Table III.D-1
Cost Comparison Summary of Ravine B Alternative [1,2,3]

		Unit Costs	Unit	Ravine B Quantity	Ravine B Cost
CAPITAL COSTS					
	General Project / Permitting / Infrastructure Cost Impacts				
1	Property Acquisition	$ 12,000	Acre	0	$ -
2	Clearing, Grubbing, and Site Preparation	$ 17,000	Acre	521	$ 8,857,000
3	Large Utility Line Relocation (345 kV Single Circuit)	$ 880	LF	8,400	$ 7,392,000
4	Fencing	$ 50	LF	65,045	$ 3,252,250
5	Environmental Wetland Mitigation (cost based on adjusted mitigation units)	$ 72,000	Acre	2.58	$ 185,760
6	Environmental Stream Mitigation (cost based on adjusted mitigation units)	Varies	LF	87,253	$ 18,466,825
7	Cultural Resources	Varies	EA	1	$ 2,000,000
8	Indiana Bat Mitigation[4]	$ 5,338	Acre	521	$ 2,781,098
9	Road Relocation (County Road)	$ 350	LF	0	$ -
10	Road Relocation (State Road)	$ 400	LF	0	$ -
				Subtotal	**$ 42,934,933**
	CCR Transportation				
11	Pipe Conveyor Transport (North Ridge Top)	$ 2,150	LF	0	$ -
12	Pipe Conveyor Transport (Ogden Ridge Road Path)	$ 2,425	LF	5,236	$ 12,697,300
13	Pipe Conveyor Transport (South Ridge Top)	$ 3,125	LF	0	$ -
14	Transfer Station	$ 250,000	EA	0	$ -
15	Haul Road - Off Landfill	$ 1,600	LF	5,308	$ 8,492,800
16	Bridge - Large (36 FT high, 440 FT long, 60 FT wide)	$ 4,000,000	EA	0	$ -
17	Bridge - Medium (200 FT long, 60 FT wide)	$ 1,750,000	EA	1	$ 1,750,000
				Subtotal	**$ 22,940,100**
	Landfill Preparation				
18	Perimeter Collection Channel - Fabric Form, 6-10' Bottom Width	$ 75.00	LF	15,073	$ 1,130,475
19	Upslope Drainage Diversion Channel - Fabric Form, 1-5' Bottom Width	$ 50.00	LF	18,105	$ 905,250
20	Subgrade Preparation - General Earthwork - Soil Inside Footprint (3000 ft R.T.)	$ 5.65	CY	1,414,591	$ 7,992,439
21	Subgrade Preparation - General Earthwork - Rock Blasting (3000 ft R.T.)	$ 21.72	CY	1,300,410	$ 28,244,905
22	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1/2 Mile	$ 5.65	CY	311,364	$ 1,759,207
23	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1 Mile	$ 5.94	CY	311,364	$ 1,849,502
24	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 2 Miles	$ 6.84	CY	1,377,839	$ 9,424,419
25	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 4 Miles	$ 8.36	CY	0	$ -
26	Landfill Composite Liner System - 0.5 mi RT Protective Cover/4 mi RT Drainage Layer	$ 91,000	Acre	0	$ -
27	Landfill Composite Liner System - 1.5 mi RT Protective Cover/4 mi RT Drainage Layer	$ 93,000	Acre	0	$ -
28	Landfill Composite Liner System - 0.5 mi RT Protective Cover/2 mi RT Drainage Layer	$ 88,000	Acre	194	$ 17,072,000
