales but with size or quantification limitation on these types of incidental sales to permanent uses;

o. animal control as may be necessary to control property damage, to protect the Property, and/or to protect the health, safety, and welfare of the public;

p. direction, location, and use signs consistent with the purposes and incidental to the uses herein provided;

q. classes, demonstrations, projects, and other educational uses to promote and teach environmental protection and conservation;

r. retreat and/or camping facilities that are compatible with the rustic and natural setting of the Property, and in accordance with the Master Plan;

s. existing and currently planned uses of the Property or in accordance with the approved Master Plan and prior written approval of Grantee, which approval shall not be unreasonably withheld, conditioned or delayed;

t. maintenance, repair, removal, rearrangement, reconfiguration, renovation, relocation, and reconstruction of existing buildings, structures, facilities, sewer and/or utility lines, and other improvements; and

u. a carousel or historic rollercoaster, in a location to be mutually approved by Grantors and Grantee.

The following additional uses are permitted in the areas designated as Tier 2, Tier 3 and Tier 4 on Exhibit B, attached hereto, subject to the same conditions set forth above (i.e., the moratorium, the prohibitions or restrictions of the Master Plan, and the restrictions and prohibitions set forth in the Private Act and Resolutions referred to above):

Tier 2: Agricenter Campus Area

a. Continuation of construction of any buildings now under construction and construction of additional buildings, structures, facilities, sewer and/or utility lines, and other improvements related to agriculture; and

b. Use, maintenance, repair and replacement of roads and parking areas and construction of new roads.

Tier 3: Agricenter Crop and Recreation Area

a. Construction of ancillary buildings, barns, silos, storage structures, facilities, sewer and/or utility lines, and other improvements;

b. Maintenance, repair, and replacement of roads and parking areas and construction of new roads;

c. A demonstration area for animal husbandry science;

d. Hiking and biking trails, lakes and ponds, and other recreational uses for the public now existing and further additional recreational uses..

Tier 4: Show Place Arena Area

a. Restaurant; catering facility;

b. Showplace arena including indoor arena, enclosed warm-up arena, outdoor covered arena, and outdoor uncovered arena;

c. Six barns (two of which are located on the Agricenter property);

d. Parking area; and

e. Such other commercial uses as may be added as a result of the Master Plan.

Each Grantor reserves the right to adopt rules and regulations with respect to the permitted uses of its property consistent with the uses permitted and purposes provided herein and with respect to protecting the health and safety of the public and consistent with the Master Plan. Each Grantor also reserves and retains the right to move, remove, rearrange, reconfigure, renovate, relocate, and reconstruct facilities, improvements, and features of its property from time to time consistent with uses and purposes herein stated and consistent with the Master Plan.

5. Prohibited Uses. Except as expressly permitted in other Tiers, the following uses of the Property are prohibited:

a. stadiums; arenas; race tracks for animals or motor vehicles; commercial uses other than those specifically permitted by this Easement, provided

that the existing horse show place arena on the Property may be located elsewhere on the Property as determined by the approved Master Plan;

b. electromagnetic transmission lines and towers, other than those permitted under existing leases as such leases may be extended or renewed, without adding additional lines or towers; provided that additional antenna may be added to the existing tower and transmission lines for operation of the Property;

c. use of motorized vehicles on the unpaved paths and trails of the Property except for maintenance and operation of the Property;

d. commercial, industrial, residential, or other real estate development;

e. manufacturing and industrial uses, excluding the mulch facility on the County property;

f. commercial mining activities, except those related to lead recovery and removal on the former firearms range site on Tier 1;

g. residential uses or hotel/motel uses, excluding temporary shelter in case of emergency or disaster;

h. subdivision of the Property;

i. dumping of garbage, trash, or building materials, provided, however, that this prohibition shall not apply to (i) lawful temporary disposal of waste resulting from daily operations of the Property (dumpsters, etc.) or (ii) lawful temporary disposal of products as part of a recycling or recovery operation established for the purpose of environmental preservation and protection (mulch recycling, cardboard recycling, etc.)

j. public or private facilities except those which implement and facilitate the purposes and uses herein provided;

k. zoos;

l. permanent fairgrounds;

m. billboards;

n. commercial advertising, except for temporary signs for marketing of special events and concessions and except for the existing signs on the Agricenter property;

o. schools;

p. colleges, except for the existing Southwest Tennessee Community College facilities on the Agricenter property;

q. structures used primarily for exhibitions and performances except for one amphitheater and outdoor exhibition facilities consistent with park purposes and uses herein provided;

r. roads and parking areas other than existing roads and parking areas and future roads and parking areas permitted by the Master Plan;

s. activities which cause significant erosion or pollution;

t. other uses inconsistent with the Master Plan; and

u. any other activities inconsistent with the purposes and uses herein provided.

6. Right of Entry and Enforcement. Grantee, its agents, and independent contractors shall have the right of entry and access to the Property at all times to make such inspections and investigations as Grantee deems appropriate and to enforce this Grant. Grantee may enforce this Easement by action at law or by injunction or other proceedings in equity. No delay of or forbearance in enforcement of Grantee's rights and remedies under this Easement shall be deemed a waiver of such rights and remedies or preclude Grantee from exercising any of its rights and remedies. Defenses of laches and estoppel based on delay in enforcing rights and remedies are waived. If Grantee is successful in enforcing its rights and remedies under this Easement in a proceeding at law or equity, Grantee shall have the right to recover from the government of Shelby County, Tennessee, its reasonable costs and expenses actually incurred including reasonable attorney's fees, irrespective of whether the need for such enforcement is caused by Grantors or a third party. In the event that Grantee or Grantee's assigns fail to enforce the provisions of this Easement or at the invitation of the Grantee, the Attorney General of the State of Tennessee may enforce the provisions of this Easement by any action at law or in equity.

In the event there is a dispute between Grantor and Grantee whether or not an activity or use is permitted or prohibited, the parties will arbitrate the dispute to a committee of 3 individuals who have significant experience with land use and conservation easements. One individual shall be selected by the Grantor, one individual by the Grantee, and the third selected by those two individuals. The three individuals will determine the dispute by majority vote, following the rules of the American Arbitration Association. The decision of the arbitration committee shall be binding or nonbinding by agreement between Grantee and Grantor prior to selection of the arbitration committee.

7. Duration. The duration of the Conservation Easement herein granted shall be perpetual, provided that Grantors may terminate this Grant to become effective on the date of any fiftieth anniversary of this Grant. Grantors shall give notice as provided in Paragraph 17 herein. This Grant shall run with the land. This Grant shall be binding on the successors and assigns of the parties and shall inure to the benefit of the successors and permitted assigns of the parties.

8. Construction. This Easement shall be liberally construed in favor of protecting, maintaining, preserving, and enhancing the conservation, natural, scenic, recreational, agricultural, scientific and parkland resources and values of the Property. Captions shall not be

used in interpreting this Grant. If any provision of this Easement is found to be ambiguous, an interpretation consistent with the purposes of this Easement and that would render the provision valid shall be favored over any interpretation that would render it invalid.

9. Severability. If any provision of this Easement shall be determined by a court of competent jurisdiction to be invalid or unenforceable, such determination shall not affect the other provisions of this Grant, which other provisions shall be enforced to the full extent permitted by law.

10. Hazardous Materials. Each Grantor agrees that it will comply with all applicable laws with respect to any hazardous or toxic substances, materials, wastes, or other substances regulated by law now located on its property. County will comply with all applicable laws with respect to the landfill and firearms range on the County property. Nothing in this paragraph shall impair Grantors' right to pursue third parties with respect to violations of environmental laws caused by such third parties. Grantee shall have no responsibility with respect to such substances, materials, waste, landfill, and firearms range.

11. Assignment by Grantee. Grantee may assign its rights and interests under this Easement to another organization which is an exempt organization as defined in Tenn. Code Ann. 66-9-303(2), which has the power and authority to hold the conservation easement herein granted subject to the provisions of this Grant, which is a state or nationally recognized conservation organization, or other similar organization accredited to hold conservation easements by the Land Trust Alliance or other successor organization of similar stature, which is approved in writing by Grantors, and which accepts the assignment. If Grantee ceases to be an exempt organization, it will assign its rights and interests under this Easement to an exempt organization approved by Grantors. Grantors will not unreasonably withhold its consent to assignment.

12. Assignment by Grantors. Grantors may assign their rights, privileges, and interests under and as reserved and retained in this Easement (including without limitation all rights of approval, determination, and regulation as to purposes and uses) to an assignee using and operating the Property, provided that such assignment shall be made expressly subject to this Easement, and Grantors agree to take all steps necessary to enforce the provisions of this Easement against any such assignee.

13. Eminent Domain. If any of the Property shall be taken under the power of eminent domain, the entire award shall be the sole property of the County.

14. Maintenance and Insurance. Each Grantor shall continue to maintain its respective property and the improvements thereon in good order, condition, and repair, and in compliance with applicable laws.

As of the date of this Easement, County is self insured as to both casualty and liability insurance with respect to the Property. If and when County shall carry casualty insurance with respect to the improvements, County shall insure the improvements for their full replacement value in accordance with County's insurance standards applicable from time to time to County's facilities. The proceeds of casualty insurance shall be used for repair and restoration of

improvements on the County property. If and when County shall carry public liability insurance with respect to the County property, County shall maintain such insurance in accordance with County's liability insurance standards applicable from time to time to County's facilities, and Grantee and Agricenter shall be named as additional insureds under such liability insurance policies. Grantors will provide Grantee and Agricenter proof of the insurance required by this paragraph.

The Agricenter shall keep the contents of the improvements on Agricenter property insured for their full replacement value. The proceeds of insurance on improvements on the Agricenter Property insured by the County shall be used for repair and restoration of such improvements. The Agricenter shall carry and maintain public liability insurance with respect to the Agricenter property. Initial limits of such liability insurance shall be $1,000,000.00 per incident, $2,000,000.00 aggregate, and thereafter the limits shall be in accordance with commercially reasonable business practices. Grantee and County shall be named as additional insureds under such liability insurance policies. Agricenter will provide Grantee and County proof of the insurance required by this paragraph.

15. Default, Right to Cure. If either party shall default under this Grant, the party in default shall have 30 days after receipt of notice of the default to cure the default, or if such default cannot reasonably be cured within said 30 days, the party in default shall have such additional time as is reasonably necessary to cure the default provided that the party in default begins to cure the default within said 30 days and diligently pursues to completion the curing of the default. No remedy shall be exercised with respect to such default unless and until the default is not cured as herein provided.

16. Notices. All notices required or permitted under this Easement shall be in writing and shall be given by hand delivery or by certified mail, return receipt requested, addressed to the parties as follows:

Grantors:

Shelby County, Tennessee
160 N. Main Street, Suite 850
Memphis, Tennessee 38103
Attention: Chief Administrative Officer

Shelby County Agricenter Commission
7777 Walnut Grove Road
Memphis, Tennessee 38120
Attention: Chairman of the Commission

with a copy to:

County Attorney
160 N. Main Street, Suite 660
Memphis, Tennessee 38103

Grantee: The Land Trust for Tennessee, Inc.
209 10th Avenue South, Suite 530
Nashville, Tennessee 38203
Attention: Executive Director

A party may change its notice address by notice as above provided.

17. Termination. Should circumstances arise that render the purposes of this Grant impossible to accomplish, this Grant may be terminated or extinguished, in whole or in part, by judicial proceedings in a court of competent jurisdiction, subject to the provisions of Paragraph 18 herein. In addition, Grantors reserve the right to terminate this Grant at the end of each fifty-year term, said terms being measured from the Effective Date hereof, and upon notice to the Grantee of intent to terminate no later than ten (10) years before the end of each fifty-year term. Said notice shall be delivered to the Grantee within a one year period beginning on the first day and ending on the last day of such respective fortieth year period. Said notice shall be effective only if in writing and delivered either (i) in person to the parties' respective authorized agent or (ii) by First Class U.S. Mail or (iii) by overnight courier with tracking capabilities to the addresses provided herein, or to such other person or address as either party may designate in writing and deliver as herein provided. Should Grantors fail to provide timely notice of intent to terminate as herein provided, this Grant shall automatically renew for an additional fifty-year term.

18. Interpretation. Nothing in this Grant or the Master Plan shall be interpreted or intended to be utilized to interfere with the rights and duties granted to the Agricenter Commission pursuant to Chapter 141 of the Private Act of 1981, nor shall this Grant, or any provisions herein, be construed or interpreted as in any way modifying or exceeding the provisions of any law with respect to the use of the Property.

IN WITNESS WHEREOF, the parties hereto have caused this Conservation Easement to be duly executed and delivered by their respective officials thereunto duly authorized as of the date first written above.

GRANTEE:

THE LAND TRUST FOR TENNESSEE, INC., a Tennessee nonprofit corporation

By: Jean C. Nelson

Print Name: Jean C. Nelson

Title: President and Executive Director

GRANTORS:

SHELBY COUNTY, TENNESSEE

By: _____
A C Wharton, Jr., County Mayor

SHELBY COUNTY AGRICENTER COMMISSION

By: _____
Hamilton Smythe, III, Chairman

Approved as to Form:

By: _____
Brian Kuhn, County Attorney

Other County Approvals:

By: _____
Michael Oakes, P.E.
County Engineer

By: _____
Bill Goss
County Real Estate Manager

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, the undersigned, a Notary Public within and for said State and County, duly commissioned and qualified, personally appeared **HAMILTON SMYTHE, III**, with whom I am personally acquainted, and who upon oath acknowledged himself to be the **Chairman of the Shelby County Agricenter Commission**, the within named bargainor, and that he as such **Chairman**, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the **Shelby County Agricenter Commission** by himself as such **Chairman.**

9th WITNESS my hand and Notarial Seal, at office in Memphis, in the County aforesaid, this _____ day of January, 2007.

Paula M. Lewis
Notary Public

MY COMMISSION EXPIRES:

_____

PAULA M. LEWIS
STATE OF TENNESSEE NOTARY PUBLIC
COUNTY OF SHELBY
MY COMM. EXP. JUNE 15, 2010

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, the undersigned, a Notary Public within and for said State and County, duly commissioned and qualified, personally appeared **A C WHARTON, JR., Mayor of Shelby County, Tennessee**, with whom I am personally acquainted, and who upon oath acknowledged himself to be the **Mayor of Shelby County, Tennessee**, the within named bargainor, one of the counties of the State of Tennessee, and that he as such Mayor of said county, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of **Shelby County, Tennessee**, by himself as such **Mayor** of said **Shelby County, Tennessee.**

WITNESS my hand and Notarial Seal, at office in Memphis, in the County aforesaid, this 16 day of January, 2007.

Paula M. Lewis
Notary Public

MY COMMISSION EXPIRES:

PAULA M. LEWIS
STATE OF TENNESSEE NOTARY PUBLIC
COUNTY OF SHELBY
MY COMM. EXP. JUNE 15, 2010

STATE OF TENNESSEE)
)
COUNTY OF Davidson)

Personally appeared before me, the undersigned, a Notary Public in and for said State and County, Jean C. Nelson, with whom I am personally acquainted, and who acknowledged that ~~he~~ She executed the within instrument for the purposes therein contained, and who further acknowledged that She is the President + Exec. Director of the maker, **The Land Trust for Tennessee, Inc.**, and is authorized by the maker to execute this instrument on behalf of the maker.

WITNESS my hand, at Nashville, Tennessee, this 4th day of January, 2007.

TRACY N. MARSH
NOTARY PUBLIC AT LARGE
DAVIDSON COUNTY, TENN.

