Report of Feasibility Study

Shelby Farms Project
Memphis, Shelby County,
Tennessee

Prepared for
Palmer Engineering Company, Inc.
Winchester, Kentucky

June 21, 2008

STANTEC CONSULTING SERVICES INC.

Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington KY 40511-2050
Tel: (859) 422-3000
Fax: (859) 422-3100

July 21, 2008

O.1.1.171468069-LX2008056R02

Mr. David M. Lindeman, PE
Palmer Engineering Company, Inc.
P.O. Box 747
Winchester, Kentucky 40392

Re: Report of Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Dear Mr. Lindeman:

As requested, Stantec Consulting Services Inc. (Stantec) has completed a feasibility study for the above referenced project in accordance with our proposal dated March 28, 2008 along with additional directives received during the course of the study. This report presents general discussions of the project background and objective, the scope of work performed and results obtained along with conclusions and recommendations relative to the path forward.

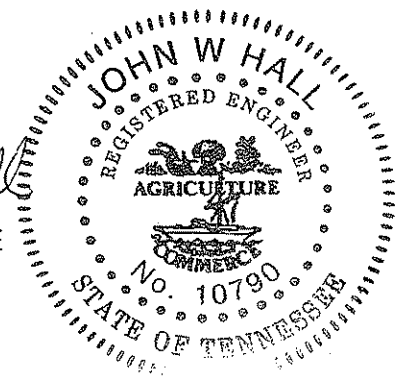
We appreciate the opportunity to provide these services to you. If you have any questions or need additional information, please call.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Michael J. Steele, PE
Associate

John Hall, PE
Associate



Don W. Fuller II, PE
Senior Associate

/mjs/cmw

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Shelby Farms Project
Memphis, Shelby County, Tennessee

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Report of Feasibility Study

Shelby Farms Project
Memphis, Shelby County, Tennessee

1. Background

Based on information provided by Palmer Engineering Company, Inc. (Palmer) it is understood that planning and design activities for a proposed north-south roadway project located in Memphis, Shelby County, Tennessee, which will connect Walnut Grove Road to Macon Road, have been initiated. The proposed roadway, known locally as "Kirby Parkway", will extend through portions of Shelby Farms Park and will be designed as a high volume, limited access facility. While the base roadway alignment is assumed not to extend into the footprint of the Shelby County (Walnut Grove Road) Landfill, alternative alignments under consideration, specifically ramps associated with the interchange, are located within portions of the facility.

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

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

2. Objective

The project objective is to perform a study to assess the feasibility of constructing roadway elements within the limits of the current landfill facility footprint in association with the proposed transportation project. To accomplish this objective the following work tasks were performed.

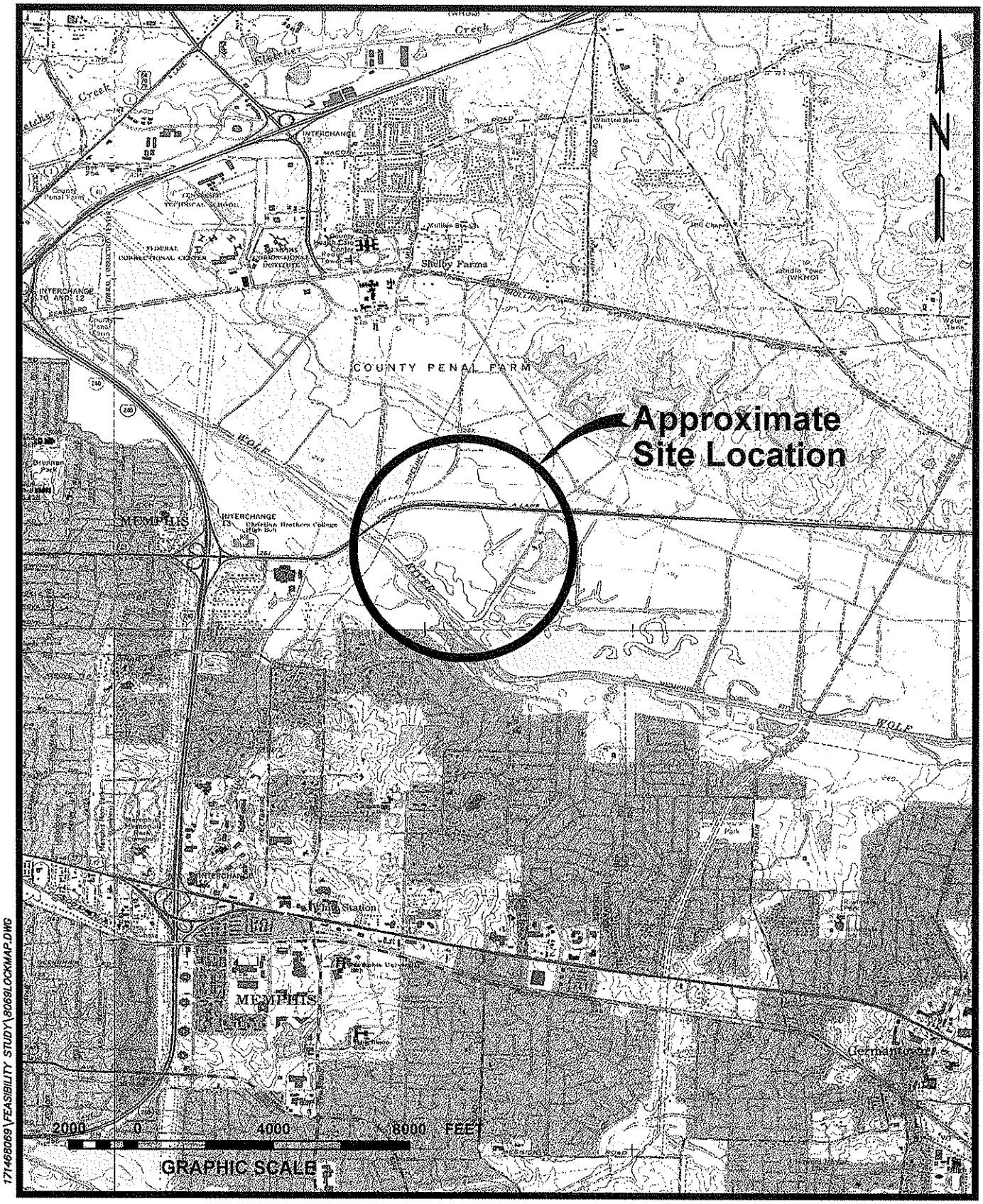

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Figure No. 1
Feasibility Study - Shelby Farms Project
Memphis, Shelby County, Tennessee
Portions of USGS 7 1/2-minute Topographic Maps (Northeast Memphis, Southeast Memphis, Germantown and Ellendale Quadrangles) Showing Approximate Site Location

- Task 1 – Project Development;
- Task 2 – Site Visit and TDEC File Review; and
- Task 3 – Feasibility Study.

It should be understood that the feasibility study is preliminary (or conceptual) in nature and was based on several key assumptions prepared from available data/information and our experience with similar projects. If these assumptions are redefined in future phases of the project, the study should be developed further to evaluate their impact on the conclusions and recommendations developed below.

3. Scope of Work

The work presented herein was performed in accordance with our proposal dated March 28, 2008 along with additional directives received from Palmer during the course of the study.

Task 1 – Project Development

Initial work commenced with a kick-off meeting conducted between Palmer and Stantec Consulting Services Inc. (Stantec) on April 10, 2008 to review the project background and objective. During the course of the study, Palmer provided selected data/information for use in project development. These data/information included the following:

- A copy of the report entitled Review of Potential Environmental Issues, Proposed Kirby Parkway, Walnut Grove Road to Macon Road, Memphis, Shelby County, Tennessee, September 2007 (Palmer Engineering Company, Inc.);
- A copy of the Shelby Farms Parkway Advisory Team Recommendations (dated February 2006);
- A copy of an U. S. Environmental Protection Agency hazardous waste assessment (dated December 27, 1983);
- A copy of an Tennessee Department of Health and Environment – Division of Solid Waste hazardous waste assessment (dated May 15, 1982); and
- Project base mapping showing three conceptual roadway alignments and as-built (or closed) landfill conditions.

As part of this task, Stantec further developed the received base mapping to consider various topographic and environmental elements available from the published on-line Geographic Information System (GIS) database. These elements included U. S. Geological Survey (USGS) topographic mapping (survey date 1965) along with the locations of streams,

floodplains and potential wetlands. Available published geologic and hydrogeologic data/information was also reviewed to develop a cursory understanding of the regional setting.