29	Groundwater Underdrain Drainage Pipes	$ 6,000	Acre	194	$ 1,164,000
30	Leachate Collection System Drainage Pipes	$ 15,000	Acre	194	$ 2,910,000
				Subtotal	**$ 72,452,197**
	ES/SWM Pond and Leachate Pond[5]				
31	Large ES/SWM Pond and Leachate Pond - Earthwork and Liner System (~35 acre-ft)	$ 3,000,000	EA	1	$ 3,000,000
32	Medium ES/SWM Pond and Leachate Pond - Earthwork and Liner System (~20 acre-ft)	$ 2,000,000	EA	0	$ -
				Subtotal	**$ 3,000,000**
	Landfill Cap Cover System				
33	Final Cover System - 2 Mile RT (12 Inches Clay; 12 Inches Topsoil)	$ 29,000	Acre	0	$ -
34	Final Cover System - 4 Mile RT (12 Inches Clay; 12 Inches Topsoil)	$ 33,000	Acre	194	$ 6,402,000
				Subtotal	**$ 6,402,000**
	Barge Transport				
35	Barge Loading Facility	$ 14,200,000	EA	0	$ -
36	Barge Unloading Facility	$ 16,100,000	EA	0	$ -
37	Ancillary Costs (Critical Spares and Office/Warehouse Space)	$ 1,600,000	EA	0	$ -
				Subtotal	**$ -**
	Additional Capital Costs				
38	Additional Capital Costs[6]				
	LG&E Overheads and Engineering Support	$ 10,250,000	LUMP	1	$ 10,250,000
	Intermediate Cover and Benches	$ 8,090,000	LUMP	1	$ 8,090,000
	QA/QC (Subgrade, Liner, Final Cover System)	$ 5,940,000	LUMP	1	$ 5,940,000
	Borrow Area Roads and On-Landfill Haul Roads	$ 7,730,000	LUMP	1	$ 7,730,000
				Subtotal	**$ 32,010,000**
				Capital Total	**$ 179,739,230**
OPERATION AND MAINTENANCE (O&M) COSTS					
	Landfill / Pipe Conveyor Operating Costs				
39	Hauling - 1 Mile Round Trip (22 CY on landfill/private road)	$ 2.56	CY	34,162,019	$ 87,454,769
40	Hauling - 2 Mile Round Trip (22 CY on landfill/private road)	$ 3.46	CY	0	$ -
41	Hauling - 3 Mile Round Trip (22 CY on landfill/private road)	$ 4.19	CY	0	$ -
42	Hauling - 30 Mile Round Trip (18 CY, 35 MPH avg)	$ 11.55	CY	0	$ -
43	Offsite CCR Disposal - Tipping Fee	$ 21.20	TON	0	$ -
44	Pipe Conveyor Cost of Operation	$ 0.20	CY	34,162,019	$ 6,832,404
				Subtotal	**$ 94,287,172**
	Barge Transport				
45	Barge Loading and Unloading Operation Cost	$ 1,100,000	YR	0	$ -
46	Barge Transportation Costs	Varies	TON	0	$ -
				Subtotal	**$ -**
	Additional O&M Costs				
47	Additional O&M Costs[6]				
	CCR Placement, Compaction, Survey, and QA/QC	$ 95,080,000	LUMP	1	$ 95,080,000
	Cleanout / Maintenance (Haul Roads, Ponds, LCS, Underdrain, and Landfill)	$ 20,240,000	LUMP	1	$ 20,240,000
	Dust Control	$ 11,500,000	LUMP	1	$ 11,500,000
				Subtotal	**$ 126,820,000**
				O&M Total	**$ 221,107,172**