Tracy N. Marsh
Notary Public
My Commission Expires My Commission Expires July 21, 2007

EXHIBIT A

PROPERTY DESCRIPTION

"County Property"

BEGINNING at the intersection of the west right-of-way line of Germantown Parkway and the south right-of-way line of Walnut Grove Road; thence south along said west right-of-way line to the north top of bank of the Wolf River; thence with said north and northeasterly top of bank of the Wolf River to a point on the east line of the Brandon Family, LP property (Instrument Number HC 7038); thence N 06°08'17" E along said east line a distance of 529.49 feet to an angle point; thence N 38°15'51" W along said east line a distance of 245.57 feet to an angle point; thence N 46°44'09" E along said east line a distance of 124.00 feet to an angle point; thence N 27°45'51" W along said east line a distance of 83.00 feet to an angle point; thence N 01°29'09" E along said east line a distance of 111.00 feet to an angle point; thence N 31°00'51" W along said east line a distance of 185.00 feet to an angle point; thence N 03°14'09" E along said east line a distance of 175.00 feet to an angle point; thence N 39°45'51" W along said east line a distance of 230.00 feet to an angle point; thence S 69°59'09" W along the north line of said Brandon property a distance of 191.00 feet to a point on the west line; thence S 01°44'09" W along said west line of Brandon property a distance of 241.00 feet to an angle point; thence S 04°44'09" W along said west line a distance of 217.00 feet to an angle point; thence S 18°44'09" W along said west line a distance of 185.00 feet to an angle point; thence S 16°44'09" W along said west line a distance of 127.00 feet to an angle point; thence S 26°44'09" W along said west line a distance of 248.53 feet to a point on the north top of bank of the Wolf River; thence northwestwardly along said top of bank of the wolf river the following courses and distances; N 61°22'43" W a distance of 113.88 feet to a point; N 54°02'51" W a distance of 336.69 feet to a point; N 39°37'53" W a distance of 223.56 feet to a point; N 28°04'22" W a distance of 391.30 feet to a point; thence N 33°32'36" W a distance of 162.98 feet to a point on the east line of the Brandon family property (Instrument Number HC 7038); thence N 35°29'06"E along said east line a distance of 338.46 feet to an angle point; thence N 07°29'06" E along said east line a distance of 250.00 feet to an angle point; thence N 21°00'54" W along said east line a distance of 130.00 feet to an angle point; thence N 76°30'54" W along the north line of said Brandon property a distance of 260.00 feet to an angle point; thence N 60°00'54" W along said north line a distance of 210.00 feet to an angle point; thence S 57°29'06" W along said north line a distance of 408.91 feet to the top of bank of said wolf river; thence N 40°59'52" W a distance of 522.57 feet to an angle point; thence N 41°06'18" W a distance of 406.90 feet to an angle point; thence N 23°49'38" W a distance of 100.55 feet to an angle point; thence N 11°49'27" W a distance of 136.72 feet to an angle point; thence N 01°38'31" W a distance of 142.54 feet to a point on the south line of the CSX Railroad (100 foot ROW); thence N 81°49'23" E along said south line a distance of 670 feet, more or less, to the point; thence N 04°20'02" E crossing said CSX Railroad (100 foot ROW) to a found 1/2" iron pin in the north line of said CSX Railroad, said point also being on the east line of the Brandon family property (Instrument Number HC 7038), said point having Tennessee State Plane Coordinates of N 320530.8667 and E 810031.3384; thence N 04°20'02" E along said east line and along the east line of the Richard Pearce property (Instrument Number DK 6926) a distance of 2072.48 feet to

the northeast corner of said Pearce property; thence N 86°16'39" W along the north line of said Pearce property a distance of 830.34 feet to a point on the said south line of Interstate Highway 40; thence N 44°20'04" E along said south line a distance of 646.52 feet to an angle point; thence N 50°30'38" E along said south line a distance of 493 feet, more or less, to a point in the northwest corner of the federal correctional facility property; thence in a southeastwardly direction along the westerly property line of the federal correctional facility property to a point in the southerly right-of-way line of the said CSX Railroad; thence in an eastwardly direction along said southerly right-of-way line of said CSX Railroad to a point in the southwesterly right-of-way line of Raleigh-LaGrange Road; thence in a southeastwardly direction along the southwesterly right-of-way line of Raleigh-LaGrange Road to its intersection with the west right-of-way line of Germantown Parkway; thence in a southwardly direction along the west right-of-way line of Germantown Parkway to the POINT OF BEGINNING.

Less and Except that portion of the said CSX Railroad (100 foot ROW) contained within this description.

"Agricenter property"

BEGINNING at a point in the south line of Walnut Grove Road (160 feet wide), said point being 1274.81 feet west of the west line of Germantown Parkway (160 feet wide) and said point being the northwest corner of the Shelby Farms Equestrian Center; thence S 16°08'46" E along the west line of the Equestrian Center 727.93 feet to a monument; thence S 02°25'53" W continuing along the west line of the Equestrian Center 1149.38 feet to a monument set in a paved road; thence S 03°17'55" W continuing along the west line of the Equestrian Center along the centerline of said road 518.12 feet to a monument set in the centerline of an intersecting paved road, said point being the southwest corner of the Shelby Farms Equestrian Center; thence S 87°25'42" E along the south line of the Equestrian Center along the centerline of said road 559.09 feet to a monument set in the west line of Germantown Parkway; thence S 14°44'58" W along the west line of Germantown Parkway 2158.85 feet to a monument set in the north line of a power line easement; thence leaving said west line of Germantown Parkway S 60°28'32" W along the north line of said easement 310.02 feet to a monument; thence N 87°25'42" W 5627.20 feet to a monument set on the bank of a drainage ditch; thence N 33°29'14" W 174.81 feet, more or less, to a point in the east line of the 374.5806 acre mature bottomland hardwood/bald cypress forest property designated by the Tennessee General Assembly as the Shelby Farms Forest, known as the Lucius Burch Natural Area (southern forest); thence N 07°00'31" E 2238.00 feet, more or less, to a point, said point being the northeast corner of said Lucius Burch Natural Area; thence N 85°58'13" W along the north line of said Lucius Burch Natural Area 1832.32 feet, more or less, to a point; thence leaving said north line N 33°29'14" W 120.00 feet, more or less, to a monument set in the west edge of a silt levee; thence N 70°58'24" W 3593.12 feet to a monument set in a field; thence N 31 °50'38" W 184.46 feet to a point in the east line of the Walnut Grove Landfill; thence along said east line N 04°00'00" E 740.61 feet to an angle point; thence continuing along said east line N 09°00'00" W 450.00 feet to an angle point; thence continuing along said east line N 48°30'00" W 400.00 feet to a point in the north line of said Walnut Grove Landfill; thence along said north line S 81 °36'16" W 332.10 feet to a point; thence N 03°55'00" E 246.46 feet to a point in the south line of Walnut Grove Road (160 feet wide); thence with said south line of Walnut Grove Road S 84°13'16" E 11373.52 feet to a point of curvature; thence continuing along said south line on a curve to the right having a radius of

2247.83 feet a distance of 288.35 feet to a monument, said point being the POINT OF BEGINNING.

The Agricenter property includes Tier 2 which is the Agricenter campus and Tier 3 which is the property outside the campus.

The Tiers are shown on the map attached hereto as Exhibit B.

EXHIBIT A-1

ROAD RIGHT-OF- WAY PROPERTY

The following land is **EXCLUDED** from the provisions of this Conservation Easement:

1. Existing and future widening of designated public roads and rights-of-way including, but not limited to, Walnut Grove Road (160' R.O.W.), Mullins Station Road (108' R.O.W.), and Raleigh-LaGrange Road (108' R.O.W.).

2. Land for proposed "Parkway right-of-way" to be used for the Shelby Farms Parkway and Walnut Grove Road widening and improvement projects.

EXHIBIT A-2

AREA 10 PROPERTY DESCRIPTION

The following land is **EXCLUDED** from the provisions of this Conservation Easement:

"Area 10"

BEGINNING at a point in the southerly right-of-way line of the Louisville and Nashville Railroad, said point being located 1500 feet, more or less, west of the centerline of Whitten Road; thence S 13°42'00" W a distance of 710 feet, more or less, to a point; thence S 69°50'04" W a distance of 419.19 feet to a point of curvature; thence along a curve to the left, having a radius of 2710 feet, a distance of 2554.12 feet to a point of tangency; thence S 15°50'04" W a distance of 2119.19 feet to a point; thence N 83°09'56" W a distance of 148.41 feet to a point of curvature; thence along a curve to the right, having a radius of 3000 feet, a distance of 2199.11 feet to a point of tangency, said point being in east line of the 413.7512 acre mature bottomland hardwood/bald cypress forest property designated by the Tennessee General Assembly as the Shelby Farms Forest, known as the Lucius Burch Natural Area (northern forest); thence along said easterly line N 41°09'56" W a distance of 4648.41 feet to a point in the southerly line of the Louisville and Nashville Railroad right-of-way; thence in an eastwardly direction along said southerly line of the Louisville and Nashville Railroad right-of-way to the POINT OF BEGINNING.

EXHIBIT A-3

EXCEPTIONS TO MORATORIUM

On Tier I:

a. Lucius Burch Natural Area Gateway Project, if permitted by the State of Tennessee;
b. Visitors Center/Plough Park Sewer Extension;
c. Public Restroom Construction (Plough Park/Gate 12)
d. Renovation/Expansion of Plough Park for playground equipment; and
e. Shelby Farms Parkway.

On Tier 2:

Construction of improvements devoted exclusively to agriculture, which may include agricultural trade association offices but may not include manufacturing.

Office Space Expansion to Helena Chemical Co. office space - 7664 Moore Road

Agricenter East Pavilion - Clear span addition to main complex facility - 7777 Walnut Grove Road

Monsanto - storage area for equipment and cotton sample office - 7616 Moore Road

Equipment shed area for farm equipment for research vendors - 7518 Moore Road

TCI Landscape - office building adjacent to Quonset Hut - 7546 Moore Road
Farmers Market tent on south side of RV Park-7777 Walnut Grove Road

Parking area for Wildlife Observation Tower

On Tier 3:

Catch'em Lake Bait Shop, restrooms and pavilion area - 6913 Moore Road

On Tier 4:

Buildings to accommodate shows of horse show associations.

Agricenter Show Place Arena restroom upgrades - 105 S. Germantown Parkway

EXHIBIT B

MAP OF TIERS

Tom Leatherwood

Shelby County Register

As evidenced by the instrument number shown below, this document has been recorded as a permanent record in the archives of the Office of the Shelby County Register.

07021070

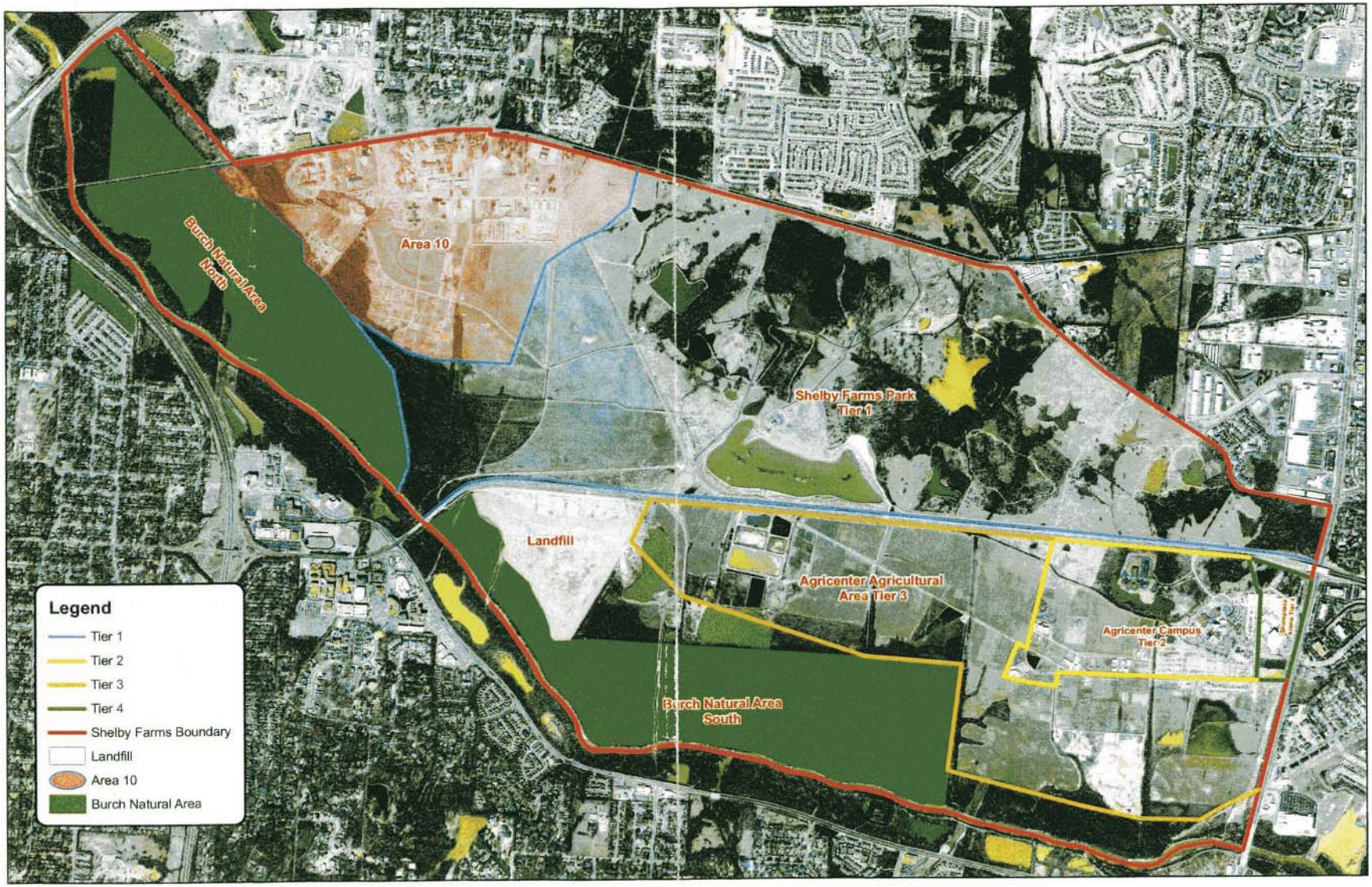
02/01/2007 - 02:11 PM

23 POS : R - BASEMENT	
BERTHA 467561-7021070	
VALUE	0.00
MORTGAGE TAX	0.00
TRANSFER TAX	0.00
RECORDING FEE	115.00
DP FEE	2.00
REGISTER'S FEE	0.00
WALK THRU FEE	0.00
TOTAL AMOUNT	117.00

TOM LEATHERWOOD

REGISTER OF DEEDS SHELBY COUNTY TENNESSEE

160 N. Main St., Suite 519 ~ Memphis, Tennessee 38103 ~ (901) 545-4366
http://register.shelby.tn.us



0 0.15 0.3 0.6 0.9 1.2 Miles

Exhibit B

Map Date: 8/02/06
Shelby County ReGIS
Aerial Photo courtesy of U.S.G.S.
photography date 2/05

Shelby County Government

A C Wharton, Jr.
Mayor

July 30, 2007

Mr. Gary Fottrell, P.E.
Environmental Program Engineer
Federal Highway Administration
640 Grassmere Park Road, Suite 112
Nashville, TN 37211

RE: Kirby Parkway – Macon Road to Walnut Grove Road
Memphis, Shelby County, Tennessee

Dear Mr. Fottrell,

The proposed Kirby Parkway project from Macon Road to Walnut Grove Road is vital to our citizens and the economic growth of Shelby County. With the support of the Shelby Farms Advisory Team and through information gathered from public comment, Alternative Q was chosen as the preferred alignment through Shelby Farms using the context sensitive process.

As Public Works Director for Shelby County, Shelby Farms falls under my supervision for land management and operational oversight. As such, I work under the guidance and direction of the Mayor of Shelby County.

I understand that Section 4(f) of the U.S. Department of Transportation Act of 1966 affords protection to *significant*, publicly owned and accessible public parks and recreation areas. I would like to provide the following points for your consideration.

- I agree with earlier decisions stating that the Shelby Farms study area **as a whole** is not considered a park. The larger Shelby Farms area is a mixed-use land holding: Shelby County Correctional facilities, Shelby County Road Department, fallow agricultural land used in agricultural pursuits, and casual and/or incidental uses (rifle range, rocket launch, and sport kite field).

- I agree with the Shelby Farms Superintendent that land use in the Shelby Farms study area has not changed to include recreational resources since the Record of Decision for the FEIS was issued in 1991.

- I agree with the Shelby Farms Superintendent that the casual and/or incidental land uses for kite flying and rocket launching can be moved to other locations in

160 North Main Street, Suite 850 • Memphis, TN 38103 • 901-545-4500 • Fax 901-545-4759

Shelby Farms and not impact the activities. Currently, the area used for the rocket launch is only used between two to three times per year and there are numerous alternative sites for this activity in Shelby Farms. The kite flying area is limited to an area of 1,042 feet along Farm Road and 840 feet along Walnut Grove Road for a total of 20.04 acres. This 20.04 acre parcel is bounded to the west and north by areas under cultivation. The Advisory Team's recommended Alternative Q would not adversely impact the kite area. Therefore, while there are numerous alternative sites for this activity in Shelby Farms, relocation of the kite area will not be necessary because of the distance from recommended Alternative Q.

- I agree that Alternative Q does not pass through any new Section 4(f) recreational resource not discussed in the FEIS or Reevaluation. Therefore, the conclusions made in the FEIS and the Reevaluation (2001) regarding Section 4(f) still remain correct.

In conclusion, through consultation with our Shelby Farms Superintendent, I agree with his findings that the project does not affect any Section 4(f) recreational resources.