Task 2 – Site Visit and TDEC File Review

Concurrent with project development, Stantec performed a site visit on April 24 and 25, 2008 to observe existing conditions and to become more familiar with the overall project setting. Site observations were primarily limited to the general appearance of the closed landfill facility and adjacent lands located north of Walnut Grove Road along with constructed waste embankment outslopes and installed surface features (i.e. fencing, drainage systems, gas extraction wells, etc.) located within the conceptual transportation project limits. Results of these observations were used in combination with available data/information to develop the base digital terrain model defined below. Selected photographs taken during this visit are provided as Appendix A.

Stantec performed a cursory review of available Tennessee Department of Environment and Conservation (TDEC) – Division of Solid Waste Management project files maintained for the landfill facility on April 24 and 25, 2008 at the Memphis, Tennessee field office. These files were primarily limited to various correspondence relative to selected operations along with closure and post-closure activities performed over the previous 30 years. Interviews were also conducted across several dates with TDEC personnel (Philip Davis and Herb Nicholson with the Memphis office as well as Glen Pugh and Abe Almassi with the Nashville office) to review the conceptual project approach and establish the possible regulatory path forward. Results of these activities were primarily used to develop landfill facility background and provide some basis for the primary mitigation approach considered herein.

Stantec also conducted an interview with Shelby County personnel (Ted Fox and Wain Gaskins) on April 25, 2008 to further refine the conceptual project approach to meet the objective outlined above. Discussions relative to the availability of certain landfill facility documents (i.e. survey drawings or other documents that define the waste limits) were also held.

Task 3 – Feasibility Study

Based on mapping received from Palmer, it is understood that three conceptual roadway alignments are under consideration. These include a base alignment wherein no construction elements are assumed to be located within the current facility footprint along with two alternative alignments (referenced herein as Options 1 and 2) that encroach upon the facility to varying degrees. Graphical representations of these alignments were prepared by Palmer and are included as Appendix B.

The feasibility study was performed as an initial assessment of potential roadway construction associated with the alternative alignments. Three fundamental approaches were considered for this assessment and include:

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

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

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

A preliminary digital terrain model of closed landfill facility conditions was prepared (in TerraModel® format) from the received base mapping to develop quantities for use in the cost opinion. It is noted that several assumptions relative to the waste limits and base contour were made based on available data/information. The model was further developed to incorporate the primary mitigation approach (removal of waste materials and replacement with suitable engineered fill) for both alternative roadway alignments. It is noted that while no engineering design or analyses were performed for the conceptual landfill facility regrade plan, several qualitative elements were incorporated. These include completed waste embankment outslopes of 5(H):1(V), which resemble current conditions and are based on anticipated aesthetics and stability considerations. A nominal perimeter corridor was also modeled between the transportation project limits and the regraded waste embankment toe to accommodate anticipated access roads and surface drainage features along with various gas monitoring and collection system elements. Based on available data/information, it was assumed that locally available clay materials suitable for low permeable (defined as 1.0×10^{-7} cm/sec or less) construction applications will be limited. Current landfill closure requirements provide for an "alternative" final cover system wherein multiple layers of soil and geosynthetic materials are used. For the purposes of the current study, it was assumed that this alternative system would be used.

A preliminary cost opinion for implementation of the primary mitigation approach for both roadway alignments was prepared. Costs were derived in (current) 2008 dollars and were based on available data/information from various published sources (RS Means Heavy Construction Cost Data (2008) and the Caterpillar Performance Handbook (Edition 38)) along with various manufacturer's cost data and our experience. No adjustments were made to these costs to account for inflation. Primary work activities considered in the cost opinion include project development (i.e. waste limits determination, preparation of waste excavation and closure plan documents and subsequent construction bid documents) along with anticipated site preparation, operations and closure activities.

It is noted that the possible regulatory path forward relative to the conceptual project approach does not preclude on-site waste relocation. Because of the above referenced environmental considerations and associated regulatory precedence, it is assumed that a horizontal expansion beyond the current landfill facility footprint is not feasible. It is further assumed that based on the considerable volumes of excavated waste materials and the anticipated aesthetics and stability considerations referenced above, a vertical expansion beyond the current peak elevation is not preferred. For these reasons, the assumed waste relocation approach is off-site disposal within a permitted Class I landfill facility. Stantec identified two candidate sites located within an approximate 20-mile radius for this purpose. Reported disposal rates (or tipping fees) were based on preliminary inquiries. No attempts to formally document these rates by executing a letter of intent or by other means were made.

4. Results

The primary mitigation approach for both alternative roadway alignments are graphically presented in the drawing set provided as Appendix C. The following lists individual sheets of this drawing set:

- Existing Conditions Plan (Sheet 1 of 4);
- Conceptual Regrade Plan – Option 1 (Sheet 2 of 4);
- Conceptual Regrade Plan – Option 2 (Sheet 3 of 4); and
- Cross Sections (Sheet 4 of 4).

Based on the modeling approach presented herein, it is estimated that 93,800 cubic yards (or 63,315 tons using a conversion factor of 0.675 tons per cubic yard based on an assumed unit weight of 50 pounds per cubic foot) of waste materials will be excavated for Option 1 and 651,600 cubic yards (or 439,763 tons) for Option 2. Furthermore, it is estimated that 13,400 cubic yards of final cover soil materials (cumulative four-foot thick layer of constructed soil barrier and vegetative soil layer) will be required for Option 1 and 48,000 cubic yards for Option 2. In both cases, it is estimated that initial stripping and stockpiling efforts will produce sufficient soil material quantities for this purpose.

Results of the preliminary cost opinion are provided as Appendix D. Table 1 presents a summary of these costs for the primary work activities derived for both alternative roadway alignments.

Table 1. Summary of Preliminary Cost Opinion

	Option 1	Option 2
Project Development [1]	$ 130,000	$ 130,000
Mobilization/Demobilization	$ 250,000	$ 250,000
Site Preparation [2]	$ 214,283	$ 291,895
Site Operations and Closure [3]	$ 4,557,158	$ 26,016,495
Subtotal (w/o contingency)	$ 5,151,442	$ 26,688,390
Contingency (25 percent)	$ 1,287,860	$ 6,672,098
Total	$ 6,439,302	$ 33,360,488

(1) Project development is anticipated to consist of a waste limits determination, preparation of waste excavation and closure plan documents and subsequent construction bid documents.

(2) Site preparation is anticipated to consist of preparation of operations, closure and health/safety plan documents, construction stakeout, installation of erosion control features, removal of existing surface features and gas collection system (within the project limits), and haul road construction.

(3) Site operations and closure is anticipated to consist of initial stripping and stockpiling efforts, excavation and (off-site) disposal of waste materials, final cover construction, installation of surface drainage features, installation of methane probes, routine dust control and site maintenance, and construction engineering and monitoring during final cover construction.

As stated above, unit costs were developed from published resources along with various manufacturer's cost data and our experience. It is noted that these costs are primarily dependent on fuel prices, which have a direct impact on the construction and transportation industries.

5. Conclusions and Recommendations

5.1. A study to assess the feasibility of constructing roadway elements within the limits of the current landfill facility footprint in association with the proposed transportation project has been performed. The feasibility study is preliminary in nature and was based on several key assumptions prepared from available data/information and our experience with similar projects. If these assumptions are redefined in future phases of the project, the study should be developed further to evaluate their impact on the conclusions and recommendations developed below.

5.2. Three conceptual roadway alignments are under consideration including a base alignment wherein no construction elements are assumed to be located within the current facility footprint along with two alternative alignments that encroach upon the facility to

varying degrees. The feasibility study was performed as an initial assessment of potential roadway construction associated with the alternative alignments. Three fundamental approaches were considered for this assessment and include:

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

Based on typical characteristics of domestic and municipal waste materials, it is judged that construction of roadway elements bearing directly across waste materials (with or without conventional subgrade improvements) will result in unpredictable amounts of non-uniform settlement. Because the transportation project objectives are anticipated to include stable foundation conditions characterized by predictable (or manageable) settlement over the design life, this approach is not recommended.

It is further judged that while the installation of deep foundation elements may prove to be a structurally feasible approach, it may also provide a direct conduit for additional groundwater impacts, thereby affecting the current post-closure status of the landfill facility. If this approach is pursued further, then a quantitative assessment to include exploration and subsequent evaluation to facilitate an environmental risk assessment is recommended.

In order to address both structural and environmental considerations, it is judged that removal of waste materials and replacement with suitable engineered fill provides a more feasible path forward. This approach is a proven technique to address poor foundation bearing conditions across a variety of project settings.