CASE STUDY:	Ravine B
STORAGE CAPACITY (MCY):	34.2
CAPITAL COST ($1 MILLION):	$180
O&M COST ($1 MILLION):	$221
TOTAL CAPITAL AND O&M COST ($1 MILLION):	$401
($/CY):	$11.73

NOTES:

1. Costs are for comparison of case studies only as described in Section III of report. Contingencies were not applied except as noted in Appendix III.D-1.
2. Costs were developed including only line items which are anticipated to be significantly different between case studies. "Common cost" items anticipated to be similar in cost for all case studies are not included (e.g. project management, or the conditioning and treatment of CCR prior to transit from TC Station). Minor construction and operations costs are not included due to the conceptual nature of the design. Examples of these cost items include: minor utility line relocations, minor erosion and sedimentation/stormwater management controls, surface and groundwater testing, mowing.
3. Costs are calculated on 2012 dollar basis (except as noted in Appendix III.D-1). No inflation or discount rates included.
4. Assumes average cost ($5,338 per acre) for Indiana Bat mitigation as described in Support Document III.D-1-4.
5. Does not include costs for leachate treatment or transport system. See Appendix III.D-1 for more information.
6. Additional Capital and O&M costs include costs previously omitted from (GAI 2014) cost analysis but added to the Case Study analysis due to comparison of landfill vs. non-landfill (e.g. mine) Site Alternatives. See Appendix III.D-1 for more information.

APPENDIX III.D-1.
Methods for Assessment of Costs

APPENDIX III.D-1 – METHODS FOR ASSESSMENT OF COSTS

SECTION 1: APPROACH TO COST ANALYSIS

- Costs for the four case study alternatives are presented in conceptual detail in Tables III.D-1 through III.D-4 in the Supplement. For selected other alternatives, cost information is provided in Appendix IV.A-2. Analyses of project costs can apply different methodologies depending on the purpose for which the cost estimates are being made. For an alternatives analysis, the primary requirement is to generate costs that allow a fair comparison among conceptual alternatives. As such the cost analysis in GAI (2014) and in this Supplement reflects the following considerations.Costs that are common to every alternative do not need to be estimated or presented. An example for the case of CCR disposal is that all material must be processed and treated to be in a dry form (<20% moisture content) before it is transported offsite. At Trimble County Generating Station, this cost alone is estimated to exceed $6 per cubic yard. The treatment cost does not vary among alternatives and therefore is not included in the cost comparisons among alternatives. The costs in the Supplement are those appropriate for comparison among disposal alternatives, and do not represent the full cost of CCR management.
- Cost factors that are simple multipliers of construction costs are not included. An example of this is any allowance for contingencies or uncertainties. The effect of such a multiplier is to widen the gap between the lower and higher cost alternatives, which has the potential to bias the analysis toward the lowest-cost option. An exception to this consideration can be when these simple multiplier costs are projected to be significant for one type of CCR disposal facility (e.g. landfill) and insignificant or absent in another (e.g. mine). In addition, in a few instances, where a cost was developed based on a bid from a third party, which included a contingency, this is included if LG&E determined it was justified. In the late stages of an alternatives analysis, these factors can be considered if and when there may be marked differences in engineering or contingency costs between two alternatives that are otherwise close in cost.
- The line items included in the cost analysis in GAI (2014) were not "all inclusive", i.e. the line items included were only those anticipated to differ significantly between landfill alternatives. Consequently, a number of line items and their associated costs were excluded, assuming they were similar among all alternatives considered, and would not affect the overall cost difference between alternatives[1]. However, in this Supplement there are two case studies (Sterling Ventures and Valley View) that do not involve construction and operation of a conventional CCR landfill, but instead will charge a tipping fee to accept CCR material from LG&E. Therefore, Tables III.D-1 through III.D-4 include line items 38 and 47, "Additional Capital Costs" and "Additional Operations and Maintenance (O&M) Costs" respectively, to account for these costs

[1] While the Valley View Municipal Solid Waste Landfill, which was an alternative considered in GAI, 2014, is not a landfill alternative that LG&E would construct and manage, the costs associated with that alternative were so far in excess of the costs for the Ravine B alternative that it was not believed to be necessary to include these additional costs for all other alternatives solely for the sake of comparison to Valley View.

that can no longer be omitted as they will now vary between alternatives. The additional line items and associated costs included on Tables III.D-1 through III.D-4 are explained further in Support Document III.D-1-17 provided on a digital disk submitted with this Supplement.