Sincerely,

Theodore C. Fox, III
Director of Public Works
Shelby County Government

cc: Mayor A C Wharton, Jr.
Shelby County

Tom Love, TDOT

APPENDIX F

FARMLAND CONVERSION FORM

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*

3. Date of Land Evaluation Request: 29 JAN 07
4. Sheet 1 of 1
1. Name of Project: KIRBY PARKWAY
5. Federal Agency Involved: FHWA
2. Type of Project: RECONSTRUCTION/REALIGNMENT
6. County and State: Shelby, Tennessee

PART II *(To be completed by NRCS)*

1. Date Request Received by NRCS: 01-29-2007
2. Person Completing Form: C. DAVIS
3. Does the corridor contain prime, unique statewide or local important farmland? (If no, the FPPA does not apply - Do not complete additional parts of this form). YES ☒ NO ☐
4. Acres Irrigated: NA
Average Farm Size: 188 ac.
5. Major Crop(s): CORN
6. Farmable Land In Government Jurisdiction: Acres: 380,470 % 76%
7. Amount of Farmland As Defined in FPPA: Acres: 283,300 % 74%
8. Name Of Land Evaluation System Used: SHELBY CO.
9. Name of Local Site Assessment System: NA
10. Date Land Evaluation Returned by NRCS: 01-29-2007

PART III *(To be completed by Federal Agency)*	Alternative Corridor For Segment			
	Corridor L	Corridor M	Corridor Q	Corridor D
A. Total Acres To Be Converted Directly	74	72	74	
B. Total Acres To Be Converted Indirectly, Or To Receive Services	Ø	Ø	Ø	
C. Total Acres In Corridor	74	72	74	0
PART IV *(To be completed by NRCS) Land Evaluation Information*				
A. Total Acres Prime And Unique Farmland	23	23	23	
B. Total Acres Statewide And Local Important Farmland	NA	NA	NA	
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	<0.01	<0.01	<0.01	
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	79	79	79	
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*	80	80	80	

PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.5(a))*	Maximum Points	Corridor L	Corridor M	Corridor Q	Corridor D
1. Area In Nonurban Use	15	Ø	Ø	Ø	
2. Perimeter In Nonurban Use	10	Ø	Ø	Ø	
3. Percent Of Corridor Being Farmed	20	15	15	15	
4. Protection Provided By State And Local Government	20	Ø	Ø	Ø	
5. Size of Present Farm Unit Compared To Average	10	Ø	Ø	Ø	
6. Creation Of Nonfarmable Farmland	25	25	25	25	
7. Availability Of Farm Support Services	5	Ø	Ø	Ø	
8. On-Farm Investments	20	10	10	10	
9. Effects Of Conversion On Farm Support Services	25	Ø	Ø	Ø	
10. Compatibility With Existing Agricultural Use	10	Ø	Ø	Ø	
TOTAL CORRIDOR ASSESSMENT POINTS	160	~~0~~ 50	~~0~~ 50	0 50	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland (From Part V)	100	80	80		
Total Corridor Assessment (From Part VI above or a local site assessment)	160	0 50	0 50	0 50	0
TOTAL POINTS *(Total of above 2 lines)*	260	0 130	0 130	0	0

1. Corridor Selected:
2. Total Acres of Farmlands to be Converted by Project:
3. Date Of Selection:
4. Was A Local Site Assessment Used? YES ☐ NO ☐
5. Reason For Selection:

Signature of Person Completing this Part: DATE

NOTE: Complete a form for each segment with more than one Alternate Corridor

APPENDIX G

HAZMAT MAP

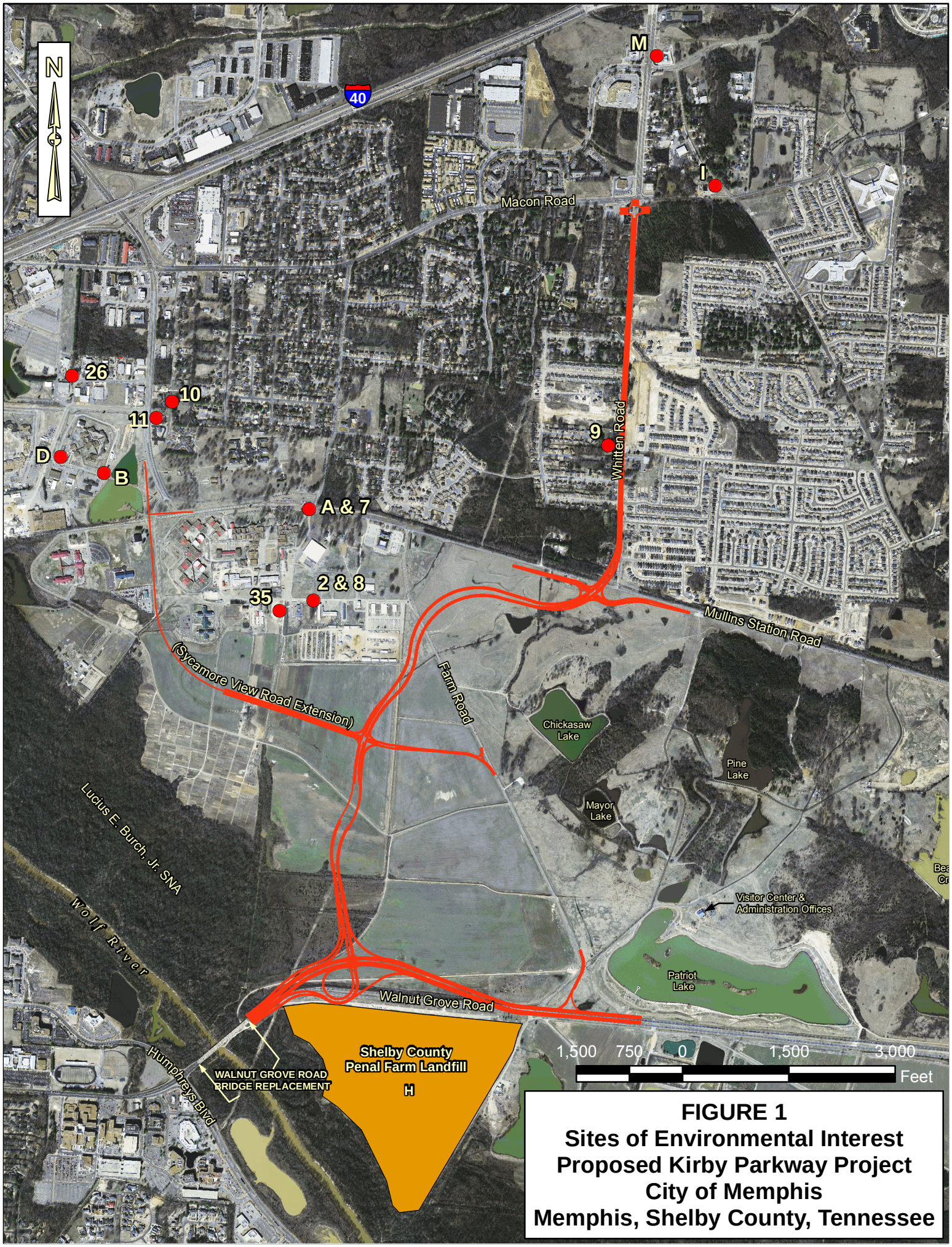


FIGURE 1
Sites of Environmental Interest
Proposed Kirby Parkway Project
City of Memphis
Memphis, Shelby County, Tennessee

APPENDIX H

MEMPHIS AQUIFER INFORMATION

Mapping an aquitard breach using shear-wave seismic reflection

B. A. Waldron · J. B. Harris · D. Larsen · A. Pell

Abstract In multi-layered hydrostratigraphic systems, aquitard breaches caused by faulting or paleo-erosion can allow substantial quantities of water of differing quality to be exchanged between aquifers. Seismic reflection technology was used to map the extent and orientation of an aquitard breach connecting a shallow alluvial aquifer to the deeper semi-confined Memphis aquifer in southwestern Tennessee, USA. Geophysical well logs indicate the presence of the aquitard at borehole locations that define the beginning and end points on two seismic survey lines, which intersect at a borehole where the aquitard is absent. A SE–NW-oriented paleochannel, 350m wide and approximately 35–40m deep, is interpreted from the seismic reflection surveys. The paleochannel cuts through the aquitard and into the upper part of the Memphis aquifer, thus creating a hydraulic connection between the shallow unconfined and deeper, semi-confined aquifers. The results indicate the potential of the shear-wave seismic reflection methods to resolve shallow breaches through fine-grained aquitards given availability of sufficient well control.

Received: 4 July 2007 / Accepted: 3 November 2008
Published online: 2 December 2008

© Springer-Verlag 2008

B. A. Waldron (✉)
Department of Civil Engineering,
University of Memphis,
3815 Central Ave., Memphis, TN 38152, USA
e-mail: bwaldron@memphi.edu
Tel.: +1-901-6783283
Fax: +1-901-6783026

J. B. Harris
Department of Geology,
Millsaps College,
1701 North St., Jackson, MS 39210, USA
e-mail: harrijb@millsaps.edu

D. Larsen
Department of Earth Sciences,
University of Memphis,
488 Patterson, Ave., Memphis, TN 38152, USA
email: dlarsen@memphis.edu

A. Pell
Department of Geology and Geophysics,
Louisiana State University,
E235 Howe-Russell Geoscience Complex,
Baton Rouge, LA 70803, USA
email: aborde8@geol.lsu.edu

Keywords Groundwater flow · Confining units · Breach · Seismic reflection · USA

Introduction

In groundwater systems comprising alternating unconsolidated aquifers and aquitards, interaquifer exchange of water influences water quality and assessment of water resource sustainability. The transfer of fresh water between aquifers depends on the aquitard integrity as well as hydraulic head distribution. An aquitard's ability to limit movement of water between adjacent aquifers may be compromised by cross-cutting faults or paleo-erosional features that provide localized short-circuiting. Contaminated water from a shallow aquifer may readily pass through sand and gravel fill of a paleovalley incised into a fine-grained confining unit to reach a deeper water-supply aquifer, for example. These localized discontinuities in an aquitard, termed breaches, can be difficult to identify without extensive subsurface geologic datasets.

Identification and mapping of aquitard breaches are important for source-water assessments and wellhead protection, especially if an aquifer with good water quality is receiving waters of poorer quality from, for example, an unconfined aquifer that is prone to contamination. Larsen et al. (2003a) determined through geochemical modeling and groundwater age-dating that as much as 30% of groundwater pumped from individual production wells in a confined aquifer proximal to a breach in the overlying aquitard came from the shallow aquifer that has water of much poorer quality. Similarly, Gerber and Howard (1996) used isotopic evidence to argue for localized downward vertical leakage through Late Wisconsinan till near Toronto, Ontario (Canada) raising concerns about possible contaminant transport from shallow surficial to deeper aquifers. Timms and Acworth (2002) described a sequence of fresh-water aquifers and aquitards in the Lower Murrumbidgee alluvial fan of the Murray Basin in Australia. Previous paleo-drainage features in this area were identified by van Dijk and Talsma (1964) from outcrop expression at ground surface. Results from Timms and Acworth (2002) using electrical image surveys revealed many more buried paleo-drainage features that were obscured at the surface by an overlying clayey deposit-van Dijk and Talsma (1964) paleo-drainage features account for only 5–20% Timms and Acworth's

 DOI 10.1007/s10040-008-0400-4

features. This significant increase in the identified number of paleo-drainage features is important as surface irrigation has raised concern regarding the migration of herbicides, pesticides and fertilizers through these aquitard breaches into the lower, partially saturated shallow aquifer.

Water transfer through an aquitard (leakage) can provide a significant source of water to a water-supply aquifer. Bradley and Phatare (1989) described the hydraulic connection between an unconfined aquifer within the Mehsana alluvial plains of the state of Gujarat, India, to underlying confined aquifers separated by a 40–50 m aquitard. The confined aquifers have been over-exploited for purposes of irrigation; therefore, causing a decline in the potentiometric surface and pronounced downward vertical gradient from the phreatic aquifer. Bradley and Phatare (1989) estimate that 90% of the extracted groundwater comes from vertical transfer of water from the phreatic aquifer with only 10% accounted for from lateral movement within the confined system. Brahana and Broshears (2001) developed a numerical model of the Mississippi Embayment in the south-central United States that evaluated groundwater production increases between 1886 and 1985. Mass balance and matching of observed-to-modeled heads were improved by allowing localized leakage through recognized aquitard breaches as well as regional leakage through the aquitard material. Zuber et al. (2000) stated that agreement between modeled and observed water levels in the Oligocene sandy aquifer of the Mazovian basin, Poland, could not be properly modeled without accounting for downward leakage

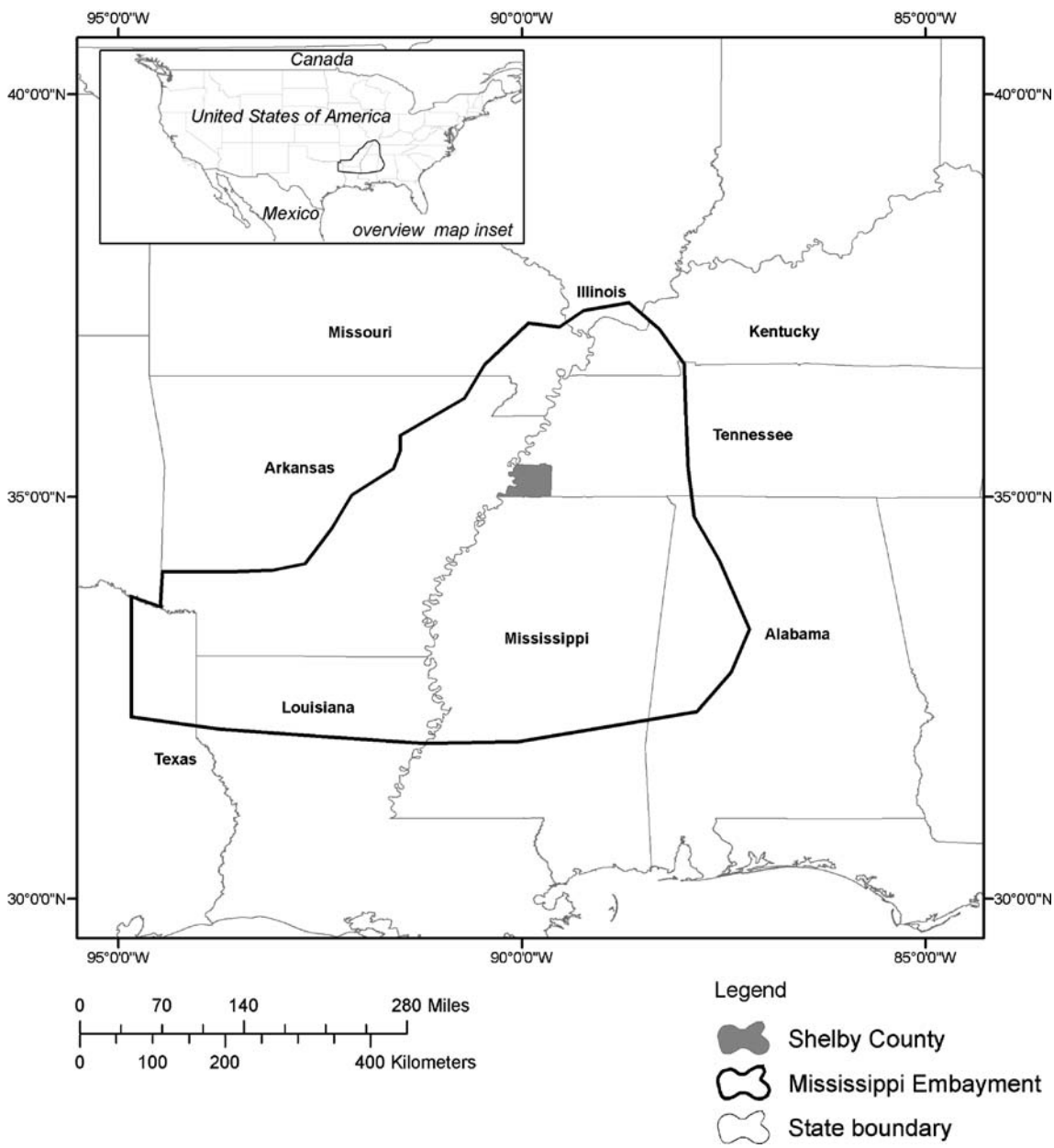


Fig. 1 Location of Shelby County within the Upper Mississippi embayment

 DOI 10.1007/s10040-008-0400-4

Era	System	Epoch	Geologic group	Geologic unit or formation	Hydrostratigraphic unit
Cenozoic	Quaternary	Holocene		Upper Alluvium	Leaky confining unit
		?			
		Pleistocene		Lower Alluvium	Shallow aquifer
	Tertiary	Eocene	Claiborne	Cockfield	Upper Claiborne confining unit
				Cook Mountain	
				Memphis Sand	Memphis aquifer

Fig. 2 Stratigraphic column of upper Mississippi Embayment for units of interest

through the aquitard; some of this occurring through deeply incised Pliocene deposits, thus connecting the Quaternary and the deeper aquifers. In Ontario, the Regional Municipality of Waterloo, servicing approximately 250,000 people, derives nearly 90% of its drinking water from the complex Waterloo Moraine groundwater system. A numerical model of the multiple aquifer sequence incorporated interaquifer exchange through breaches in the aquitards. Martin and Frind (1998) observed that although aquifer water levels were not sensitive to the presence of these breaches, the effect of this leakage on derived capture zones was profound.