5.3. A preliminary digital terrain model of closed landfill facility conditions was prepared to develop quantities for use in the cost opinion. The model was further developed to incorporate the primary mitigation approach for both alternative roadway alignments. Results of this effort indicate that an estimated 93,800 cubic yards (or 63,315 tons) of waste materials will be excavated for Option 1 and 651,600 cubic yards (or 439,763 tons) for Option 2. Furthermore, it is estimated that 13,400 cubic yards of final cover soil materials will be required for Option 1 and 48,000 cubic yards for Option 2. In both cases, it is estimated that initial stripping and stockpiling efforts will produce sufficient soil material quantities for this purpose.

In order to facilitate proper delineation of the current landfill facility, it is recommended that a waste limits determination be performed. It should be understood that TDEC personnel indicated that prior to this fieldwork, a detailed exploration and health/safety plan would need to be submitted for approval.

5.4. The assumed waste relocation approach is off-site disposal within a permitted Class I landfill facility. It is noted, however, that while the regulatory precedence may suggest that horizontal expansion of the current footprint is not feasible, the possible regulatory path forward relative to on-site waste relocation does not preclude a vertical expansion. Provided that careful attention is placed on the above referenced aesthetics and stability considerations, this alternative may be considered further. Based on discussions with TDEC

personnel, it is anticipated that expansion of the current landfill facility would require a permit modification wherein exploration and subsequent evaluation would need to be performed in order to prepare the permit documents.

5.5. Results of the preliminary cost opinion indicate that applying the primary mitigation approach to both alternative roadway alignments will range from roughly $6.4 million for Option 1 and $33.4 million for Option 2. It is noted that these costs include an applied contingency of 25 percent, which is considered appropriate for a preliminary (or conceptual) study of this nature.

5.6. It is assumed that encountered waste materials are Class I solid waste per current TDEC classification requirements. Based on discussions with TDEC personnel, it is understood that if this is not the case, then a waste determination would need to be performed to facilitate development of proper excavation, loadout and transportation methods for disposal within an appropriate permitted facility.

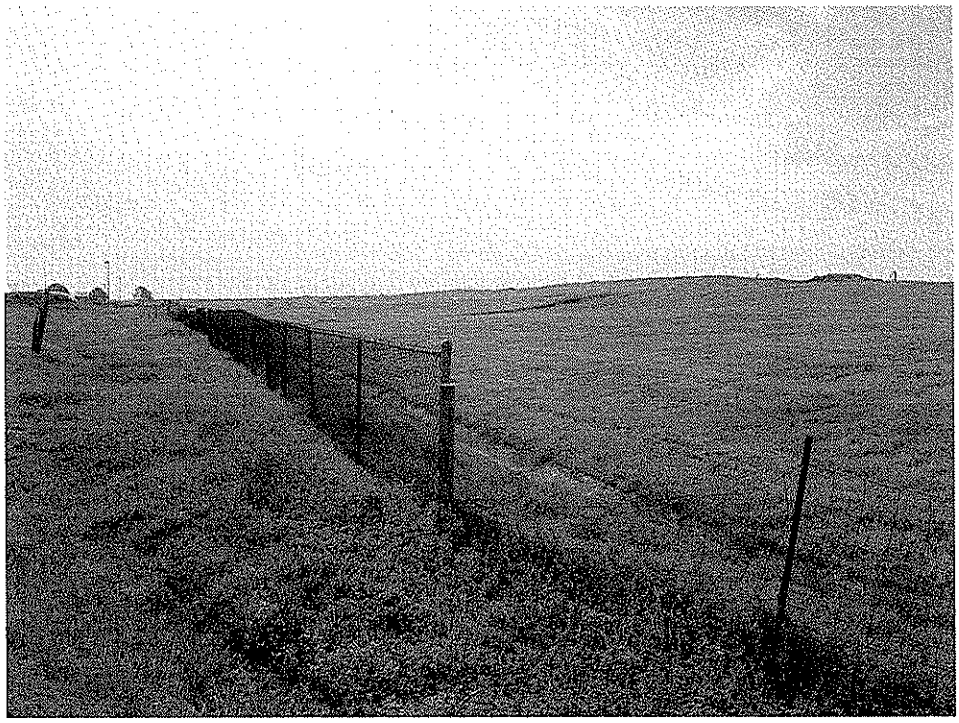
5.7. The results, conclusions and recommendations presented herein are based on the feasibility study prepared by Stantec along with available data/information referenced herein and our experience with similar projects, using that degree of care and skill ordinarily exercised under similar circumstances by respectable members of the engineering profession. No warranties expressed or implied, can be provided to the accuracy of information supplied by others.

Appendix A

Site Photographs

Southwestern View of Shelby County Landfill (4/25/08)

Southern View of Shelby County Landfill (4/25/08)



Southeastern View of Shelby County Landfill (4/25/08)

Eastern View of Shelby County Landfill (4/25/08)

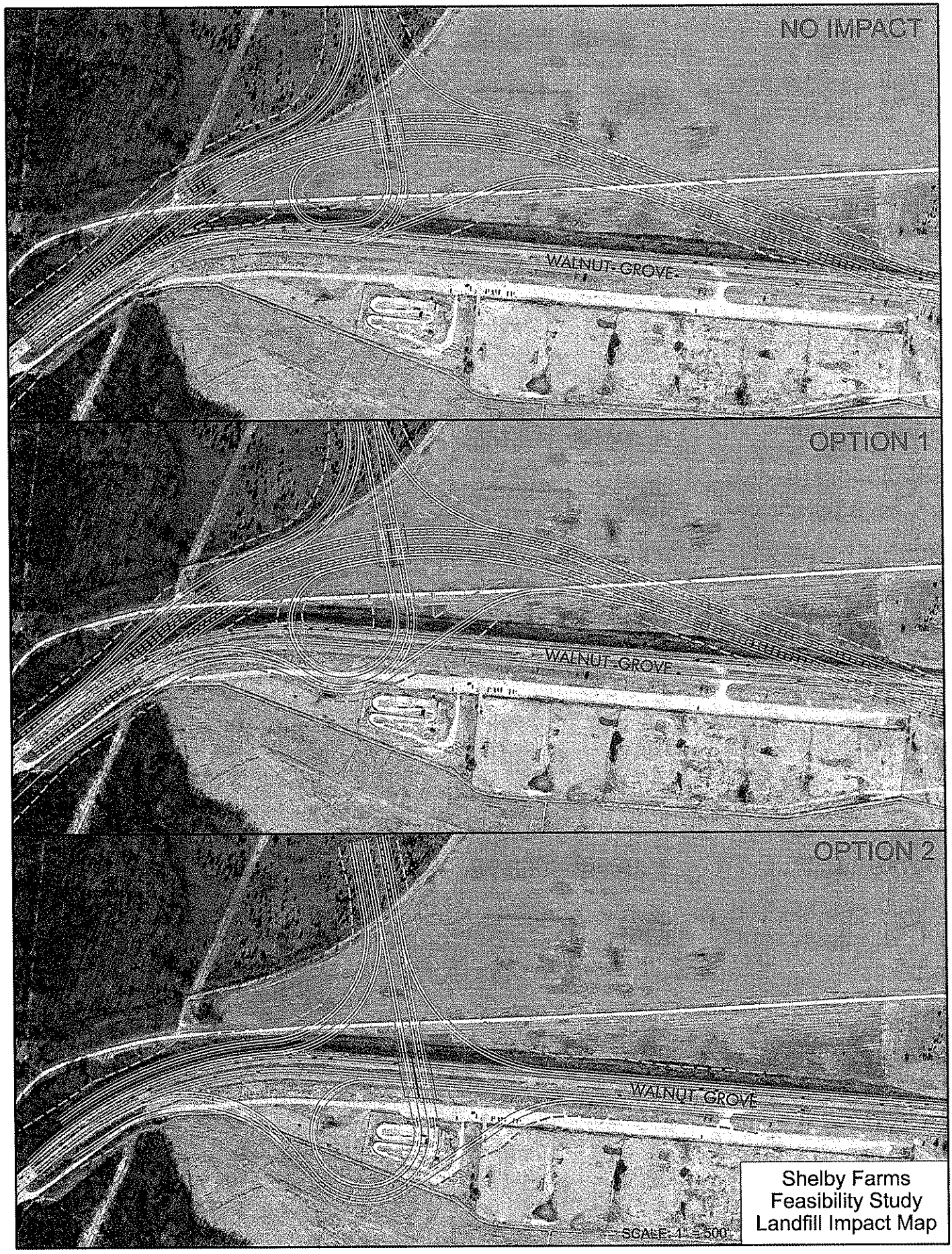
BMX Track Located Within Northern Portion of Shelby County Landfill (4/25/08)