- No consideration is given to timing factors that are common in many types of financial analyses, such as for a rate-of-return determination. There is no adjustment for inflation on future operations costs, possible future increases in energy costs, discounting to bring future costs to present value, or return on investment if operation costs are fully funded on Day 1 but only expended over time. LG&E considers the gross costs for construction and 37 years of operations to provide the fairest comparison of relative costs among alternatives.
- Costs that are expected to be small for any alternative are not quantified. An example is the cost for relocation of local water, sewer and other utility lines, which are typically a fraction of one percent of total costs. These small costs are reasonably ignored given they are dominated by the costs of landfill and transportation system construction and operation. In contrast, relocation of a large transmission line is costly enough to be considered.
- While LG&E understands that unit costs can vary on a year to year basis, costs in this analysis are not adjusted based on a particular year. Costs in GAI (2014) are based on 2012 data. Accordingly, to respond to EPA's requests for additional documentation on evaluated alternatives, the Supplement uses the same 2012 cost basis and provides more detailed documentation of the underlying cost estimates. A few cost elements developed specifically for this Supplement are based upon 2013 or 2014 information. For initial comparison purposes, it is considered acceptable to have a mixture of years in the cost estimates, so long as for any one project element (such as barge transportation) the estimates are consistent among all alternatives (in that case, 2014). In the late stages of an alternatives analysis, adjustment of costs to a common year can be considered if and when the result could markedly affect the cost comparison between two alternatives that are otherwise close in cost.
- Costs are based on relatively comparable levels of conceptual engineering. The expectation is that for any alternative, more detailed design-level engineering would identify additional cost items or contingencies. To make a fair comparison, costs for all alternatives have been made based solely on conceptual-level engineering. The assessment is more detailed for alternatives in Section III and order-of-magnitude for alternatives in Section IV.

The Alternatives Analysis in GAI (2014) involved estimation of planning-level costs for several dozen CCR disposal alternatives. This Appendix documents the methods used for those estimates in more detail than was provided in GAI (2014), as well as additional cost information analyzed specifically in the case study analysis.

The development of the comparison cost estimates for the alternatives included the following steps, detailed in the following sections of this Appendix.

- Section 2 describes the identification of project elements which may be different between generic alternative designs that would account for major cost components. Construction and operation elements were identified separately based on experience with the full range of elements in a large CCR disposal facility project.
- Section 3 describes how a unit cost was prepared based on known or reliable cost sources such as a.) known standardized construction cost estimating reference books (e.g. RS Means), or b.) estimated costs quoted specifically for the alternatives analyzed in this report, or c.) estimated costs quoted from similar components of comparable past projects (i.e. past construction bid/cost experience and/or vendor/supplier quotes) for each category of project element.
- Section 4 describes how the magnitude (or unit quantity) of each element was estimated based on conceptual design drawings or other project-specific considerations.
- Section 5 describes how costs for each project element were totaled by multiplying the unit cost by the unit quantity. Costs for a few project elements were calculated on a specific site-by-site basis. An example explanation of how the unit costs and unit quantity are used to develop the cost for a particular Line Item is also included in this section.

Each step in this methodology is explained and documented here in Appendix III.D-1. If a unit cost requires additional justification or backup information, it is included in the Support Documents provided in the digital disk submitted as part of this Supplement. Appendix III.C-1 describes the conceptual design process for CCR landfills and the types of project attributes that may require a cost estimate. Tables III.D-1 through III.D-4 provide the results of the application of these methods to the four case studies.

SECTION 2: PROJECT ELEMENTS ANALYZED FOR COST

The first step in the assessment of costs was to identify the project elements that would account for major costs for a CCR disposal facility. Based on past experience with construction and operation of large CCR disposal facilities, project elements that were anticipated to cause significant differences in costs between the alternatives were identified as described below. As described above, project elements that were anticipated to be similar or the same between alternatives [for example, project management, quality assurance/quality control (QA/QC), CCR treatment and transportation system at TC Station, etc.], were not included in the cost analysis.