Identification of interaquifer leakage between the shallow and the Memphis aquifers through natural breaches in the Upper Claiborne confining unit dates back

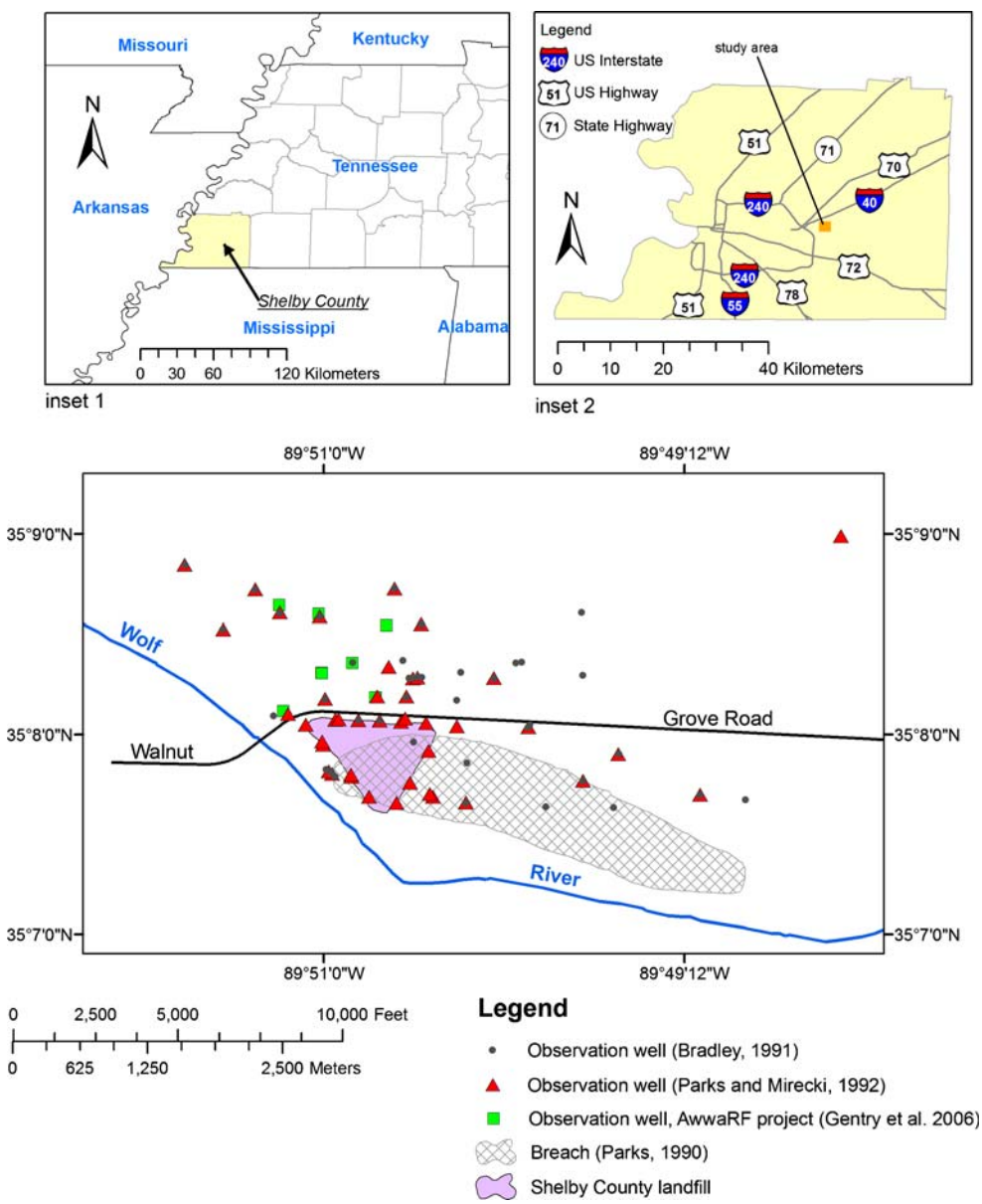


Fig. 3 Study area at Shelby Farms Park in Memphis, Tennessee, north of the closed Shelby County landfill and Walnut Grove Road and east of the Wolf River. Observation wells were installed to monitor leachate migration from the landfill and map the aquitard breach

 DOI 10.1007/s10040-008-0400-4

to the early 1960s (Criner et al. 1964; Bell and Nyman 1968). Drilling has provided the best indication of the existence of such breaches, yet only serves to represent a point location and not an aerial extent. Analysis of geochemical analyses and environmental tracers using lumped parameter modeling can constrain locations of breaches (Ivey 2003), but again provides limited information on geometry of breaches. Anomalous water-table depressions provide additional means for breach characterization, providing information regarding plausible breach extent and orientation.

In this investigation, seismic reflection methods were used to refine the extent and orientation of an aquitard breach that had previously been identified using borehole, hydraulic, and geochemical data (Bradley 1991; Parks and Mirecki 1992; Gentry et al. 2003, 2006a, b). The seismic data also provide evidence regarding the origin of the aquitard breach that cannot be obtained from the previously employed methods. Seismic reflection methods have been useful in mapping subsurface stratigraphy and structure in regard to groundwater resources (Miller et al. 1994, 1999; Merey et al. 1992; Hammer et al. 2004; Jensen et al. 2002; Sharpe et al. 2003; Shtivelman and Goldman 2000). The results of this study further clarify the capabilities and limitations of seismic reflection methods in assessment of shallow subsurface stratigraphy, and illustrate the utility of the method for identifying the extent and origin of aquitard breaches.

Hydrogeologic setting

The study area lies within the upper Mississippi embayment (Fig. 1), a shallow Cretaceous-Tertiary basin in the south-central United States that is underlain by Paleozoic rocks and filled with over 1,000 m of Cretaceous, Tertiary, and Quaternary sediments (Cushing et al. 1964; Van Arsdale and TenBrink 2000). The embayment sediments form a series of alternating sand aquifers and clay, silt, and sand confining units (Cushing et al. 1964).

Of interest in this study are the Eocene Memphis Sand, Eocene Cook Mountain and Cockfield formations, and various Pleistocene to Holocene loess and alluvial deposits (Fig. 2). The Memphis Sand is composed of fine- to very

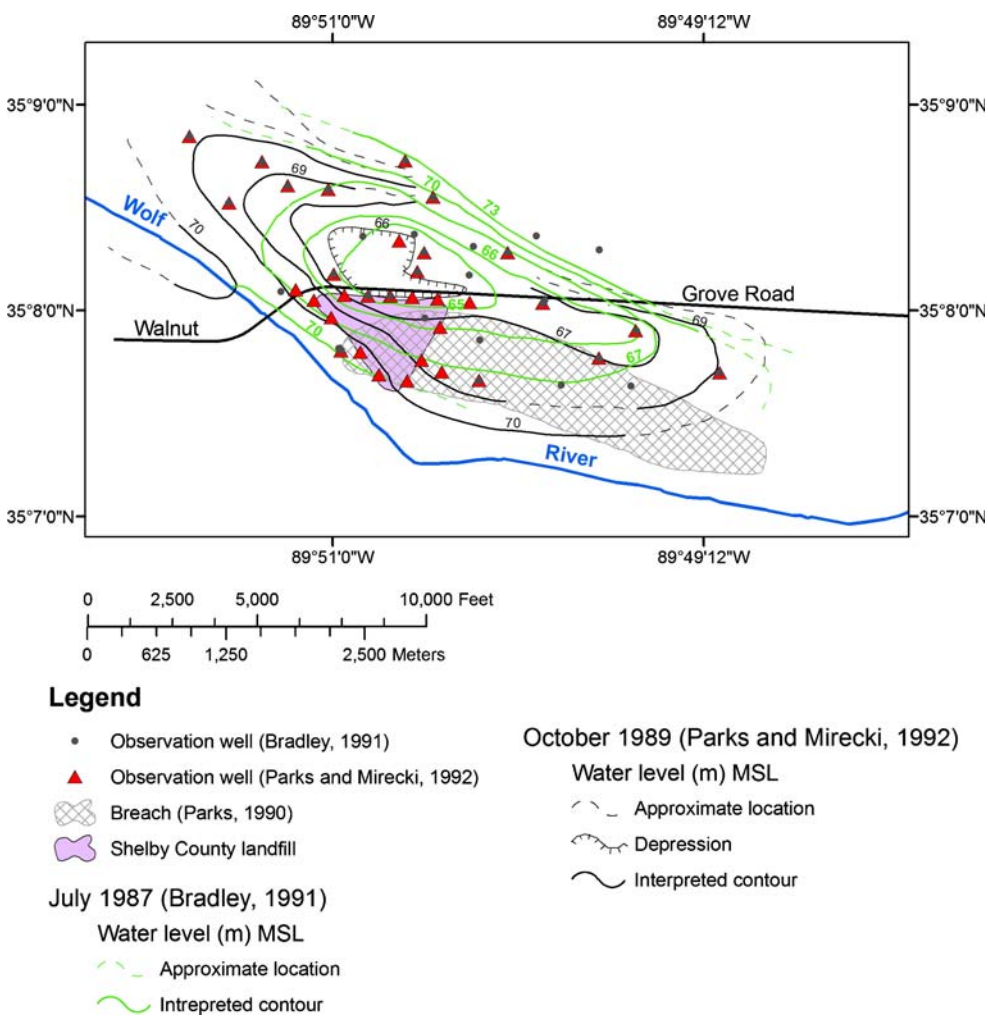


Fig. 4 Water table elevations—m above mean sea level (m MSL)—across the study area of the shallow, unconfined aquifer. Note, contour intervals are not standardized

 DOI 10.1007/s10040-008-0400-4

coarse-grained sand with subordinate clay and is as much as 240-m thick. The Memphis Sand corresponds directly with the Memphis aquifer, a prolific aquifer that provides water to municipalities and industries throughout the Tennessee-Mississippi-Arkansas region. Overlying the Memphis Sand are mainly fine-grained strata of the Cook Mountain and Cockfield formations. These formations are composed primarily of silty clay interbedded with sand and silt. The Upper Claiborne formations comprise the Upper Claiborne confining unit, which provides confinement for the Memphis aquifer over much of the region; however, sand intervals are locally thick enough to be used as aquifers (Parks and Carmichael 1990) or provide hydraulic communication between the Memphis aquifer and overlying aquifer (Parks 1990; Larsen et al. 2003a, b, c). The Quaternary alluvial deposits include sand and gravel strata of the Pliocene(?) and Pleistocene terrace deposits in the upland areas and lower late Pleistocene and Holocene alluvium in the modern valleys (Carmichael et al. 1997; Larsen et al. 2003c). Blanketing the alluvial deposits is loess and reworked loess of thicknesses ranging from 25 m at the Mississippi bluff line to a few meters in the modern valleys. The Quaternary sand and gravel deposits form a regional shallow aquifer with the overlying loess providing leaky confinement.

Site description

Of the ten identified breaches in the Upper Claiborne aquitard beneath Shelby County (Graham and Parks 1986; Parks 1990; Parks and Mirecki 1992; Parks et al. 1995), a breach identified north of a closed landfill at Shelby Farms was selected for the seismic survey for the following reasons: (1) good well control; (2) the site is part of a 2-km^2 park so surface-generated noise (rail, construction, vehicular traffic) is minimal; (3) geologic cross-sections exist for a portion of the study area; and (4) downward leakage is known to occur from the shallow aquifer to the Memphis aquifer (Fig. 3; Bradley 1991; Parks and Mirecki 1992). Bradley (1991) in cooperation with other agencies conducted a detailed study of the groundwater hydrology and potential leakage near the Shelby Farms landfill. Parks and Mirecki (1992) further investigated the groundwater chemistry proximal to the landfill for potential contamination of the Memphis aquifer. Gentry et al. (2006a, b) studied the groundwater transport process through the breach. A total of 69 observation wells or exploratory boreholes were completed as part of these investigations, thus providing a detailed understanding of the site hydrogeology.

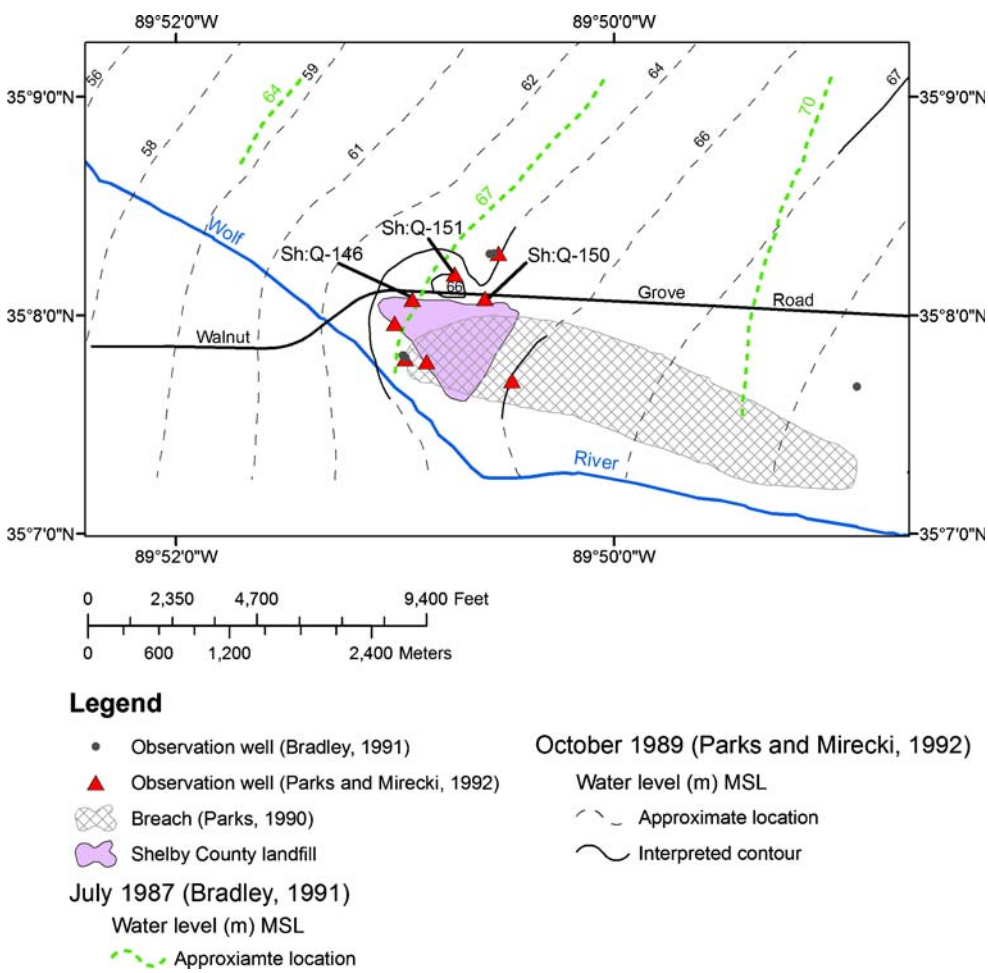


Fig. 5 Potentiometric contours of the Memphis aquifer across the study area. Note: contour intervals are not standardized

 DOI 10.1007/s10040-008-0400-4

This study focuses on a cluster of wells surrounding well Sh:Q-151 in which the Upper Claiborne confining unit is absent (Fig. 3). The area land use is primarily agricultural with limited open grass field and forest areas. Approximately 3–5 m of loess overlie the shallow aquifer, which ranges from 14 to 17 m thick (Bradley 1988). The Upper Claiborne confining unit underlies the shallow aquifer and ranges in thickness from 0 to 18 m. The underlying Memphis aquifer is approximately 200 m thick.

Past investigations

Water-level measurements were conducted in both the shallow and Memphis aquifers in July 1987 (Bradley 1991) and October 1989 (Parks and Mirecki 1992). The shallow aquifer water levels indicated a persistent depression in the water table north of Walnut Grove with interpreted contours elongated along the course of the Wolf River (Fig. 4). A gradient exists from the Wolf River to the depression in the water table, and flow is corroborated by a calculated reduction in the Wolf River discharge of 0.45 m^3/s—though this is within measurement error (Bradley 1991). Bradley (1991) indicated a gradual gradient in the piezeometric surface of the Memphis aquifer in a W–NW direction, whereas Parks and Mirecki (1992) suggested a slight mounding of the potentiometric surface in the Memphis aquifer north of Walnut Grove in proximity to Sh:Q-151 superimposed on the overall trend shown in Bradley (1991)(Fig. 5).

Parks and Mirecki (1992) constructed two cross-sections, one of which included the segment between wells Sh:Q-146, Sh:Q-151 and Sh:Q-150. All of these

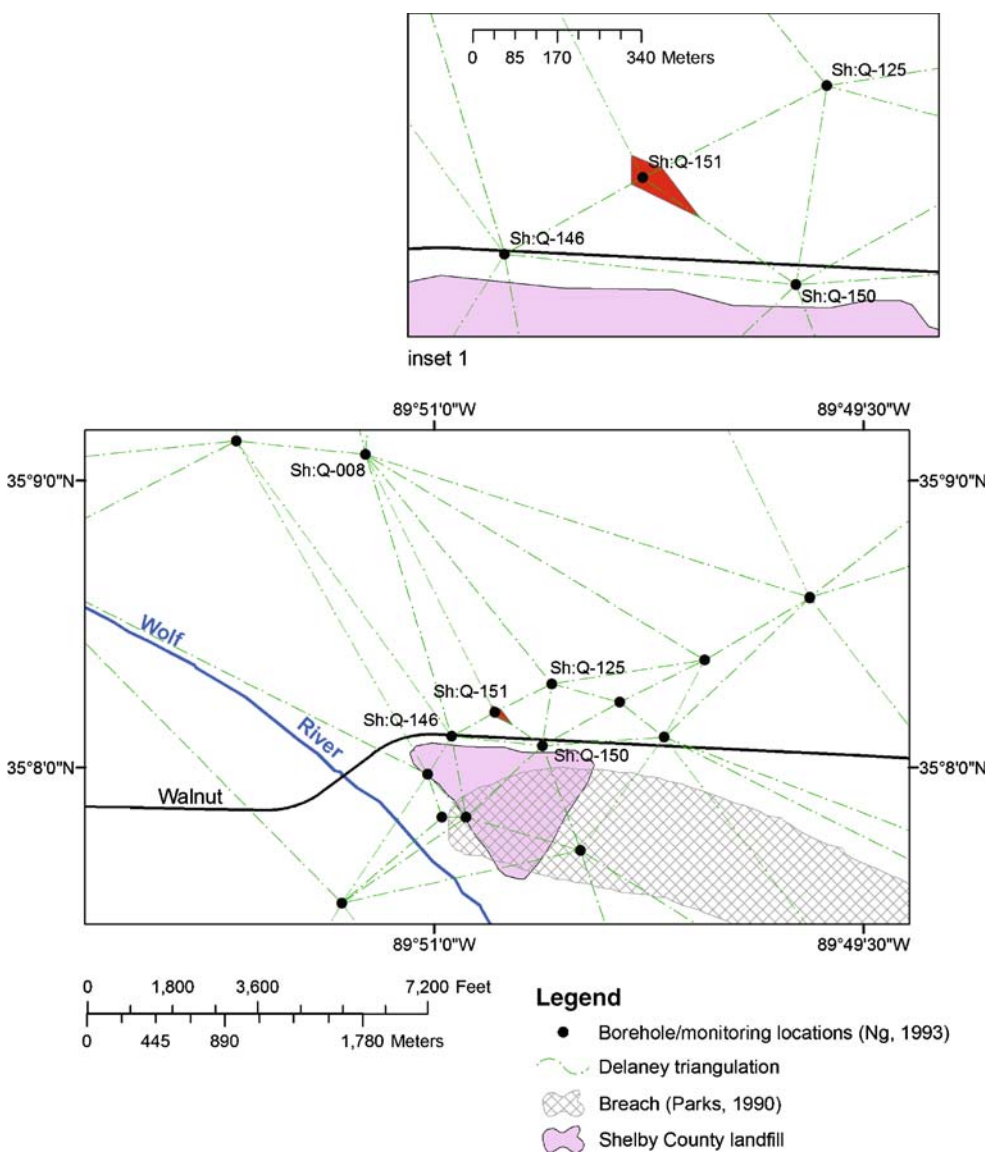


Fig. 6 Delaney triangulation delineation for boreholes used by Ng (1993) to interpolate the thickness of the aquitard separating the shallow aquifer from the Memphis aquifer. *Inset* represents an enlarged view of the aquitard breach mapped by Ng

 DOI 10.1007/s10040-008-0400-4

observation wells are screened within the Memphis aquifer. Wells Sh:Q-146 and Sh:Q-150 (Fig. 5) indicate thicknesses of aquitard of 11 and 2.5 m, respectively. In their cross-section, the thickness of the confining unit is drawn as an assumed linear reduction in thickness from wells Sh:Q-146 and Sh:Q-150 to Sh:Q-151.