Typical Gas Extraction Well Located Within Northern Portion of Shelby County Landfill (4/25/08)

Adjacent Lands Located North of Walnut Grove Road (4/25/08)

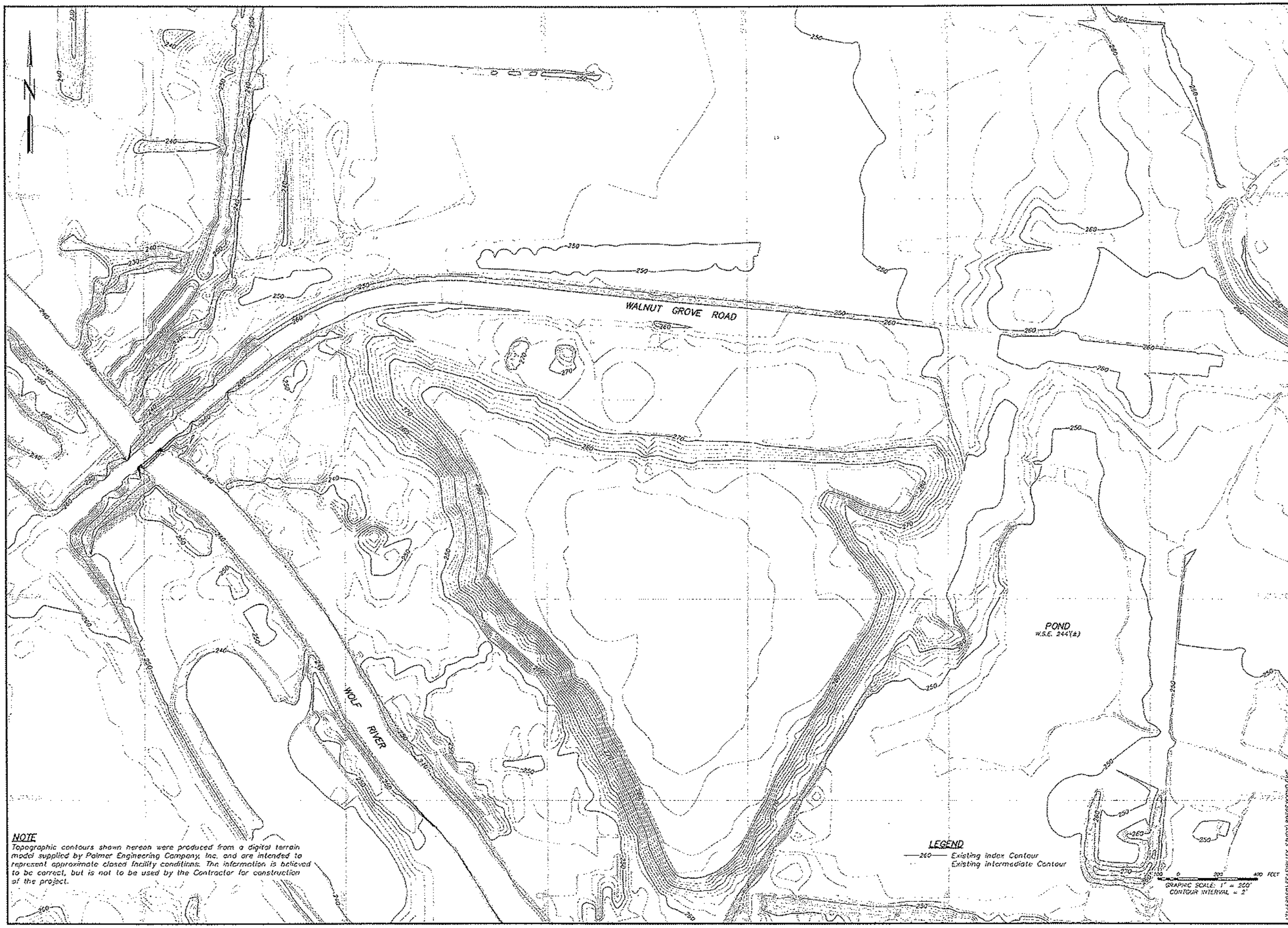
Appendix B

Conceptual Roadway Alignment Graphics


NO IMPACT
WALNUT GROVE
OPTION 1
WALNUT GROVE
OPTION 2
WALNUT GROVE
SCALE: 1" = 500'
Shelby Farms
Feasibility Study
Landfill Impact Map

Appendix C

Drawings



NOTE
Topographic contours shown hereon were produced from a digital terrain model supplied by Palmer Engineering Company, Inc. and are intended to represent approximate closed facility conditions. The information is believed to be correct, but is not to be used by the Contractor for construction of the project.

LEGEND
—260— Existing Index Contour
Existing Intermediate Contour

EXISTING CONDITIONS PLAN

FEASIBILITY STUDY
SHELBY FARMS PROJECT
MEMPHIS, SHELBY COUNTY, TENNESSEE

PROJECT NO.	171458059
DATE	JULY, 2008
DRAWN BY	DWS
CHECKED BY	MJS
CHECKED BY	JEI
SCALE	1" = 200'
REVISED	
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4.	
5.	
6.	
7.	
8.	

SHEET
1 OF 4

Stantec Consulting Services Inc.
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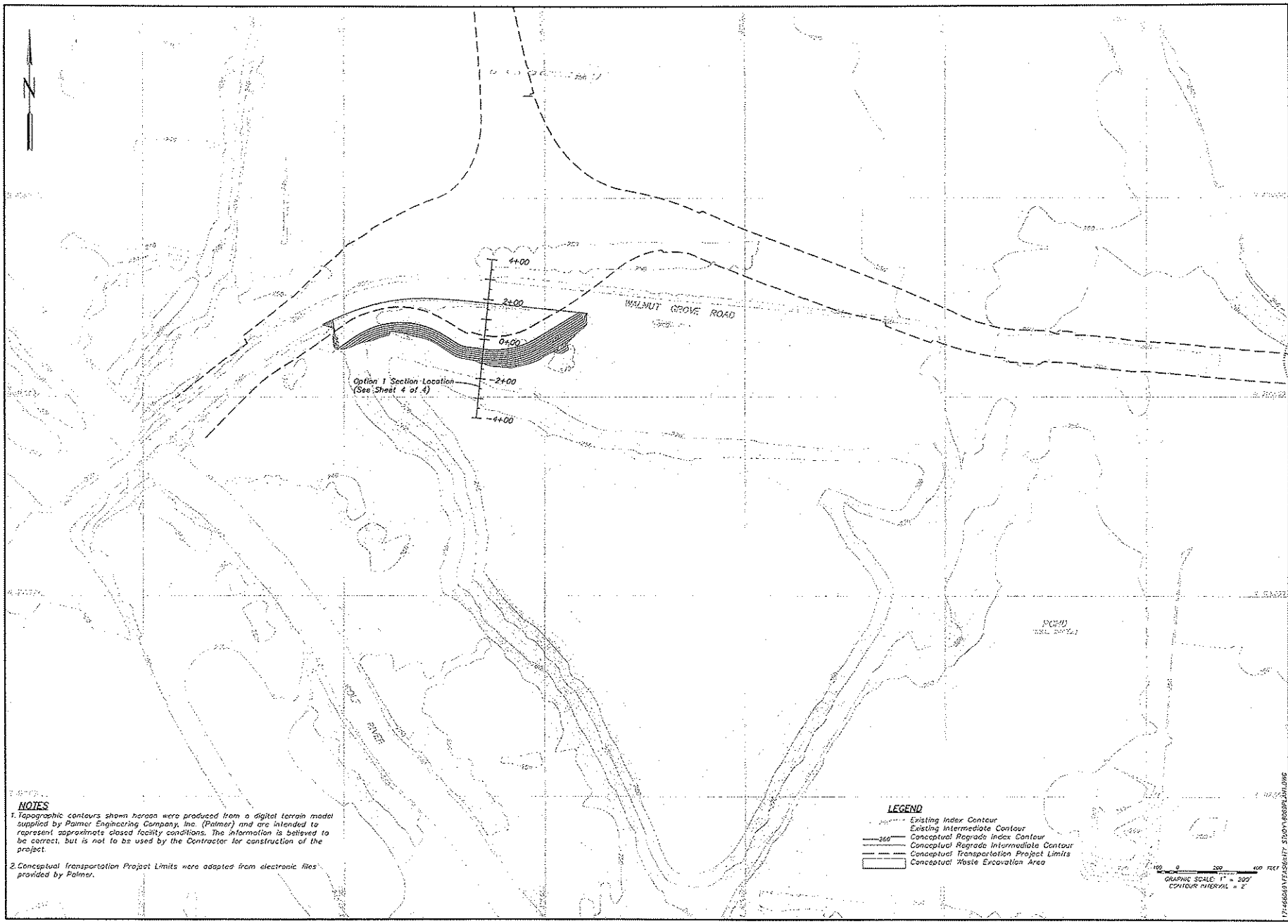

NOTES

1. Topographic contours shown hereon were produced from a digital terrain model supplied by Palmer Engineering Company, Inc. (Palmer) and are intended to represent approximate closed facility conditions. The information is believed to be correct, but is not to be used by the Contractor for construction of the project.