The following project elements were identified to be major components for a CCR disposal facility for which costs were to be developed. The project elements have been grouped between capital and operation and maintenance (O&M) costs.

Line Item #	Description	Cost ($)	Per Unit
Capital Costs			
1	Property Acquisition	$12,000	Acre
2	Clearing, Grubbing, and Site Preparation	$17,000	Acre
3	Large Utility Line Relocation	$880	Linear Foot

Line Item #	Description	Cost ($)	Per Unit
			(LF)
4	Fencing	$50	LF
5	Environmental Wetland Mitigation (cost based on adjusted mitigation units (AMU) and may be increased by 1.2 factor for temporal loss if In Lieu Fee option is utilized; rate of $72,000/acre includes the 1.2 factor)	$72,000	Acre
6	Environmental Stream Mitigation (cost based on AMU and may be increased by 1.2 factor for temporal loss if In Lieu Fee option is utilized)	$170	AMU
7	Cultural Resources (Potential Phase III data recovery)	Varies	EA
8	Indiana Bat Mitigation	$5,338	Acre
9	Road Relocation (County Road)	$350	LF
10	Road Relocation (State Road)	$400	LF
11	Pipe Conveyor Transport (similar to North Ridge Top path at Ravine B)	$2,150	LF
12	Pipe Conveyor Transport (similar to Ogden Ridge Road path at Ravine B)	$2,425	LF
13	Pipe Conveyor Transport (similar to South Ridge Top path at Ravine B)	$3,125	LF
14	Transfer Station	$250,000	EA
15	Haul Road - Off Landfill	$1,600	LF
16	Bridge - Large (36 Feet (FT) high, 440 FT long, 60 FT wide)	$4,000,000	EA
17	Bridge - Medium (200 FT long, 60 FT wide)	$1,750,000	EA
18	Perimeter Collection Channel - Fabric Form, 6-10' Bottom Width	$75.00	LF
19	Upslope Drainage Diversion Channel - Fabric Form, 1-5' Bottom Width	$50.00	LF
20	Subgrade Preparation - General Earthwork - Soil Inside Footprint (3000 foot Round Trip)	$5.65	CY
21	Subgrade Preparation - General Earthwork - Rock Blasting (3000 foot Round Trip)	$21.72	CY
22	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1/2 Mile	$5.65	CY
23	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1 Mile	$5.94	CY
24	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 2 Miles	$6.84	CY
25	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 4 Miles	$8.36	CY
26	Landfill Composite Liner System - 0.5 mi Round Trip Protective Cover/4 mi Round Trip Drainage Layer	$91,000	Acre
27	Landfill Composite Liner System - 1.5 mi Round Trip Protective Cover/4 mi Round Trip Drainage Layer	$93,000	Acre
28	Landfill Composite Liner System - 0.5 mi Round Trip Protective Cover/2 mi Round Trip Drainage Layer	$88,000	Acre
29	Groundwater Underdrain Drainage Pipes	$6,000	Acre
30	Leachate Collection System Drainage Pipes	$15,000	Acre
31	Large Erosion and Sedimentation/Stormwater Management (ES/SWM) Pond and Leachate Pond - Earthwork and Liner System (~35 acre-ft)	$3,000,000	EA
32	Medium ES/SWM Pond and Leachate Pond - Earthwork and Liner System (~20 acre-ft)	$2,000,000	EA
33	Final Cover System - 2 Mile Round Trip (12 Inches Clay; 12 Inches Topsoil)	$29,000	Acre
34	Final Cover System - 4 Mile Round Trip (12 Inches Clay; 12 Inches Topsoil)	$33,000	Acre