More recent investigations at the Shelby Farms landfill site were conducted by Ng (1993), Gentry (1998), and Gentry et al. (2003), all of whom used numerical modeling studies to estimate the extent of the aquitard breach and groundwater flux to the Memphis aquifer. As part of Ng's work, the extent of the breach north of the landfill, indicated by well Sh:Q-151, was determined through interpolation of well log data using Delauney triangulation (Fig. 6). Delauney triangulation results in breach geometry connecting well Sh:Q-008 with wells Sh:Q-146, Sh:Q-151 and Sh:Q-150 forcing long, thin triangles, an artifact that can limit the ability of the triangulation network to represent local variation (Watson and Philip 1984). Gentry et al. (2003) used a genetic algorithm (GA) to estimate recharge to the Memphis aquifer through the breach north of the landfill, again focusing on the area adjacent to well Sh:Q-151. Their model incorporated aspects of Ng's (1993) numerical model. At specified recharge rates, areas of accretion through suspected thinning or absence of the confining clay were determined with calculated levels of probable occurrence. The resulting area of accretion, which varied in size depending on the recharge rate, was somewhat circular with well Sh:Q-151 forming the centroid.

Gentry et al. (2006a, b) installed more wells at the breach site as well as at several downgradient locations in the Memphis aquifer. They conducted hydraulic testing, sedimentological analyses, chemical and isotopic tracer studies, and further GA modeling to assess groundwater flow rates and processes through the Shelby Farms landfill breach. Although the additional boreholes constrain the extent of the breach and provide additional information regarding its origin, the shape was not further clarified by these efforts.

Seismic data acquisition and analysis

The area of seismic investigation focuses on the water-table depression encompassing well Sh:Q-151, as delineated by Bradley (1991) and Parks and Mirecki (1992) (Fig. 7). A large part of this area is used for crop production and, as a result, at times access to the area was limited. A pilot survey was used to determine if seismic reflection technology had the potential to depict the aquitard at shallow depths.

SH-wave (horizontally polarized) seismic reflection methods have been used to map shallow geologic features in unconsolidated, water-saturated sediments (Suyama et al. 1987; Hasbrouck 1991; Goforth and Hayward 1992; Harris et al. 2000; Young and Hoyos 2001). The choice of SH- as the preferred shear wave phase is based on the idea that SH- signals should be easier to identify because pure SH- energy reflects and refracts only as an SH-wave and, unlike P-waves (compressional wave) and SV-waves (vertically polarized shear wave), does not experience mode conversion. P-wave reflection data are highly influenced (both in quality and geologic significance) by

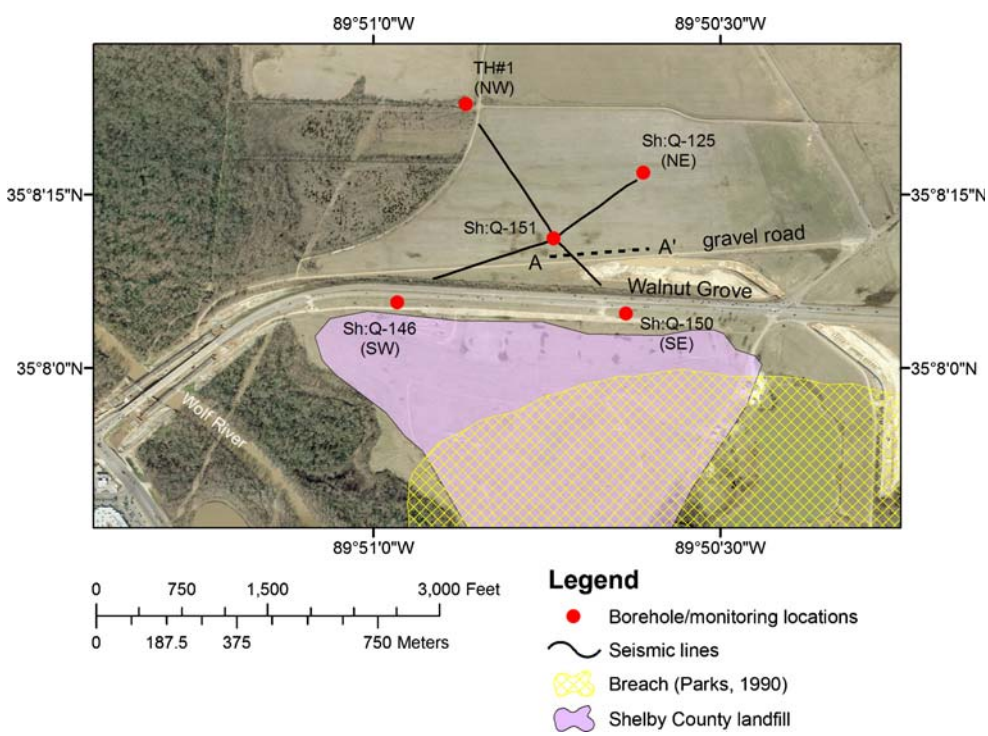


Fig. 7 Aerial photo of study area overlain by the three seismic survey transects: *A–A'*, *SE–NW* and *SW–NE*

 DOI 10.1007/s10040-008-0400-4

the depth of water saturation in near-surface materials. Because S-waves travel with the velocity of the sediment framework, they are not greatly affected by the degree of saturation, and often lead to more consistent, high-quality data in unconsolidated, water-saturated sediment sequences. Due to the small target size for many shallow reflection surveys, seismic resolution is frequently the most important consideration when choosing a survey method. Although S-waves are rarely observed in the same frequency range as P-waves, in the authors' experience with shallow surveys in the Mississippi Embayment, S-waves commonly have frequencies of 0.5–0.25 to those of P-waves. For seismic energy of the same frequency and because S-waves travel with lower velocities than P-waves, shear wavelengths are shorter and resolution is higher. The higher resolution is particularly evident in water-saturated, alluvial material where the P-wave velocity is regularly 5–10 times higher than the S-wave velocity. Shallow reflections on S-wave field records from the Shelby Farms area show dominant frequencies of 40–50 Hz. Reflection (from shot gathers), refraction (Cramer 2005), and downhole (University of Memphis) S-wave data sets were integrated to develop the velocity functions used in stacking the reflection data. From the frequency and velocity observations, the vertical resolution for the Shelby Farms site was calculated to be between 1.5 and 2.5 m.

The shear (S)-wave seismic method was chosen for the pilot survey based on its ability to provide high-resolution images of near-surface geology in unconsolidated, water-saturated sediments such as those present in the Mississippi Valley (Harris et al. 1998). In addition, a previous study utilizing S-wave reflection methods (Larsen et al. 2003b; Pell et al. 2005) in the Sheahan well field of central Memphis, provided a high-quality image of an erosional swale in the shallow subsurface. The pilot survey (A–A′) was conducted along the shoulder of a gravel access road immediately south of well Sh:Q-151 (Fig. 7). The survey was positioned to cross over areas where the aquitard was present (well Sh:Q-125 with an aquitard thickness of 6 m) to where it was absent near well Sh:Q-151. From prior experience, horizontally polarized geophones were spaced at 2-m intervals, the source for the shear waves was a 1.8-kg sledge hammer struck horizontally against a 10-kg metal I-beam and the reflection data

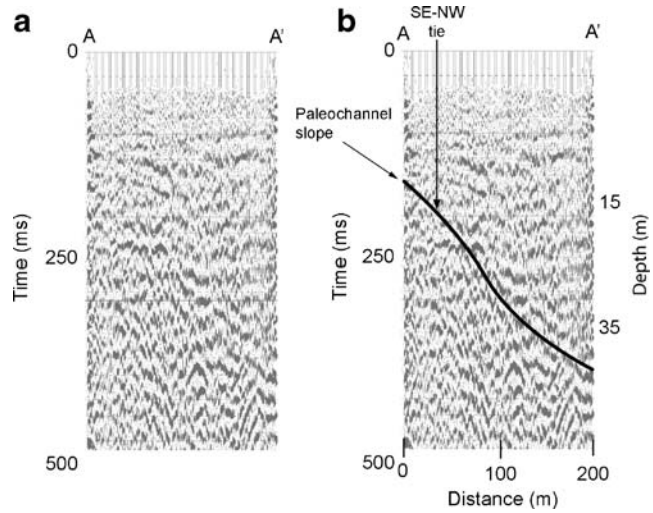


Fig. 8 Seismic profile of transect A–A′ **a** without interpretation and **b** with interpretation

were recorded on a 24-channel engineering seismograph and processed using a standard sequence for shallow CMP (common midpoint) seismic reflection data (i.e., Baker 1999; see Table 1). Data processing followed these steps: reformat to SEGY (Society of Exploration Geophysicists format Y), bad trace edit, first arrival muting, CMP (common-midpoint) sorting, bandpass filter (20–80 Hz), automatic gain control (200 ms window), velocity analysis, normal moveout correction (NMO), and developing the CMP stack (12-fold).

The 12-fold stacked seismic profile indicates a possible erosional structure into the Memphis aquifer with semi-coherent reflection energy, primarily in the 100–350 ms range (10–50 m deep), visible along the length of the line (Fig. 8). Based on the results of previous shallow S-wave seismic reflection profiling in Mississippi valley (Harris et al. 1998), this data set can be considered to be of low to medium quality. The Upper Claiborne confining unit was anticipated to be observed at the eastern margin of the line, then thin and become absent toward the western edge. An east-dipping feature was mapped ranging from approximately 15 m on the west end of the profile to nearly 40 m on the east end of the profile, however. The down-sloping contact is interpreted to be the top of the

Table 1 Seismic data acquisition parameters for pilot and full surveys

Field parameter	Survey line	
	Gravel road (A–A′)	SE–NW and SW–NE
Energy source	1.8-kg sledge hammer/I-beam (5 impacts)	1.8-kg sledge hammer/I-beam (5 impacts)
Source interval	2 m	3 m
Receiver	14-Hz horizontal geophones	14-Hz horizontal geophones
Receiver interval	2 m	3 m
Spread configuration	split spread	split spread
Recording system	Seistronix RAS 24	Seistronix RAS 25
Sample interval	0.25 ms	0.25 ms
Maximum fold	12 fold	12 fold
Field filters	Out	Out
Record length	500 ms	1,000 ms

 DOI 10.1007/s10040-008-0400-4

Memphis aquifer because the depth of the structure is well below the base of the confining unit interpolated from the four corner control points, boreholes TH#1, Sh:Q-125, Sh:Q-146, and Sh:Q-150. The structure resembles a paleo-erosional feature with horizontal reflections east of the feature boundary suggesting layered depositional fill of a channel. Although data quality was fair, the pilot survey illustrates the potential of seismic reflection to map the extent and possible orientation of the breach.

The full-scale survey was scheduled while the field was fallow. Two survey lines were chosen such that the SE–NW line followed the longitudinal orientation of the water table depression, the SW–NE line traversed the depression (Fig. 7), and the lines intersected at well Sh:Q-151. The NE and NW points were set at well Sh:Q-125 and borehole TH#1, respectively, both with geologic records that penetrated through the aquitard. The SE and SW points fall short of their intended control points, wells

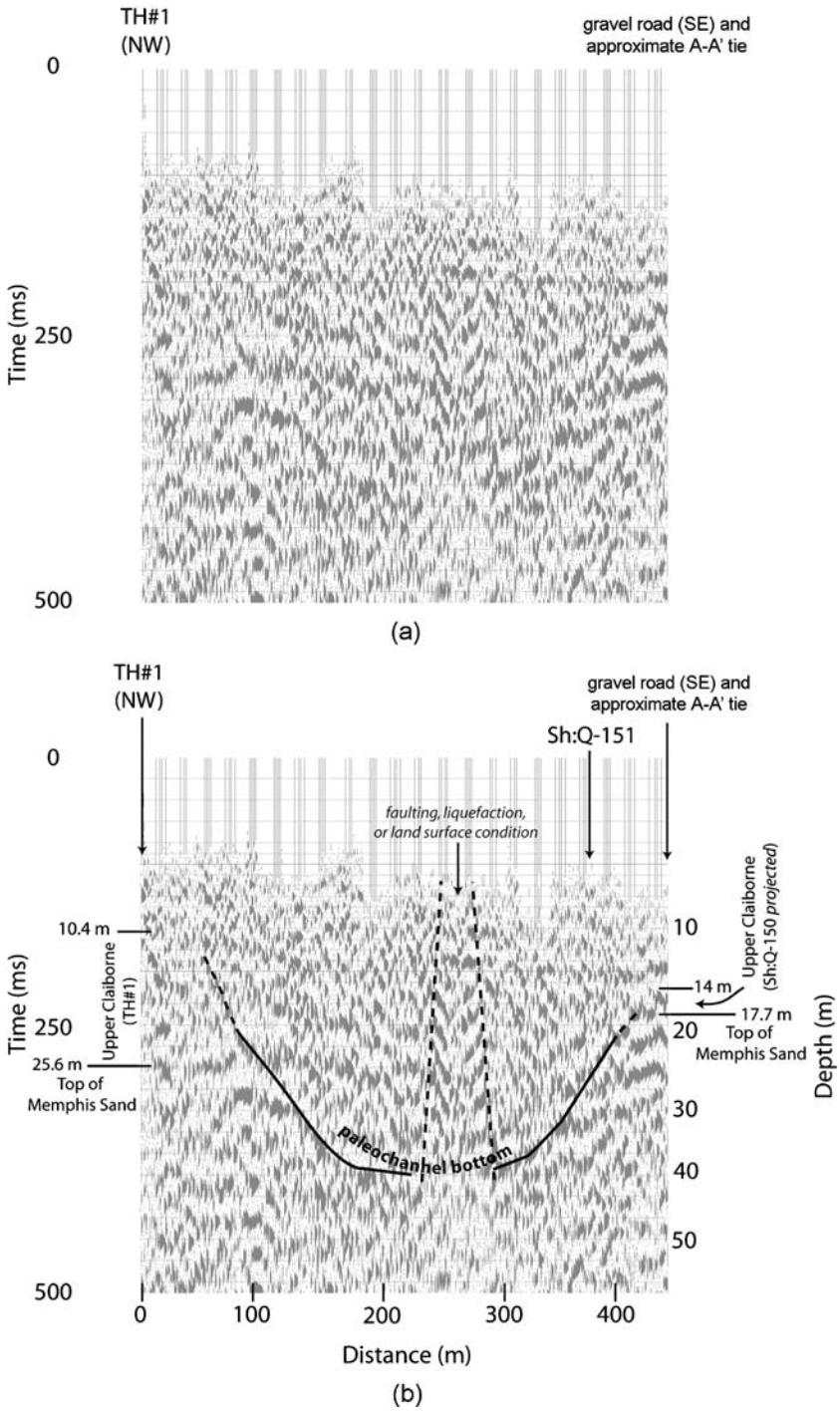


Fig. 9 Seismic profile of transect SE–NW **a** without interpretation and **b** with interpretation. *Dashed lines* indicate possible paleochannel delineation

 DOI 10.1007/s10040-008-0400-4

ShQ-150 and Sh:Q-146, respectively, because the wells lie on the south side of Walnut Grove Road, a divided four-lane thoroughfare. Thus, the southern portions of the survey lines are truncated prematurely north of Walnut Grove.

The field at the time of the seismic survey was moist after many consecutive weeks of periodic rainfall events. There was concern that the soft soil may allow for slippage of the I-beam seismic source thus reducing energy coupling. There was also concern that wind-induced surface noise and/or traffic noise would negatively influence data quality; however, noise monitoring during the survey indicated a minimal impact. The only change in seismic data acquisition or processing from the pilot survey to the full-scale survey was the use of a 3-m geophone interval (see Table 1). Although overall data quality is fair, well control proximal to the survey line end points allowed the top of the Memphis aquifer to be identified on the profiles with relatively good consistency.