2. Conceptual transportation Project Limits were adapted from electronic files provided by Palmer.

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CONCEPTUAL REGRADE PLAN - OPTION 1

FEASIBILITY STUDY
SHELBY FARMS PROJECT
MEMPHIS, SHELBY COUNTY, TENNESSEE

PROJECT NO.	171469069
DATE	JULY, 2008
DRAWN BY	DMG
CHECKED BY	WJS
CHECKED BY	
SCALE	1" = 200'
REVISED	

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2 OF 4

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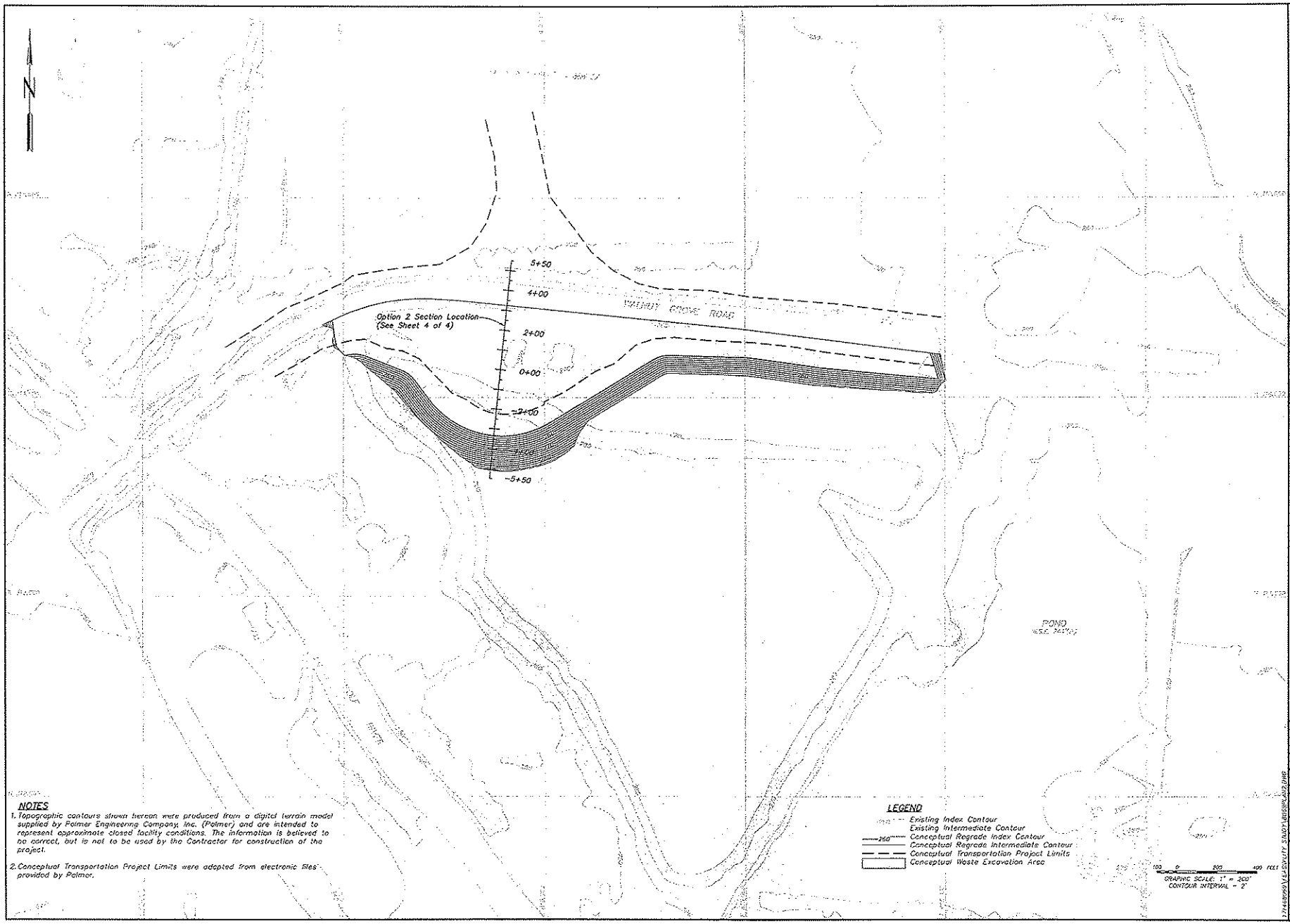

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CONCEPTUAL REGRADE PLAN - OPTION 2
FEASIBILITY STUDY
SHELBY FARMS PROJECT
MEMPHIS, SHELBY COUNTY, TENNESSEE

PROJECT NO.	171408029
DATE	JULY, 2019
DRAWN BY	GWC
CHECKED BY	MJC
CHECKED BY	AJ
SCALE	1" = 200'
REVISED	

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3 OF 4

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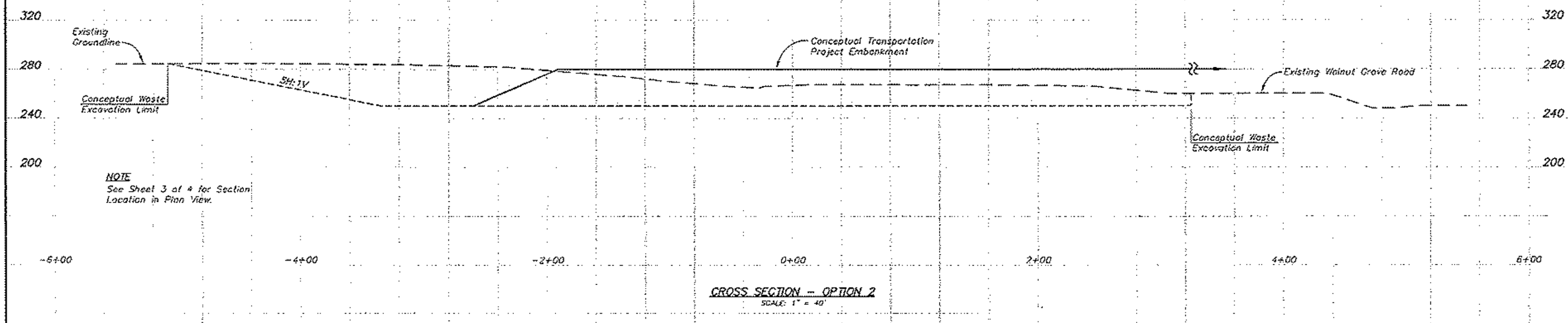

CROSS SECTION – OPTION 2
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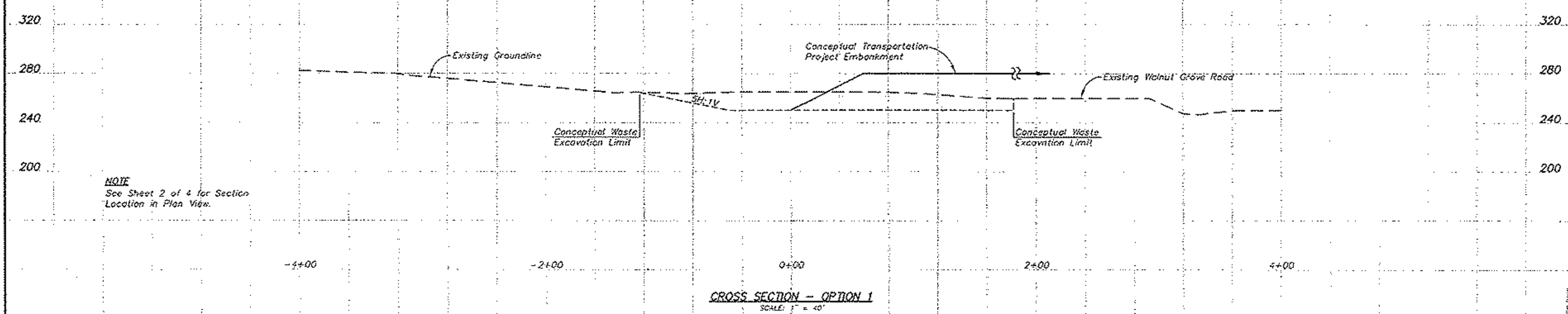

CROSS SECTION – OPTION 1
SCALE: 1" = 40'

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CROSS SECTIONS
FEASIBILITY STUDY
SHELBY FARMS PROJECT
MEMPHIS, SHELBY COUNTY, TENNESSEE

PROJECT NO.	171468069
DATE	JULY, 2008
DRAWN BY	SPS
CHECKED BY	WJS
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SCALE	1" = 40'
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SHEET
4 OF 4

Appendix D

Preliminary Cost Opinion

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Summary

	Option 1		Option 2	
Assumed Waste Excavation (cubic yards)	93,800		651,600	
Assumed Waste Excavation (tons)	63,315		439,763	
Economic Evaluation (derived in 2008 $)				
Project Development				
Determine Waste Limits	$ 32,500		$ 32,500	
Prepare Waste Excavation and Closure Plan	$ 62,500		$ 62,500	
Prepare Bid Documents and Assist w/ Contractor Selection	$ 35,000		$ 35,000	
		$ 130,000		$ 130,000
Mobilization/Demobilization		$ 250,000		$ 250,000
Site Preparation				
Prepare Operations, Closure and Health/Safety Plan	$ 5,000		$ 5,000	
Perform Construction Stakeout	$ 5,000		$ 25,000	
Install Erosion Control Features	$ 3,825		$ 5,100	
Remove Surface Features and Gas Collection System	$ 10,000		$ 50,000	
Construct On-Site Haul Road	$ 190,458		$ 206,795	
		$ 214,283		$ 291,895
Site Operations and Closure				
Strip and Stockpile Existing Vegetative Soil Material	$ 90,525		$ 402,475	
Excavate and Dispose Waste Material	$ 2,865,001		$ 19,899,258	
Construct Final Cover	$ 1,437,800		$ 5,152,000	
Install Surface Drainage Features	$ 50,000		$ 100,000	
Install Methane Probes	$ 25,000		$ 75,000	
Perform Dust Control and Site Maintenance	$ 68,832		$ 327,762	
Construction Engineering and Monitoring	$ 20,000		$ 60,000	
		$ 4,557,158		$ 26,016,495
Subtotal (w/o Contingency)		$ 5,151,442		$ 26,688,390
Contingency (25 *percent*)		$ 1,287,860		$ 6,672,098
Total		$ 6,439,302		$ 33,360,488

Notes: 1. *Assumed waste excavation quantities based on conceptual regrade models developed from base mapping provided by Palmer Engineering Company, Inc. and available data/information.*

2. *Assumed activities for waste limits determination include surveying and a combination of intrusive and non-intrusive exploration techniques. It is noted that the exploration and health/safety plan will be subject to regulatory review.*

3. *Assumed activities for waste excavation and closure plan will require engineering design and "permit-level" documents subject to regulatory review.*

4. *A conversion factor of 0.675 tons per cubic yard (based on an assumed unit weight of 50 pounds per cubic foot) was used for waste materials.*

5. *Costs were derived in (current) 2008 $ and were based on available data/information from various published sources along with various manufacturer's cost data and our experience. No adjustments were made to these costs to account for inflation.*

6. *Salvage value of infrastructure and/or equipment was not considered.*

7. *Site Preparation and Development*

   a. *Assumed Operations, Closure and Health/Safety Plan will be developed by the Contractor and be subject to regulatory review.*

   b. *Erosion control features assumed to consist of 3-foot high polypropylene silt fence installed under ideal conditions.*

   c. *Haul Road Construction*

      i. *Haul road dimensions assumed to be 15 feet wide (supporting one-way traffic) and 18 inches thick with varying lengths.*

      ii. *Haul road materials assumed to consist of Nos. 2 and 57 stone and geotextile fabric.*

      iii. *Drainage features assumed to consist of grass-lined ditches.*

Summary (cont.)

8. *Site Operations and Closure*

   a. *Initial site preparation and development activities assume that a recoverable 2-foot thick layer of existing vegetative soil material will be stripped/stockpiled for final cover construction applications.*

   b. *Waste materials assumed to consist of Class I solid waste. These materials assumed to be excavated and transported (hauled) off-site for disposal within permitted facilities located within 20 miles of Shelby County Landfill.*

   c. *Waste excavation (and transport) assumed to primarily occur 6 days per week (up to 10 hours per day) across various periods in*

   d. *Waste excavation costs based on CAT 330D L hydraulic excavator capactity and assumed production rates.*

   e. *Waste transportation (haul) costs based on highway hauler w/ dump trailer capacity and assumed production rates.*

   f. *Average waste transport speed assumed to be 45 miles per hour. An additional 10 minutes per transport cycle was included to account for potential delays at disposal facility scales.*

   g. *Alternative final cover system consisting of multiple layers of soil and geosynthetic layers is assumed. It is further assumed that initial stripping and stockpiling efforts will produce sufficient soil material quantities for this purpose.*

   h. *Dust control assumed to consist of "light" watering during site activities.*

   i *Site maintenance costs assumed to include site observations and material/labor costs for repairs.*

   j. *Construction engineering and monitoring assumed to occur during final cover construction.*

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Option 1

Item	Unit	Estimated Quantity	Unit Cost (2008 $)	Extended Cost (2008 $)	
I. Project Development					
A. Determine Waste Limits					
1. Prepare Exploration/Safety Plan	LS	1	$ 5,000.00	$ 5,000	
2. Perform Fieldwork	LS	1	$ 25,000.00	$ 25,000	
3. Prepare Report	LS	1	$ 2,500.00	$ 2,500	
B. Prepare Waste Excavation and Closure Plan					
1. Perform Aerial Site and Hydrographic Survey	LS	1	$ 20,000.00	$ 20,000	
2. Review Project Objectives and Data/Information	LS	1	$ 2,500.00	$ 2,500	
3. Prepare Base Model	LS	1	$ 5,000.00	$ 5,000	
4. Prepare Excavation Plan	LS	1	$ 10,000.00	$ 10,000	
5. Prepare Final Grading and Surface Drainage Plan	LS	1	$ 10,000.00	$ 10,000	
6. Prepare Details, Sections, Profiles, etc.	LS	1	$ 5,000.00	$ 5,000	
7. Prepare Plan Documents (*drawings and specifications*)	LS	1	$ 10,000.00	$ 10,000	
C. Prepare Bid Documents and Assist w/ Contractor Selection					
1. Convert Plan Documents to Construction Documents	LS	1	$ 20,000.00	$ 20,000	
2. Prepare Engineer's Cost Opinion (*for site activities*)	LS	1	$ 5,000.00	$ 5,000	
3. Coordinate and Assist w/ Bid Negotiation	LS	1	$ 10,000.00	$ 10,000	
			Subtotal - Project Development		$ 130,000
II. Mobilization/Demobilization	LS	1	$ 250,000.00	$ 250,000	
			Subtotal - Mobilization/Demobilization		$ 250,000
III. Site Preparation					
A. Prepare Operations, Closure and Health/Safety Plan	LS	1	$ 5,000.00	$ 5,000	
B. Perform Construction Stakeout	LS	1	$ 5,000.00	$ 5,000	
C. Install Erosion Control Features (*silt fence*)	LF	5,100	$ 0.75	$ 3,825	
D. Remove Surface Features and Gas Collection System	LS	1	$ 10,000.00	$ 10,000	
E. Construct On-Site Haul Road					
1. Grade Subgrade for Base Course, Roadways	SY	5,333	$ 0.40	$ 2,333	
2. Geotextile Fabric	SY	5,833	$ 1.50	$ 8,750	
3. Road Materials (*Nos. 2 and 57 stone*)	CY	2,917	$ 37.50	$ 109,375	
4. Construct Road Ditch (*grass-lined*)	LF	7,000	$ 10.00	$ 70,000	
			Subtotal - Site Preparation		$ 214,283
IV. Site Operations and Closure					
A. Strip and Stockpile Existing Vegetative Soil Material	CY	21,300	$ 4.25	$ 90,525	
B. Excavate and Dispose Waste Material					
1. Excavate/Loadout	LS	1	$ 163,985.85	$ 163,986	
2. Transport (Haul) Off-Site to Disposal Facility	LS	1	$ 326,702.79	$ 326,703	
3. Dispose Off-Site (*tipping fee*)	TON	63,315	$ 37.50	$ 2,374,313	
C. Construct Final Cover System					
1. Soil Barrier (*from on-site stockpile*)					
a. Excavate/Loadout	CY	6,700	$ 1.75	$ 11,725	
b. Transport (Haul) On-Site to Working Face	CY	6,700	$ 2.50	$ 16,750	
c. Compaction	CY	6,700	$ 1.25	$ 8,375	
2. Geosynthetics					
a. Geosynthetic Clay Liner	SY	90,450	$ 5.50	$ 497,475	
b. Geomembrane	SY	90,450	$ 4.50	$ 407,025	
c. Geocomposite	SY	90,450	$ 5.00	$ 452,250	
3. Vegetative Layer (*from on-site stockpile*)					
a. Excavate/Loadout	CY	6,700	$ 1.75	$ 11,725	
b. Transport (Haul) On-Site to Working Face	CY	6,700	$ 2.50	$ 16,750	
c. Placement	CY	6,700	$ 1.75	$ 11,725	
d. Seeding and Mulching	ACRE	2	$ 2,000.00	$ 4,000	
D. Install Surface Drainage Features (*flumes, ditches, etc.*)	LS	1	$ 50,000.00	$ 50,000	
E. Install Methane Probes	LS	1	$ 25,000.00	$ 25,000	
F. Perform Dust Control and Site Maintenance					
1. Perform Dust Control (*light*)	DAY	61	$ 800.00	$ 48,832	
2. Perform Site Maintenance (*erosion control features and haul road*)	LS	1	$ 20,000.00	$ 20,000	
G. Construction Engineering and Monitoring (*during final cover construction*)	MONTH	1	$ 20,000.00	$ 20,000	
			Subtotal - Site Operations and Closure		$ 4,557,158
			Subtotal (w/o Contingency)		$ 5,151,442
			Contingency (25 percent)		$ 1,287,860
			Total		$ 6,439,302