The SE–NW line (Fig. 9) shows strong reflections near the SE termination and weaker reflections approaching the NW control point, borehole TH#1, indicating that a paleochannel feature truncates the Upper Claiborne deposits and uppermost Memphis Sand. Sloping reflec-

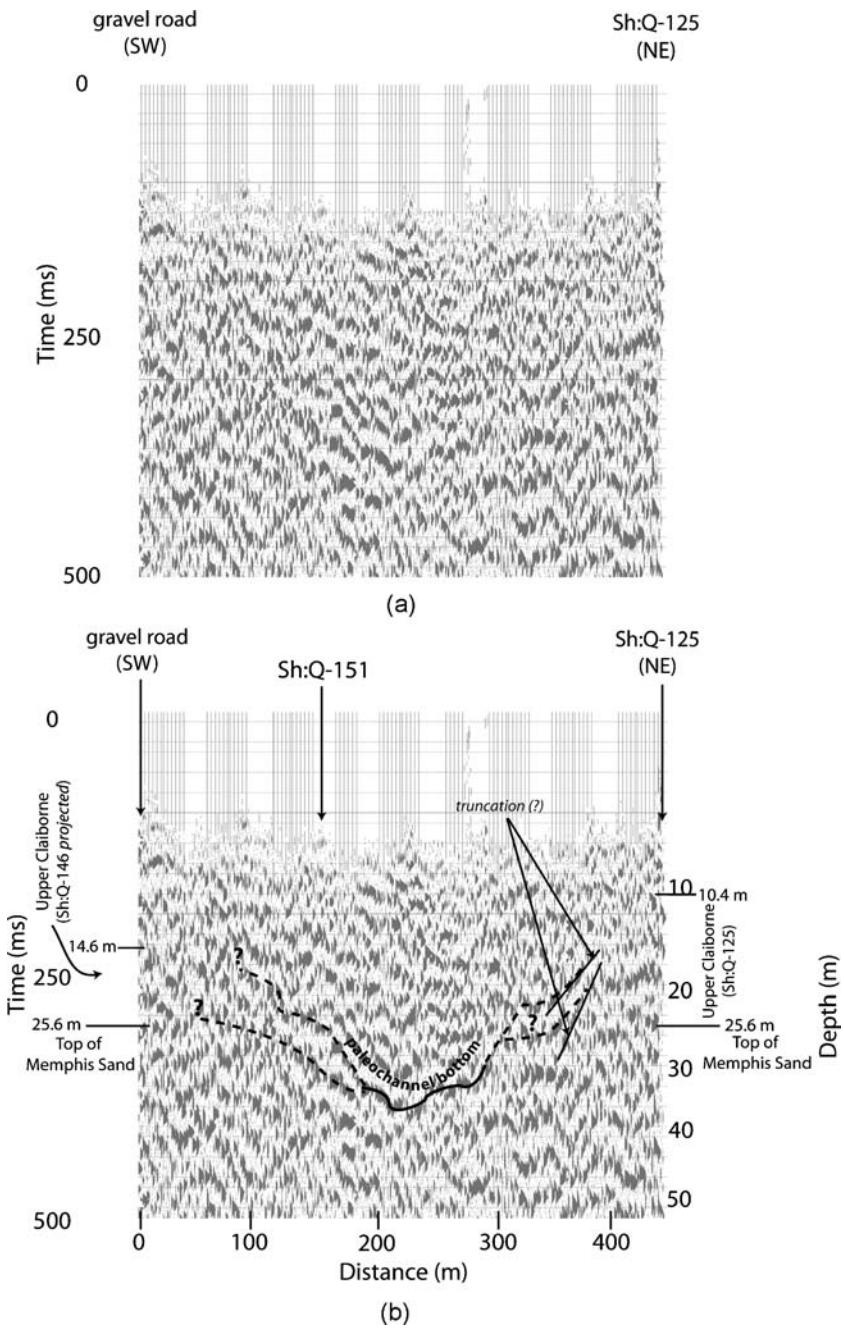


Fig. 10 Seismic profile of transect SW–NE **a** without interpretation and **b** with interpretation. *Dashed lines* indicate possible paleochannel delineation

 DOI 10.1007/s10040-008-0400-4

tions within the paleochannel follow the general slope of the channel sides and may indicate depositional layering, similar to that observed in the pilot survey. The paleochannel along this orientation is approximately 325 m wide and 30 m deep. An anomalous zone approximately 50 m wide and extending to depth is observed between 200 and 300 m SE of borehole TH#1. The presence of diffractions in this vertically oriented zone suggests a possible geologic structure such as a fault zone or liquefaction vent. Shallow faults (Velasco et al. 2005) and liquefaction (Broughton et al. 2001) have both been identified within the Wolf River floodplain.

The SW–NE line was expected to transect a suspected SE-NW oriented paleochannel or erosional scar; thus, a cross-sectional profile would be revealed by the seismic reflection survey. However, a paleochannel structure is more difficult to interpret in the SW–NE line (Fig. 10). The best well control for this line is at the NE point at well Sh:Q-125. The Upper Claiborne in Sh:Q-125 is identified from the gamma log by two closely spaced, strong gamma signals at 10 m and 19 m (see strong reflector, Fig. 10) followed by a gradual gamma signal decrease (transition) until reaching the Memphis Sand at approximately 25 m. The top of the Memphis Sand in the profile is indicated by a strong reflection signal, then truncated approximately 50 m SW of well Sh:Q-125. Following the paleochannel bank is difficult to the SW, yet the base of the channel is estimated to be at 35 or 40 m below ground surface, thus corroborating the findings from the SE–NW line.

Mapping the paleochannel extent, dimensions and orientation with the pilot survey A–A′, a NW-SE oriented paleochannel is interpreted (Fig. 11), seemingly reversed from the hypothesized profile. The pilot survey begins just outside the western or southern margin of the paleo-erosional feature and terminates within the aquitard breach. The suggested base of the feature mapped in the pilot survey closely approximates the depth mapped in the SE–NW profile.

Discussion

The results of the three seismic surveys have better defined the extent, orientation, and origin of the breach structure north of the Shelby Farms landfill, Memphis, Tennessee. The three seismic lines indicate a paleochannel structure incised through the Upper Claiborne strata and into the Memphis Sand. Drilling returns from borehole Sh:Q-151 (Parks and Mirecki 1992) and cores from adjacent boreholes (Gentry et al. 2006a, b) indicate that the paleochannel feature is filled with fine to medium sand, although some gravel horizons may exist. The paleochannel is approximately 300 m wide, 35–40 m deep and oriented in a SE–NW direction. The delineation of the breach by Ng (1993) using Delauney triangulation was much smaller than the interpreted paleochannel, yet Ng's mapping did indicate a SE–NW orientation. Although the S-wave seismic data quality was fair, seismic reflection in combination with well control and water-level data constrain the breach extent and clarify its fluvial origin.

The lateral continuity of the paleochannel cannot be assessed with the present survey data. Presence of clay in three surrounding boreholes toward the NW section suggests a possible termination; this inference is supported

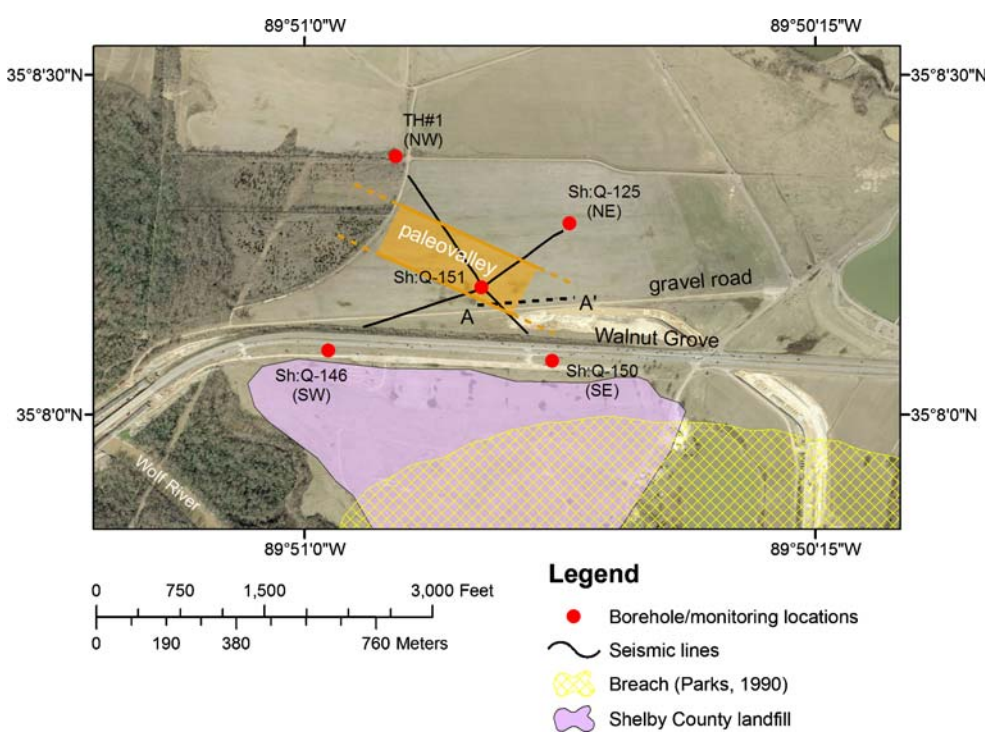


Fig. 11 Location, extent and orientation of a paleochannel forming a breach in the aquitard separating the shallow aquifer from the Memphis aquifer. *Dashing* indicates probable extension of the paleochannel

 DOI 10.1007/s10040-008-0400-4

further by substantially different water levels in the alluvial and Memphis aquifers (Parks and Mirecki 1992; Gentry et al. 2006a, b). The lack of borehole control and similar water levels in the two aquifers to the SE of borehole Sh:Q-151 suggest that the breach extends or other breaches exist in this direction.

A possible explanation for the low signal-to-noise ratio of the S-wave data is a subsurface with laterally discontinuous units (such as a buried fluvial channel) that would not return strong reflections. More seismic reflection work in the area is required to more fully map the dimensions and path of the paleochannel. Thorough testing of various seismic energy sources in the area, including weight drop, projectile and vibratory sources that generate compressional and shear seismic waves, might improve future survey results and reduce interpretation error. Because low-fold, hammer-impact seismic reflection data commonly have signal-to-noise ratios that are not ideal, only basic processing steps were employed in order to minimize processing artifacts (and maximize interpretation confidence) produced by "over-processing" noisy data. Likewise, migration was not applied as it is not a common step used in processing shallow seismic reflection data (Black et al. 1994). The steep dips on the interpreted paleochannel boundaries are a result of high vertical exaggerations (8–12X) on the plotted seismic sections (Figs. 8, 9, and 10). Actual apparent dips are small, ranging from 6–9°, and migration is unlikely to affect the interpretation.

Beyond the Shelby Farms site, Parks (1990) delineated a number of aquitard breaches that vary in size and shape throughout Shelby County using primarily borehole data. With long-term water production from the Memphis aquifer resulting in a gradient reversal between water levels in it and the unconfined aquifer above, the aquitard breaches will continue to play a large role in the quality and supply of water to the Memphis aquifer. To accurately quantify the water transfer through these breaches in the aquitard and take proactive measures to monitor if not limit human activity in proximity to them, it is imperative that the extent, the origin (e.g., paleochannel, fault, liquefaction, etc.), and the spatial distribution be determined.

Conclusions

A pilot S-wave reflection seismic survey and two full-scale S-wave reflection seismic transects were used to define the extent and origin of a breach through the Upper Claiborne confining at Shelby Farms in Memphis, Tennessee. Previous borehole, hydraulic, and sedimentological studies had established the presence of a breach through the Upper Claiborne confining unit at the site; however, the extent and origin of the breach were still unknown. Although the data quality for the surveys was low to medium, a paleochannel feature that incises through the confining unit and into the upper Memphis Sand was identified. The crossing transects allow determination of a SE–NW trending discontinuity in the fine-grained confining unit strata, which correlates well with stratigraphic control from borehole logs. The results indicate that shallow S-wave reflection seismic methods are useful for detailed characterization of breaches through confining units, especially where suitable borehole log and hydraulic data are available.

Acknowledgements We wish to acknowledge the contributions by the following entities and individuals: The University of Memphis' Ground Water Institute for funding; Ted Fox, Shelby County Director of Public Works, and Steve Satterfield, Shelby Farms superintendent, for site access; and Jack Carmichael, USGS senior hydrologist, for editorial comments and drilling data.

References

Baker GS (1999) Processing near-surface seismic-reflection data: a primer, (Course Notes Series No. 9). Society of Exploration Geophysicists, Tulsa, OK

Bell EA, Nyman DJ (1968) Flow pattern and related chemical quality of ground water in the "500-foot" sand in the Memphis area, Tennessee. US Geol Surv Water Suppl Pap 1853, 27 pp

Black RA, Steeples DW, Miller RD (1994) Migration of shallow seismic reflection data. Geophysics 59:402–410

Bradley MW (1988) Construction, geologic, and ground-water data for observation wells near the Shelby County landfill, Memphis, Tennessee. U.S. Geol Surv Open File Rep 88-486, 32 pp

Bradley MW (1991) Ground-water hydrology and the effects of vertical leakage and leachate migration on ground-water quality near the Shelby County landfill, Memphis, Tennessee. US Geol Surv Water Resour Invest Rep 90-4075, 42 pp

Bradley E, Phatare PN (1989) Paloehydrology affecting recharge to overexploited semiconfined aquifers in the Mehsana area, Hujarat State, India. J Hydrol 108:309–322

Brahana JV, Broshears RE (2001) Hydrogeology and ground-water flow in the Memphis and Fort Pillow aquifers in the Memphis area, Tennessee. US Geol Surv Water Resour Invest Report 89-4131, 56 pp

Broughton AT, Van Arsdale RB, Broughton JH (2001) Liquefaction susceptibility mapping in the City of Memphis and Shelby County, Tennessee. Eng Geol 62:207–222

Carmichael JK, Parks WS, Kingsbury JA, Ladd DE (1997) Hydrogeology and ground-water quality at the Naval Support Activity Memphis, near Millington, Tennessee. US Geol Surv Water Resour Invest Rep 97-4158:1–64

Cramer C (2005) Geotech. In: Memphis-Shelby County Hazard Mapping Project Site Response Data. Center for Earthquake Research and Information, Memphis, TN. http://www.ceri.memphis.edu/geotech/. Cited 15 December 2005

Criner JH, Sun P-CP, Nyman DJ (1964) Hydrology of aquifer systems in the Memphis area, Tennessee. US Geol Surv Water Suppl Pap 1779-O, 53 pp

Cushing EM, Boswell EH, Speer PR, Hosman RL (1964) Water resources of the Mississippi embayment: availability of water in the Mississippi embayment. US Geol Surv Prof Pap 448-A, 13 pp

Gentry RW (1998) The development of a genetic algorithm technique to solve the inverse ground water problem associated with accretion to a semi-confined aquifer. PhD Thesis, University of Memphis, USA

Gentry RW, Larsen D, Ivey SS (2003) Efficacy of genetic algorithm to investigate small scale aquitard leakage. J Hydraul Eng 129:527–535

Gentry RW, Ku T-L, Luo S, Todd V, Larsen D, McCarthy JF (2006a) Resolving Aquifer Behavior Near a focused recharge feature based upon synoptic wellfield hydrogeochemical tracer results. J Hydrol 323:387–403

Gentry RW, McKay L, Thonnard N, Anderson JL, Larsen D, Carmichael JK, Solomon K (2006b) Novel techniques for