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Waste Excavation Cost Worksheet for Option 1
(Based on CAT 330D L Hydraulic Excavator Capacity and Assumed Production Rates)

Assumed Waste Excavation (cubic yards)	93,800	*from base model*
Assumed Waste Excavation (tons)	63,315	*calculated using 0.675 tons per cubic yard; assume waste material unit weight = 50 pounds per cubic foot*
Excavator Capacity		
using		
Gross Bucket Capacity (cubic yards)	3.00	*from CAT Performance Handbook, Edition 38*
adjusted by		
Fill Factor	0.75	*assumed*
Swell Factor	1.00	*assumed*
to achieve		
Net Bucket Capacity (cubic yards)	2.25	*calculated*
Net Bucket Capacity (tons)	1.52	*calculated*
Excavator Production		
using net bucket capacity and considering		
Cycle Time (seconds)	16.20	*from CAT Performance Handbook, Edition 38*
to achieve		
Excavator Production (tons / operational hour)	337.50	*calculated*
adjusted by		
Excavator (Mechanical) Availability	0.95	*assumed*
Truck Accessibility	0.68	*assumed; considers assumed truck loadout position time*
to achieve		
Adjusted Excavator Production (tons / scheduled hour)	218.03	*calculated*
Units Required		
using assumed waste excavation quantity and considering		
Waste Excavation (tons/week)	12,663	*calculated using assumed (initial) 5-week excavation period*
Excavator Requirement (tons/day)	2,111	*calculated using assumed 6 shifts per week*
Adjusted Excavator Production (tons/day)	2,180.25	*calculated using adjusted excavation production for assumed 10-hour working period per shift*
to achieve		
Units Required per Day	0.97	*calculated*
Units Scheduled per Day	1	*assumed*
Assumed Excavation Production		
considering		
Units Scheduled per Day	1	*assumed*
multiplied by		
Adjusted Excavator Production (tons/day)	2,180.25	
to achieve		
Assumed Excavation Production (tons/day)	2,180.25	*calculated using adjusted excavation production per scheduled unit per day*
Schedule		
using		
Scheduled Days Per Excavation Period	29	*assumed*
and considering		
Scheduled Hours Per Day	10	*calculated using scheduled units for assumed 10-hour working period per shift*
to achieve		
Scheduled Hours Per Excavation Period	290	*calculated*
Base Year Cost		
using schedule and considering		
Unit Cost per Hour	$ 564.68	*calculated using assumed unit rate of $2.59 per ton (or $1.75 per cubic yard)*
to achieve		
Total Cost	$ 163,985.85	*calculated*

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Transport (Haul) Off-Site Cost Worksheet for Option 1
(Based on Highway Hauler w/ Dump Trailer Capacity and Assumed Production Rates)

Assumed Waste Excavation (cubic yards)		93,800	*from waste excavation cost worksheet*
Assumed Waste Excavation (tons)		63,315	*from waste excavation cost worksheet*
Excavator Capacity and Production Summary			
Net Bucket Capacity (tons)		1.52	*from waste excavation cost worksheet*
Cycle Time (seconds)		16.20	*from waste excavation cost worksheet*
Truck Capacity			
using			
Truck Capacity (cubic yards)		35	*considering probable weight restrictions (roughly 40 tons per loaded unit)*
to achieve			
Truck Capacity (tons)		23.63	*calculated using 0.675 tons per cubic yard; assume waste material unit weight = 50 pounds per cubic foot*
Truck Production			
using truck capacity and excavator capacity/production and considering			
Enter Load Area and Position (minutes)		2	*assumed*
Load (minutes)		4.20	*calculated*
Loaded Travel (minutes)		31.67	*calculated using assumed 20 miles @ average speed of 45 miles/hour + 5 minute delay (typ.)*
Enter Dump Area, Position and Dump (minutes)		15	*assumed*
Empty Travel (minutes)		31.67	*calculated using assumed 20 miles @ average speed of 45 miles/hour + 5 minute delay (typ.)*
to achieve			
Cycle Time (minutes)		84.53	*calculated*
Cycle Time (hour)		1.41	*calculated*
using truck capacity and cycle time to achieve			
Truck Production (tons / operational hour)		16.77	*calculated*
adjusted by			
Truck (Mechanical) Availability		0.95	*assumed*
Excavator Accessibility		0.95	*assumed*
to achieve			
Adjusted Truck Production (tons / scheduled hour)		15.13	*calculated*
Units Required			
using assumed waste excavation quantity and considering			
Assumed Waste Excavation Production (tons/day)		2,180	*from waste excavation cost worksheet*
Adjusted Truck Production (tons/day)		151	*calculated using adjusted truck production for assumed 10-hour working period per shift*
to achieve			
Units Required per Day		14.41	*calculated*
Units Scheduled per Day		15	*assumed*
Schedule			
using			
Scheduled Days Per Excavation Period		29	*from waste excavation cost worksheet*
and considering			
Scheduled Hours Per Day		150	*calculated using scheduled units for assumed 10-hour working period per shift*
to achieve			
Scheduled Hours Per Excavation Period		4,356	*calculated*
Base Year Cost			
using schedule and considering			
Unit Cost per Hour	$	75.00	*calculated using assumed trucking rate*
to achieve			
Total Cost	$	326,702.79	*calculated*

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Option 2

Item	Unit	Estimated Quantity	Unit Cost (2008 $)	Extended Cost (2008 $)	
I. Project Development					
A. Determine Waste Limits					
1. Prepare Exploration/Safety Plan	LS	1	$ 5,000.00	$ 5,000	
2. Perform Fieldwork	LS	1	$ 25,000.00	$ 25,000	
3. Prepare Report	LS	1	$ 2,500.00	$ 2,500	
B. Prepare Waste Excavation and Closure Plan					
1. Perform Aerial Site and Hydrographic Survey	LS	1	$ 20,000.00	$ 20,000	
2. Review Project Objectives and Data/Information	LS	1	$ 2,500.00	$ 2,500	
3. Prepare Base Model	LS	1	$ 5,000.00	$ 5,000	
4. Prepare Excavation Plan	LS	1	$ 10,000.00	$ 10,000	
5. Prepare Final Grading and Surface Drainage Plan	LS	1	$ 10,000.00	$ 10,000	
6. Prepare Details, Sections, Profiles, etc.	LS	1	$ 5,000.00	$ 5,000	
7. Prepare Plan Documents (*drawings and specifications*)	LS	1	$ 10,000.00	$ 10,000	
C. Prepare Bid Documents and Assist w/ Contractor Selection					
1. Convert Plan Documents to Construction Documents	LS	1	$ 20,000.00	$ 20,000	
2. Prepare Engineer's Cost Opinion (*for site activities*)	LS	1	$ 5,000.00	$ 5,000	
3. Coordinate and Assist w/ Bid Negotiation	LS	1	$ 10,000.00	$ 10,000	
			Subtotal - Project Development		$ 130,000
II. Mobilization/Demobilization	LS	1	$ 250,000.00	$ 250,000	
			Subtotal - Mobilization/Demobilization		$ 250,000
III. Site Preparation					
A. Prepare Operations, Closure and Health/Safety Plan	LS	1	$ 5,000.00	$ 5,000	
B. Perform Construction Stakeout	LS	1	$ 25,000.00	$ 25,000	
C. Install Erosion Control Features (*silt fence*)	LF	6,800	$ 0.75	$ 5,100	
D. Remove Surface Features and Gas Collection System	LS	1	$ 50,000.00	$ 50,000	
E. Construct On-Site Haul Road					
1. Grade Subgrade for Base Course, Roadways	SY	6,333	$ 0.40	$ 2,533	
2. Geotextile Fabric	SY	6,333	$ 1.50	$ 9,500	
3. Road Materials (*Nos. 2 and 57 stone*)	CY	3,167	$ 37.50	$ 118,763	
4. Construct Road Ditch (*grass-lined*)	LF	7,600	$ 10.00	$ 76,000	
			Subtotal - Site Preparation		$ 291,895
IV. Site Operations and Closure					
A. Strip and Stockpile Existing Vegetative Soil Material	CY	94,700	$ 4.25	$ 402,475	
B. Excavate and Dispose Waste Material					
1. Excavate/Loadout	LS	1	$ 1,138,986.17	$ 1,138,986	
2. Transport (Haul) Off-Site to Disposal Facility	LS	1	$ 2,269,158.93	$ 2,269,159	
3. Dispose Off-Site (*tipping fee*)	TON	439,763	$ 37.50	$ 16,491,113	
C. Construct Final Cover System					
1. Soil Barrier (*from on-site stockpile*)					
a. Excavate/Loadout	CY	24,000	$ 1.75	$ 42,000	
b. Transport (Haul) On-Site to Working Face	CY	24,000	$ 2.50	$ 60,000	
c. Compaction	CY	24,000	$ 1.25	$ 30,000	
2. Geosynthetics					
a. Geosynthetic Clay Liner	SY	324,000	$ 5.50	$ 1,782,000	
b. Geomembrane	SY	324,000	$ 4.50	$ 1,458,000	
c. Geocomposite	SY	324,000	$ 5.00	$ 1,620,000	
3. Vegetative Layer (*from on-site stockpile*)					
a. Excavate/Loadout	CY	24,000	$ 1.75	$ 42,000	
b. Transport (Haul) On-Site to Working Face	CY	24,000	$ 2.50	$ 60,000	
c. Placement	CY	24,000	$ 1.75	$ 42,000	
d. Seeding and Mulching	ACRE	8	$ 2,000.00	$ 16,000	
D. Install Surface Drainage Features (*flumes, ditches, etc.*)	LS	1	$ 100,000.00	$ 100,000	
E. Install Methane Probes	LS	1	$ 75,000.00	$ 75,000	
F. Perform Site Maintenance (*erosion control features and haul road*)					
1. Perform Dust Control (*light*)	DAY	285	$ 800.00	$ 227,762	
2. Perform Site Maintenance	LS	1	$ 100,000.00	$ 100,000	
G. Construction Engineering and Monitoring (*during final cover construction*)	MONTH	3	$ 20,000.00	$ 60,000	
			Subtotal - Site Operations and Closure		$ 26,016,495
			Subtotal (w/o Contingency)		$ 26,688,390
			Contingency (25 percent)		$ 6,672,098
			Total		$ 33,360,488

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Waste Excavation Cost Worksheet for Option 2
(Based on CAT 330D L Hydraulic Excavator Capacity and Assumed Production Rates)

Assumed Waste Excavation (cubic yards)	651,600	*from base model*
Assumed Waste Excavation (tons)	439,765	*calculated using 0.675 tons per cubic yard; assume waste material unit weight = 50 pounds per cubic foot*
Excavator Capacity		
using		
Gross Bucket Capacity (cubic yards)	3.00	*from CAT Performance Handbook, Edition 38*
adjusted by		
Fill Factor	0.75	*assumed*
Swell Factor	1.00	*assumed*
to achieve		
Net Bucket Capacity (cubic yards)	2.25	*calculated*
Net Bucket Capacity (tons)	152	*calculated*
Excavator Production		
using net bucket capacity and considering		
Cycle Time (seconds)	16.20	*from CAT Performance Handbook, Edition 38*
to achieve		
Excavator Production (tons / operational hour)	337.50	*calculated*
adjusted by		
Excavator (Mechanical) Availability	0.95	*assumed*
Truck Accessibility	0.68	*assumed; considers assumed truck loadout position time*
to achieve		
Adjusted Excavator Production (tons / scheduled hour)	218.03	*calculated*
Units Required		
using assumed waste excavation quantity and considering		
Waste Excavation (tons/week)	12,934	*calculated using assumed (initial) 34-week excavation period*
Excavator Requirement (tons/day)	2,156	*calculated using assumed 6 shifts per week*
Adjusted Excavator Production (tons/day)	2,180.25	*calculated using adjusted excavation production for assumed 10-hour working period per shift*
to achieve		
Units Required per Day	0.99	*calculated*
Units Scheduled per Day	1	*assumed*
Assumed Excavation Production		
considering		
Units Scheduled per Day	1	*assumed*
multiplied by		
Adjusted Excavator Production (tons/day)	2,180.25	
to achieve		
Assumed Excavation Production (tons/day)	2,180.25	*calculated using adjusted excavation production per scheduled unit per day*
Schedule		
using		
Scheduled Days Per Excavation Period	202	*assumed*
and considering		
Scheduled Hours Per Day	10	*calculated using scheduled units for assumed 10-hour working period per shift*
to achieve		
Scheduled Hours Per Excavation Period	2,017	*calculated*
Base Year Cost		
using schedule and considering		
Unit Cost per Hour	$ 564.68	*calculated using assumed unit rate of $2.59 per ton (or $1.75 per cubic yard)*
to achieve		
Total Cost	$ 1,138,966.17	*calculated*

Preliminary Cost Opinion

Feasibility Study
Shelby Farms Project
Memphis, Shelby County, Tennessee

Transport (Haul) Off-Site Cost Worksheet for Option 2
(Based on Highway Hauler w/ Dump Trailer Capacity and Assumed Production Rates)

Assumed Waste Excavation (cubic yards)	651,600	*from waste excavation cost worksheet*
Assumed Waste Excavation (tons)	439,763	*from waste excavation cost worksheet*
Excavator Capacity and Production Summary		
Net Bucket Capacity (tons)	1.52	*from waste excavation cost worksheet*
Cycle Time (seconds)	16.20	*from waste excavation cost worksheet*
Truck Capacity		
using		
Truck Capacity (cubic yards)	35	*considering probable weight restrictions (roughly 40 tons per loaded unit)*
to achieve		
Truck Capacity (tons)	23.63	*calculated using 0.675 tons per cubic yard; assume waste material unit weight = 50 pounds per cubic foot*
Truck Production		
using truck capacity and excavator capacity/production and considering		
Enter Load Area and Position (minutes)	2	*assumed*
Load (minutes)	4.20	*calculated*
Loaded Travel (minutes)	31.67	*calculated using assumed 20 miles @ average speed of 45 miles/hour + 5 minute delay (typ.)*
Enter Dump Area, Position and Dump (minutes)	15	*assumed*
Empty Travel (minutes)	31.67	*calculated using assumed 20 miles @ average speed of 45 miles/hour + 5 minute delay (typ.)*
to achieve		
Cycle Time (minutes)	84.53	*calculated*
Cycle Time (hour)	1.41	*calculated*
using truck capacity and cycle time to achieve		
Truck Production (tons / operational hour)	16.77	*calculated*
adjusted by		
Truck (Mechanical) Availability	0.95	*assumed*
Excavator Accessibility	0.95	*assumed*
to achieve		
Adjusted Truck Production (tons / scheduled hour)	15.13	*calculated*
Units Required		
using assumed waste excavation quantity and considering		
Assumed Waste Excavation Production (tons/day)	2,180	*from waste excavation cost worksheet*
Adjusted Truck Production (tons/day)	151	*calculated using adjusted truck production for assumed 10-hour working period per shift*
to achieve		
Units Required per Day	14.41	*calculated*
Units Scheduled per Day	15	*assumed*
Schedule		
using		
Scheduled Days Per Excavation Period	202	*from waste excavation cost worksheet*
and considering		
Scheduled Hours Per Day	150	*calculated using scheduled units for assumed 10-hour working period per shift*
to achieve		
Scheduled Hours Per Excavation Period	30,255	*calculated*
Base Year Cost		
using schedule and considering		
Unit Cost per Hour	$ 75.00	*calculated using assumed trucking rate*
to achieve		
Total Cost	$ 2,269,158.99	*calculated*