 DOI 10.1007/s10040-008-0400-4

investigating recharge to the Memphis aquifer. American Water Works Association, Denver, CO, 97 pp
Gerber RE, Howard KW (1996) Evidence for recent groundwater flow through Late Wisconsinan till near Toronto, Ontario. Can Geotech J 33:538–555
Goforth T, Hayward C (1992) Seismic reflection investigation of a bedrock surface buried under alluvium. Geophysics 57:1217–1227
Graham DD, Parks WS (1986) Potential leakage among principal aquifers in the Memphis area, Tennessee. US Geol Surv Water Resour Invest Rep 85-4295, 45 pp
Hammer P, Clowes RM, Ramachandran K (2004) Seismic reflection imaging of thin, kimberlite dykes and sills: exploration and deposit characterization of the Snap Lake dyke, Canada. Lithos 76:359–367
Harris JB, Berman SA, Beard WC, Street RL (1998) Shallow seismic reflection investigations of neotectonic activity in the Lower Mississippi Valley. Paper presented at the 68th Annual International Meeting of the Society of Exploration Geophysicists, New Orleans, LA, 14–18 September 1998
Harris JB, Miller RD, Xia J, Hunter JA, Park CB, Laflen DR, Good RL (2000) Near-surface shear wave reflection surveys in the Fraser River delta, BC Canada. 70th Annual International Meeting of the Society of Exploration Geophysicists, SEG, Tulsa, OK, extended abstracts, pp 1327–1330
Hasbrouck WP (1991) Four shallow-depth, shear-wave feasibility studies. Geophysics 56:1875–1885
Ivey SS (2003) The development of a combined age distribution and inverse technique to identify wellhead protection zones for a semi-confined aquifer. PhD Thesis, University of Memphis, USA
Jensen JB, Kuijpers A, Bennike O, Laier T, Werner F (2002) New geological aspects for freshwater seepage and formation in Eckernforde Bay, western Baltic. Cont Shelf Res 22:2159–2173
Larsen D, Gentry RW, Solomon DK (2003a) The geochemistry and mixing of leakage in a semi-confined aquifer at a municipal well field. Appl Geochem 18:1043–1063
Larsen D, Gentry RW, Ivey S, Solomon DK, Harris JB (2003b) Groundwater leakage through a confining unit beneath a municipal well field, Memphis, Tennessee, USA. In: Schulz HD, Hadeler A (eds) Geochemical processes in soil and groundwater. Wiley, Berlin
Larsen D, Spann EW, McClure DM, Gentry R (2003c) Selected sediment properties of Quaternary deposits, Shelby County, Tennessee: implications for contaminant hydrogeology and Quaternary stratigraphy. Southeast Geol 42:99–110
Martin PJ, Frind EO (1998) Modeling a complex multi-aquifer system: the Waterloo Moraine. Ground Water 36:679–690
Merey C, Miller RD, Ticken EJ, Lewis JS (1992) Hydrogeologic characterization using a shallow seismic reflection survey at Ford Ord, California. Soc Explor Geophys 1:370–373
Miller RD, Xia J, Deane JW, Anderson JM, Laflen DR, Acker PM, Brohammer MC (1994) High resolution seismic reflection survey to image the top and bottom of a shallow clay layer at the Memphis Defense Depot, Memphis, Tennessee. US Army Corps Eng Open File Rep 94–18, 17 pp
Miller RD, Xia J, Park CB, Ivanov JM (1999) Multichannel analysis of surface waves to map bedrock. The Leading Edge 18(12):1392–1396
Ng YG (1993) Ground water modeling at the Shelby County landfill, Memphis, Tennessee. MSc Thesis, University of Memphis, USA
Parks WS (1990) Hydrogeology and preliminary assessment of the potential for contamination of the Memphis aquifer in the Memphis area, Tennessee. US Geol Surv Water Resour Invest Rep 90-4092, 39 pp
Parks WS, Carmichael JK (1990) Geology and ground-water resources of the Memphis Sand in western Tennessee. US Geol Surv Water Resour Invest Rep 88-4182, 30 pp
Parks WS, Mirecki JE (1992) Hydrogeology, ground-water quality, and potential for water-supply contamination near the Shelby County landfill in Memphis, Tennessee. US Geol Surv Water Resour Invest Rep 91-4173, 79 pp
Parks WS, Mirecki JE, Kingsbury JA (1995) Hydrogeology, ground-water quality, and source of ground water causing water-quality changes in the Davis well field at Memphis, Tennessee. US Geol Surv Water Resour Invest Rep 94-4212, 58 pp
Pell AB, Harris JB, Waldron BA (2005) Seismic reflection imaging of suspected "windows" in the upper confining unit of the Memphis (Tennessee) Aquifer. Paper presented at the 18th Annual Meeting, Symposium on the Application of Geophysics to Engineering and Environmental Problems, Atlanta, GA, 3–7 April 2005
Sharpe DR, Pugin A, Pullan SE, Gorrell G (2003) Application of seismic stratigraphy and sedimentology to regional hydrogeological investigations: an example from Oak Ridges Moraine, southern Ontario, Canada. Can Geotech J 40:711–730
Shtivelman V, Goldman M (2000) Integration of shallow reflection seismics and time domain electromagnetics for detailed study of the coastal aquifer in the Nitzanim area of Israel. J Appl Geophys 44:197–215
Suyama K, Imai T, Ohtomo H, Ohta K, Takahashi T (1987) Delineation of structures in alluvium and diluvium using SH-wave reflection and VSP methods. In: Shear-wave exploration, vol 1. Society of Exploration Geophysicists, Tulsa, OK, pp 165–179
Timms W, Acworth RI (2002) Origin, lithology and weathering characteristics of upper tertiary-quaternary clay aquitard units on the Lower Murrumbidgee alluvial fan. Aust J Earth Sci 49:525–537
Van Arsdale RB, TenBrink RK (2000) Late Cretaceous and Cenozoic geology of the New Madrid seismic zone. Seismol Soc Am Bull 90:345–356
van Dijk DC, Talsma T (1964) Soils of portion of the Coleambally Irrigation Area, NSW. CSIRO Soils and Landuse Series 47, CISRO, Clayton South, Australia
Velasco M, Van Arsdale R, Waldron B, Harris J, Cox R (2005) Quaternary faulting beneath Memphis, Tennessee. Seismol Res Lett 776:598–614
Watson DF, Philip GM (1984) Triangle based interpolation. Math Geol 16:779–795
Young RA, Hoyos J (2001) Near-surface, SH-wave surveys in unconsolidated, alluvial sediments. The Leading Edge 20:936–948
Zuber A, Weise SM, Osenbruck K, Pajnowska H, Grabezak J (2000) Age and recharge pattern of water in the Oligocene of the Mazovian basin (Poland) as indicated by environmental tracers. J Hydrol 233:174–188

 DOI 10.1007/s10040-008-0400-4

MEMPHIS LIGHT, GAS AND WATER DIVISION

JERRY R. COLLINS, JR., P.E.
President and CEO

November 9, 2009

Mr. Wain Gaskins
City Engineer Dept.
City of Memphis
125 N Main St., Rm 644
Memphis TN 38103

Dear Mr. Gaskins:

As you know, Memphis is world class when it comes to high quality drinking water. Anything that threatens or has the potential to threaten this resource has to be taken seriously and carefully investigated. MLGW's customers, my staff, and MLGW's Board of Commissioners have called to my attention a potential threat to Memphis and MLGW's greatest natural resource, the Memphis aquifer.

The proposed road in Shelby Farms Park crossing west of Farm Road is located in an area that has been identified in studies as having a direct connection to the Memphis aquifer through hydro geological windows. Dr. Jerry Lee Anderson, Director of the Ground Water Institute at the University of Memphis, has carefully investigated this issue and has made four recommendations for the design, construction, and operation of the proposed road to mitigate any potential effects. I have provided a copy of Dr. Anderson's entire letter for your engineering staff's review. Briefly, Dr. Anderson's recommendations are as follows:

1. A total-containment policy should 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.

2. No-fill material should be removed from the Wolf River flood plain that would potentially expose the upper Memphis aquifer.

3. A monitoring program should 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 would involve periodic sampling of the existing well network for those constituents identified in the Parks and Mirecki report. This information should serve well to evaluate the potential for any spill contents to reach water supplies.

P. O. BOX 430 MEMPHIS, TENNESSEE 38101-0430 TELEPHONE (901) 528-4470 FAX (901) 528-4321

4. All discharge from the proposed road should 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.

On behalf of MLGW's customers, staff and Board of Commissioners, I would like to ask you to take Dr. Anderson's recommendations into consideration in the design, construction, and operation phases of this project. If clarification is needed on any issue or you want to discuss this further, please do not hesitate to contact me and I will arrange for my staff or Dr. Anderson to meet with you or your staff at your convenience.

Thank you for considering MLGW's customers and Board of Commissioners' request.

Sincerely,

Jerry R. Collins, Jr.

Ground Water Institute

300 Engineering Admin Bldg
Memphis, Tennessee 38152-3170

THE UNIVERSITY OF
MEMPHIS

Office: 901.678.3062
Fax: 901.678.3078

September 9, 2009

Dr. Fred Von Hofe
MLGW Water Quality Laboratory
3937 Grandview Ave
Memphis, TN 38111

Dear Fred;

The staff of the Ground Water Institute was asked to provide a professional opinion regarding the questions that you posed concerning, in general, the impacts of infrastructure activities in the vicinity of Shelby Farms on the quality of water from the Memphis aquifer. The four issues to be addressed are:

1. The actual construction of the proposed roadway crossing west of Farm Road;
2. Runoff from the roadway finding its way into the hydrogeologic window in the vicinity of the closed Shelby Farms landfill and traveling to McCord or Sheahan Pumping Stations;
3. Potential contamination from a major spill on the road way finding its way into the hydrogeologic window and traveling to McCord or Sheahan Pumping Stations;
4. Contamination from major infrastructure improvements such as sewer lines, gas lines, etc.

In general, all of the issues can be succinctly rephrased as "What impacts, if any, will the current and planned activities regarding addition of new infrastructure improvements in the western part of Shelby Farms, namely, the construction of the new road and associated sewer lines crossing west of Farm Road have on the future operation of Sheahan and McCord Pumping stations.

We believe there should be not impacts on the operations of the McCord Pumping Station because it is topographically and geohydrologically upgradient from these activities. The location of the two routes should not even be close to the 10-year capture zone of the McCord Pumping Station. Consequently, only the probable impacts on the Sheahan Pumping Station will be addressed.

Background Information:

In 1986-1987 an investigation of potential leakage of leachate from the Shelby County landfill near Memphis was conducted for the Shelby County Department of Public Works and the Tennessee Department of Public Health and Environment (now Tennessee Department of Environment and Conservation (TDEC)), Division of Solid Waste Management by the United States Geological Survey (USGS). The migration of leachate from the landfill to the shallow alluvial aquifer system and the potential leakage to the confined Memphis aquifer was investigated. Observation wells were installed and water samples were collected to define the potential leachate occurrence.

The investigations determined that a depression or a lowering in the water table within the shallow alluvial aquifer exists north of the now-closed Shelby County landfill at Shelby Farms (Bradley, 1991). Water surface levels within the cone of depression were as much as 14 feet lower than those of the adjacent Wolf River. Recharge from the river and leachate from the landfill was found to be moving toward the depression. The presence of leachate within the shallow aquifer was confirmed from determinations of dissolved solids and dissolved chloride concentrations and comparison with areas upgradient from the affected zone. Additionally, dissolved solids concentrations in water samples from the upper Memphis aquifer near the landfill were higher than in samples from the Memphis aquifer in unaffected areas. Leakage from the alluvial aquifer to the Memphis aquifer was confirmed from chemical analyses and hydraulic head data. Tritium analysis of water from the upper Memphis aquifer

also indicated the presence of modern water. The report found that vertical migration of ground water could transmit leachate down to the Memphis aquifer. The presence of contamination of the alluvial aquifer was confirmed, but chemical data did not demonstrate unequivocally the occurrence of leachate in the Memphis aquifer in this report (Bradley, 1991). This report was inconclusive regarding the presence of contamination in the Memphis aquifer, but strongly indicated leachate movement from the landfill and potential movement of leachate from the landfill to the upper portion of the Memphis aquifer.

Subsequent to the Bradley report in 1991 and as a result of previous findings, the USGS conducted an additional study of the area. This study (Parks and Mirecki, 1992) was conducted in cooperation with the Shelby County Department of Public Works from 1989-1991 to further investigate the hydrogeology and ground water quality specific to the Shelby County landfill in east Memphis. Additional wells were installed and interpretation of the hydrogeologic data again indicated that the confining unit was thin or absent just north of the landfill. A water table map of the landfill vicinity confirmed the existence of a depression in the water table north and northeast of the landfill. Additionally, a map of the potentiometric surface of the Memphis aquifer showed that water levels were anomalously high just north of the landfill, indicating downward leakage of water from the alluvial aquifer to the Memphis aquifer. Analysis of the water quality data for major and trace inorganic constitutes and nutrients confirmed that leachate from the landfill had migrated northeastward in the alluvial aquifer toward the depression in the water table and that contaminants in the alluvial aquifer had migrated downward into the Memphis aquifer. Concentrations of selected constituents in the leachate plume were 2 to 20 times above background concentrations. The major and trace constituents that best characterized the plume were total organic carbon, chloride, dissolved solids, iron, ammonia nitrogen, calcium, sodium, iodide, barium, strontium, boron, and cadmium. The report indicated that several of these contaminants were also found in the Memphis aquifer wells, namely, dissolved solids, calcium, sodium, and possibly ammonia nitrogen, chloride, barium, and strontium. A companion paper by Mirecki and Parks (1994) demonstrated that leachate components in the upper Memphis aquifer could be as much as 37% by volume. The distribution of halogenated alkanes (specifically dichlorodifluoromethane and trichlorofluoromethane) and halogenated alkenes (specifically 1, 2-trans-dichloroethene and vinyl chloride) in samples from wells screened in both the alluvial and Memphis aquifers were similar to the distribution of major and trace inorganic constituents that characterized the leachate plume. The report indicated that the ground water supply most susceptible to this contamination from the Shelby County landfill was the Sheahan well field. No mention was made of pesticides or herbicides that were in use due to the agricultural practices in the immediate vicinity of the depression or "window". It was noted that the Sheahan well field is approximately 5 miles west and downgradient from the landfill in the direction of the groundwater flow. Using an estimated groundwater velocity of 0.5 to 1.5 feet per day in the Memphis aquifer, it was calculated to take from 50 to 150 years for the ground water to travel from the Shelby County landfill to the Sheahan well field. The authors of the report concluded that given the time and distance of the transport, any contaminants in the ground water would not likely persist to reach this well field because of the effects of various physical, chemical and biological processes, including dilution and adsorption.

To further evaluate the potential water quality threats presented by the window north of the Shelby County landfill, Ng (1993) conducted a numerical model study of the ground water flow in the vicinity of the Shelby County landfill. His findings are summarized below. The model incorporated three layers and a 500,000 ft^2 hydrogeologic window between the alluvial aquifer and the Memphis aquifer north of Shelby County landfill. The transient MODFLOW model closely reproduced the measured 1989 water levels. Simulated flows in layer 1 (alluvial aquifer) was primarily towards the window located north of the disposal site. Whereas, simulated flows in layer 2 (Memphis aquifer) was westerly towards the Sheahan well field. The sensitivity analysis of the model indicated that the concept of a relatively impermeable confining unit separating two distinct aquifers was invalid; thus, demonstrating a numerical basis for the window. Results from particle tracking using MODPATH and MODPLOT

indicated the travel time of a particle flowing from the edge of the landfill to the window to be about 2 years. The penetration time through the window was less than 1 year. The travel time from the window to the Sheahan well field was approximately 146 years.

Gentry, (1998) and Gentry et al. (2001; 2003), investigated the use of a genetic algorithm (GA) to determine the flux or flow through the window at the Shelby County landfill. A genetic algorithm (GA) technique was utilized to locate the area of accretion recharge to a semi-confined aquifer and to determine the flux through the probable location of the window. Gentry (1998) determined the flux entering the probable location of the window was about 442,875 ft^3/day or a recharge rate at the window of 0.8 ft/day or greater. However, Gentry et al. (2003) clarified that the GA model cannot uniquely determine the recharge rate without further spatial constraints on the extent of the window location.

Gentry et al. (2006), through a detailed hydrogeologic and tracer study of the study in the vicinity of the Shelby Farms landfill site funded by the American Water Works Association Research Foundation (AwwaRF), further investigated recharge through the hydrogeologic window. Their hydrostratigraphic studies further constrained the size of the window, although clear boundaries could not be constructed. Hydraulic data obtained through grain-size analysis and head levels were used to calculate vertical groundwater velocities of 0.3 to 1.5 ft/day, consistent with a vertical travel time of less than a year estimated by Ng (1993). However, hydraulic data obtained from well tests produced lower hydraulic conductivity values and resulting vertical velocities between 0.002 and 0.015 ft/day. Tritium and helium-3 data yielded recharge rates of 0.003 to 0.013, similar to those of the field hydraulic data. These latter data suggest vertical flux rates approximately 2 orders of magnitude less than that of Ng (1993) and Gentry (1998). However, considering the modeling results of Gentry et al. (2003), they point to a larger window area, consistent with the multiple window hypotheses of Gentry et al. (2006). Tritium/Helium-3 based Darcy velocities between the window and a down gradient site yielded values between 0.2 and 3.6 ft/d, which are higher than velocities obtained from well test data, but are within the range utilized by Parks and Mirecki (1992) in calculating travel time from the Shelby Farms landfill to the Sheahan well field. Water quality data from the Gentry et al. (2006) report extend the influence of leachate in the Memphis aquifer to depths in excess of 200 ft below land surface and 3,600 ft downgradient from the window site.

Most recently, Waldron et al (2009) mapped the aquitard breach north of the Shelby County landfill using seismic reflection. A pilot S-wave reflection seismic survey and two full-scale S-wave seismic reflection transects were used to define the extent and origin of the breach through the Upper Claiborne confining unit at the site. The data quality of the survey was low to medium, but evidence of a 1,100 ft-wide, 35-foot deep paleochannel feature that incised through the confining unit and into the upper Memphis Sand was identified. The crossing transect allowed for the determination of a SE-NW trending discontinuity in the fine-grained confining unit strata which correlated well with the stratigraphic control from borehole logs.

Summary and Conclusions:

With the above information provided as background, there is very little doubt as to the existence of a "window" or vertical leakage path in the vicinity of the area north of the Shelby County landfill. Even with all of the attention given to the size and location, there still remains a doubt as to the extents of the breach or paleochannel. What is known is that the axis of the paleochannel extends from the SE to the NW. It still remains a question as to how far northwest it extends or whether other window features are present in the area. Certainly it could extend and cross the centerline of the proposed route across Shelby Farms. Since the extents of the breach, i.e. width, depths, and length, are not well defined; it would not be in the best interest of protecting the integrity of the Memphis aquifer to allow any construction that would lower the grade of the floodplain. Such construction activities could possibly, depending on depth of excavation, expose the upper part of the Memphis aquifer to direct

contamination from anthropogenic activities and any spill, if not contained on the roadway, could empty directly onto the Memphis aquifer.

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. Gentry et al. (2006) has already identified landfill leachate entering into the Memphis aquifer deeper and farther than previously mapped. Of course, any hazardous or chemical material spill on the proposed route in the vicinity of the crossing has a chance of making its way into the existing "window". Bradley (1991) and Waldron (2005) have stated that the Wolf River loses water to the alluvial aquifer proximal to the landfill. Simply capturing road runoff and discharging it westward to Wolf River will not suffice. Road runoff should be discharged further downstream, again away from the present cone of depression centered on the breach. Also, the presence of the new sewer line in the vicinity of the window presents the same dilemma. It seems that no matter how well one tries try to seal sewer line junctions, the possibility of exfiltration from the pipes still exists.

The next question that subsequently arises is "would these sources of additional contamination pose an additional threat to the Sheahan well field?" Parks and Mirecki (1992) indicated that due to the probable retardation and degradation processes during ground-water flow in the Memphis aquifer and the 150-year travel time for leachate from the Shelby County landfill to reach the Sheahan pumping station, the contamination at Shelby Farms was unlikely to cause any problems at production wells. It seems that the addition of any hazard or chemical material from a spill on the route or due to sewer line leakage would be answered the same way. However, this would be true for a substance that would be subject to decomposition, degradation, and/or absorption. Yet, if a substance behaves in a chemically conservative manner (such as MTBE or barium, which are less susceptible to retardation or degradation), then it might very well reach the Sheahan well field. Currently there are no downgradient observations wells in the Memphis aquifer beyond those installed during the AwwaRF study that are available to allow one to monitor the current movement of the known contaminants in the upper Memphis aquifer. An observation well just east of the Wolf River and northwest of the landfill and a second observation well on the west side of Wolf River towards the Sheahan well field would serve as early warning if a contaminant plume is making progress towards Sheahan. Also, through monitoring of existing and additional down gradient wells one should be able to determine if any retardation or degradation processes are affecting leachate concentrations or other contaminants that could later be introduced.

Recommendations:

Given that much is still unknown regarding the ultimate impact of the leachate on the Memphis aquifer and water supplies in the Sheahan well field, any possible introduction of additional contaminants should be viewed in the same light. Therefore, the following recommendations are provided:

1. The true extent of the window or breach should be defined. The breach is anticipated to be larger than what has presently been mapped by Waldron et al. (2009). A combination of geophysical techniques with good well control would be needed to fully map the breach. Recent mapping of the aquitard proximal to the AgriCenter by Waldron and Magnani in 2006 has refined the seismic reflection technique resulting in greatly improved data quality. Knowing the extent of the breach will improve estimates of leakage potential and time of travel and provide planners valuable information that might impact construction such as reducing or eliminating topsoil removal.
2. A total-containment policy should 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 grits 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.

3. No fill material should be removed from the Wolf River floodplain that would potentially expose the upper Memphis aquifer.
4. An extensive monitoring program should begin to evaluate the downgradient extent of the 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 for those constituents identified in the Parks and Mirecki report. This information should serve well to evaluate the potential for any spill contents to reach water supplies.
5. Two additional observations wells should be constructed further downgradient of the breach to monitor the movement of the plume and assist in the determination of the rate of degradation of the chemical contaminants. These two wells may be suitable for well control to conduct the more extensive seismic study reference in 1 above.
6. Recommend that Wolf River discharge measurement be taken at various locations between Germantown Parkway bridge crossing and the I-40 bridge crossing during both low and high flows. This would help in identifying how distant road runoff should be discharged.

If you need further clarification or want to discuss this further, please do not hesitate to contact the Ground Water Institute.

Respectfully submitted;

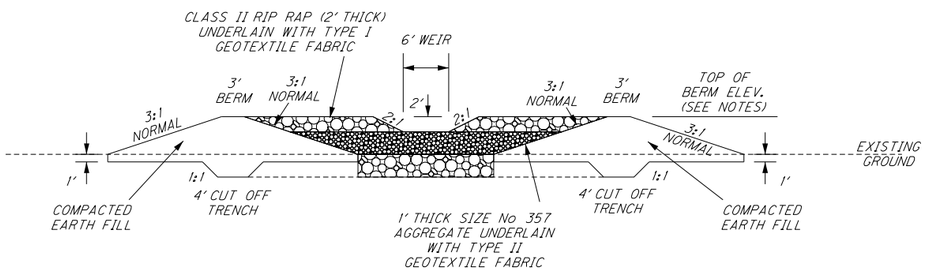
Jerry Lee Anderson, Ph.D., PE, D.WRE, F.ASCE
Director

COUNTY OF	ITEM NO.	SHEET NO.
BARREN	03-13.00	R2G

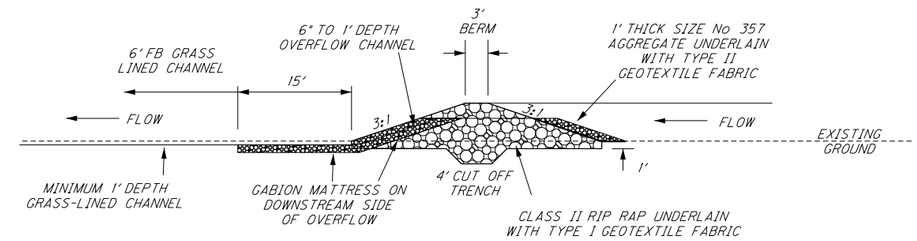
TYPICAL SECTIONS

SINKHOLE PROTECTION BASIN

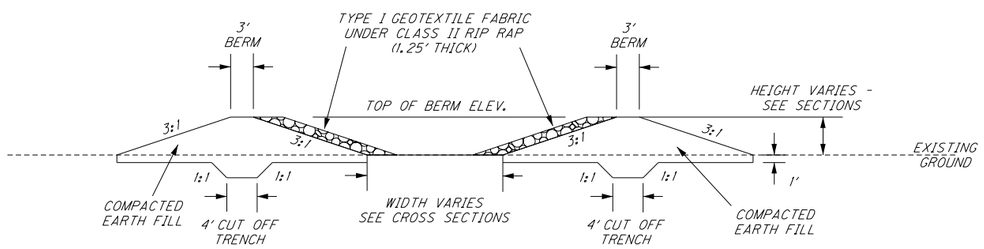
(APART FROM ROADWAY EMBANKMENT)



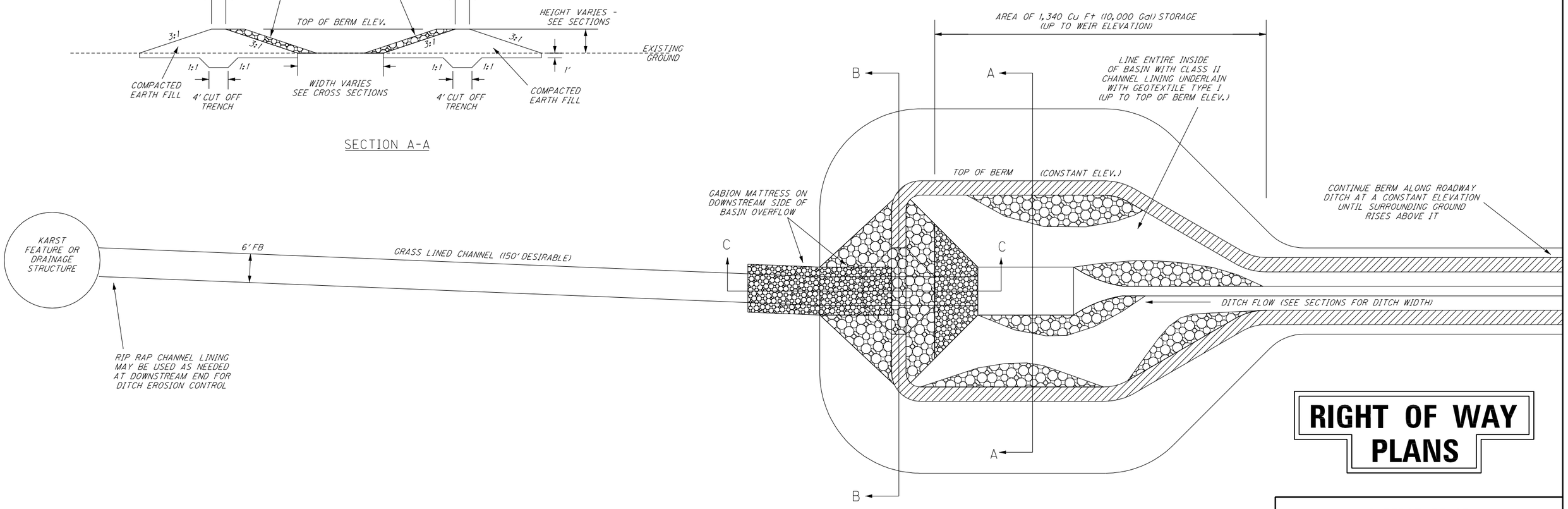
SECTION B-B



SECTION C-C



SECTION A-A



RIGHT OF WAY PLANS

NOT TO SCALE

INTERSTATE 65
SINKHOLE PROTECTION BASIN DETAIL

containment-typical.dgn

5/19/2011

COUNTY OF	ITEM NO.	SHEET NO.
BARREN	03-13.00	R2F

TYPICAL SECTIONS

SINKHOLE PROTECTION BASIN

(CONSTRUCTION NOTES)

THE MINIMUM VOLUME OF THE BASIN IS TO BE 1,340 CUBIC FEET (10,000 GALLONS) AT OR BELOW THE OVERFLOW WEIR ELEVATION. ADDITIONAL VOLUME MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER. THE BASIN SHOULD BE PLACED SO THAT A MINIMUM OF 100' (150' DESIRABLE) GRASS-LINED CHANNEL CAN BE PLACED BETWEEN THE STRUCTURE AND THE DOWNSTREAM STRUCTURE OR SINKHOLE.

RIP RAP CHANNEL LINING MAY BE USED AT OR NEAR THE SINKHOLE OR DOWNSTREAM DRAINAGE STRUCTURE (AT THE END OF THE GRASS-LINED CHANNEL) AS NEEDED FOR DITCH EROSION CONTROL.

ONLY THE DOWNSTREAM (RIP RAP AND AGGREGATE) PORTION OF THE BASIN IS DESIGNED TO BE POROUS. THE OTHER SIDES SHOULD BE CONSTRUCTED OF COMPACTED CLAY OR OTHER SUITABLE MATERIAL.

BASINS CLOSE TO THE ROADWAY, WHERE THE TOP OF BERM ELEVATION IS WITHIN THE CLEAR ZONE, WILL REQUIRE GUARDRAIL OR OTHER PROTECTION.

THE BASINS ARE DESIGNED TO DETAIN AND MINIMIZE THE POLLUTANTS ASSOCIATED WITH ROADWAY STORMWATER RUNOFF, AND PROVIDE A MEASURE OF PROTECTION FOR NEARBY SINKHOLES AND KARST FEATURES. TO THE MAXIMUM EXTENT PRACTICABLE, ROADWAY RUNOFF SHALL BE KEPT SEPARATE FROM OFF-ROADWAY RUNOFF, AND ROUTED THROUGH A BASIN BEFORE ENTERING A SINKHOLE. ROUTING OF LARGE DRAINAGE AREAS THROUGH A BASIN SHOULD BE AVOIDED.

THE BASIN SHOULD NOT BE PLACED DOWNSTREAM OF ANY PIPE, CULVERT, OR OTHER DRAINAGE STRUCTURE WHOSE HYDRAULIC PERFORMANCE MAY BE AFFECTED BY THE BASIN. WHERE THAT PLACEMENT IS UNAVOIDABLE, HYDRAULIC COMPUTATIONS SHALL BE PROVIDED (STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER) SHOWING THE BASIN HAS NO AFFECT ON THE UPSTREAM STRUCTURE PERFORMANCE. THE COMPUTATIONS WILL BE KEPT ON PERMANENT RECORD WITH OTHER PROJECT DOUMENTATION.

THE TOP OF BERM SHALL BE CONSTUCTED TO BE A MINIMUM DEPTH OF 3' BELOW THE LOWEST AFFECTED ROADWAY SHOULDER ELEVATION, THE LOWEST ENTRANCE OR SIDE ROAD SHOULDER ELEVATION, OR ANY OTHER FLOOD-SENSITIVE STRUCTURE WITHIN THE PONDING LIMITS OF THE BASIN.

THE BASIN MAY BE USED AS A TEMPORARY SEDIMENT CONTROL STRUCTURE PROVIDED:

- ONCE THE ENTIRE BASIN DRAINAGE AREA IS FULLY STABILIZED (PAVED AND/OR FULLY VEGETATED), ALL SEDIMENT IS REMOVED. ALL REMAINING RIP RAP AND AGGREGATE MUST BE CLEAN AND FREE OF SILT AND DEBRIS.
- THE No 357 AGGREGATE AND TYPE II GEOTEXTILE FABRIC MUST BE REMOVED AND REPLACED WITH NEW, CLEAN STONE AND FABRIC.
- THE PERMANENT STORAGE (BELOW THE SPILLWAY) IS A MINIMUM OF 1,340 CUBIC FEET.
- A BELOW-GRADE TRAP FOR SEDIMENT STORAGE (IN OR UPSTREAM FROM THE BASIN) IS SUGGESTED DURING CONSTRUCTION, BEFORE THE DRAINAGE AREA IS FULLY STABILIZED.

SINKHOLE CLASSIFICATIONS

SOURCE: "GROUNDWATER HAZARD MAP OF THE TURNHOLE SPRING KARST GROUNDWATER BASIN" A PRODUCT OF MAMMOTH CAVE AREA INTERNATIONAL BIOSPHERE RESERVE.

SYMBOLS	DESCRIPTION
TYPE V	SOIL COVERED SINKHOLE WITH NO OBVIOUS SINKPOINT, POORLY DRAINED, MAY POND AFTER RAINFALLS, MAY CONTAIN WATER TOLERANT PLANTS.
TYPE IV	SOIL COVERED SINKHOLE WITH NO OBVIOUS SINKPOINT, NO SIGNS OF PONDING, FAIRLY WELL DRAINED.
TYPE III	EXPOSED ROCKBED SINKHOLE WITH NO OBVIOUS SINKPOINT, NO SIGNS OF PONDING, FAIRLY WELL DRAINED.
TYPE II	SOIL COVERED SINKHOLE, OBVIOUS SINKPOINT, VERY WELL DRAINED.
TYPE I	EXPOSED ROCKBED SINKHOLE, OBVIOUS SINKPOINT, VERY WELL DRAINED.
CLASS V INJECTION WELL	A SINKHOLE, CRACK OR FISSURE THAT HAS BEEN MODIFIED OR IMPROVED BY MAN TO ALLOW EFFECIENT DRAINAGE OF SURFACE WATERS.
SWALE	A SHALLOW DEPRESSION ADJACENT TO A ROADWAY WITH NO OBVIOUS SINKPOINT, WATER DRAINS DIFFUSELY INTO THE GROUND.

RIGHT OF WAY PLANS

NOT TO SCALE

INTERSTATE 65
SINKHOLE PROTECTION BASIN NOTES

containment-typical.dgn

5/19/2011

APPENDIX I

LIST OF PERSONS RESPONSIBLE FOR PREPARATION OF SFEIS AND THEIR QUALIFICATIONS

This document was prepared by the U.S. Department of Transportation, Federal Highway Administration, and the Tennessee Department of Transportation, with assistance from Palmer Engineering, Inc. Technical assistance was provided by Powers Hill Design, Stantec Consulting Services, Inc., and Panamerican Consultants, Inc.

Tennessee Department of Transportation

Mr. Tom Love Transportation Manager NEPA Documentation Office TDOT Environmental Division	BS Agriculture 38 years experience
Mr. Joe Matlock Transportation Planner NEPA Documentation Office TDOT Environmental Division	BS Political Science, History, and Sociology 37 years experience

Federal Highway Administration

Mr. Gary Fottrell, P.E. Environmental Program Engineer	BS Civil Engineering 27 years experience

Palmer Engineering, Inc.

Mr. Chris Blevins Director of Environmental Services	BS Geography 14 years environmental experience Document Preparation
Ms. Elizabeth Bullock Environmental Engineer	MS Agricultural Engineering 10 years experience Biological Base Study
Ms. Lee E. Carolan Senior Environmental Biologist	BS Biological Science 20 years environmental experience Underground Storage Tank, Biological Base Studies
Mr. Charles O. Danison, Jr. Environmental Specialist	BS Meteorology 34 years environmental experience Air and Noise Base Studies
Mr. William R. Davis, Jr. Senior Project Manager	BS Mechanical Engineering 16 years environmental experience Underground Storage Tank Base Study
Mr. H. Robert Kennedy Traffic Planning Manager	BS Urban and Regional Planning 39 years experience Traffic Forecasting

Mr. Richard Lambert Engineering Technician	AS Architectural Technology 16 years experience Displays/Visualizations/Exhibits
Mr. David Lindeman, P.E. Director of Transportation	BS Civil Engineering 24 years transportation experience CSS and Quality Control
Ms. Gina Morris, P.G. Director of Environmental Services (previously)	MS Geology/Mathematics 34 years environmental experience Document Preparation
Mr. Robert Oney Environmental Biologist	BS Wildlife Management 6 years environmental experience Biological Base Study
Ms. Karis D. Pumphrey Environmental Scientist	BS Environmental Health Sciences MA Geography 5 years environmental experience Document Preparation and Socioeconomic
Mr. Jeffrey Schwierjohann Senior Environmental Biologist	BS Wildlife Management 13 years environmental experience Biological Base Study
Mr. Stephen Sewell, P.E., PTOE Project Engineer	BS Civil Engineering 10 years transportation experience Design
Mr. Gary Sharpe, P.E. Senior Project Manager	BS Civil Engineering 34 years transportation experience CSS
Ms. Rain Storm Environmental Biologist	BS Wildlife Management 9 years environmental experience Biological Base Study
Mr. Jon Totty Environmental and GIS Specialist	BS Industrial Technology 11 years environmental experience Exhibits

Powers Hill Design

Ms. Nisha Powers President	BS Civil Engineering 12 years experience CSS
Mr. Steve Hill Chief Operating Officer	BS Civil Engineering 32 years experience CSS

Stantec Consulting Services, Inc.

Mr. Michael J. Steele, P.E. Associate	BS Civil Engineering 11 years experience Landfill Feasibility Study
Mr. John W. Hall, P.E. Associate	MS Civil Engineering 34 years experience Landfill Feasibility Study
Mr. Don W Fuller II, P.E. Senior Associate	MS Civil Engineering 23 years experience Landfill Feasibility Study

Panamerican Consultants, Inc.

Mr. Andrew Saatkamp Staff Archaeologist	MA Archaeology 16 years experience Archaeological Base Study
Mr. C. Andrew Buchner Senior Archaeologist	MA Archaeology 20 years experience Principal Investigator Archaeological Base Study