Line Item #	Description	Cost ($)	Per Unit
35	Barge Loading Facility	$8,300,000	EA
36	Barge Unloading Facility	$16,100,000	EA
37	Ancillary Costs (Critical Spares and Office/Warehouse Space)	$1,600,000	EA
38	Additional Capital Costs	Varies	LUMP
Operation and Maintenance (O&M) Costs			
39	Hauling - 1 Mile Round Trip (22 CY on landfill/private road)	$2.56	CY
40	Hauling - 2 Mile Round Trip (22 CY on landfill/private road)	$3.46	CY
41	Hauling - 3 Mile Round Trip (22 CY on landfill/private road)	$4.19	CY
42	Hauling - 30 Mile Round Trip (18 CY, 35 MPH avg)	$11.55	CY
43	Offsite CCR Disposal - Tipping Fee	Varies	TON
44	Pipe Conveyor Cost of Operation	$0.20	CY
45	Barge Loading and Unloading Operation Cost	$1,100,000	YR
46	Barge Transportation Costs	Varies	TON
47	Additional O&M Costs	Varies	LUMP

SECTION 3: UNIT COST DESCRIPTION

A variety of sources were consulted to calculate the unit costs for each project element. For standard construction costs, such as hauling, excavating, general earthwork, etc, the 2012 edition of *RS Means Heavy Construction Cost Data* was used. RS Means is widely accepted in the construction industry as one of the standards in construction cost valuation. The RS Means source provides unit costs on a nationwide level and a 'location factor' for various cities/areas throughout the United States that allows for inflation or deflation of unit costs. The 'location factors' are percentage ratios of a specific city's material and labor costs to the national average cost of the same item. The location factor from Frankfort, KY was selected for use in all cost estimating, as it is the city listed in RS Means with the closest proximity to the alternatives evaluated. The location factor used in all RS Means sourced unit costs is 0.76.

More complex project element costs (such as property acquisition, utility relocations, bridges, haul road, ponds) were typically developed from GAI or LG&E experience on previous projects and adapted or scaled to the conceptual alternatives analyzed herein. For other project elements that required outside reference (such as off-site CCR disposal/tipping fee or pipe conveyor and barge transport), unit cost information was sourced from available vendors and suppliers in the form of price quotes and budgetary cost estimates. All costs are calculated on a 2012 dollar basis except as noted in Section 4. A breakdown of the unit costs, including a listing of the elements combined to develop each unit cost, can be found in Table Appendix III.D-1– Unit Cost Development. A description of the layout and format of Table Appendix III.D-1 is as follows:

> From left to right, the column headings include the Line Item number, a checkbox that identifies whether the project element is a capital or O&M cost, a description of project element, the unit cost, the unit, the source of costing information, the RS Means # (if applicable), and any conversion calculations used to convert units. When multiple sub-items comprise a line item, the total was added up and rounded for ease of calculation.

Line Item costs that were developed from RS Means display the RS Means Item Number (correlates to the Line Item number provided in the *2012 RS Means Heavy Construction Cost Data* source books), the Line Item's original cost and unit, the adjusted cost using the location factor for Frankfort, KY, and, if necessary, the unit adjustment equation to calculate the cost in a more reasonable and easily estimated unit for the estimate (for example, converting a $ per square yard cost into $ per acre). The scans of the pages from RS Means used for the unit cost development are included as Support Document III.D-1-1.

For Line Items not developed from RS Means, and that required additional backup cost sheets, price quotes, or calculations, a short description of the source is included in the fourth column and a reference to Support Documents III.D-1-2 through III.D-1-19 is listed in the last column on the right of the table. Support Documents III.D-1-2 through III.D-1-19 include detailed backup for how these unit costs were developed.

SECTION 4: UNIT QUANTITY DEVELOPMENT

Once the Line Items were identified and unit costs for those elements were developed, the unit quantity of each Line Item was estimated for various alternatives based on conceptual design drawings and/or other project specific considerations as described herein.[2] A description of how the units for each Line Item were quantified is described below. Also included for each Line Item is a listing of the unit cost and how the unit is multiplied by the unit cost in order to quantify the estimated cost for each Line Item.

CAPITAL COSTS

Line Item 1 - Property Acquisition – A conceptual impact boundary was developed based on space required to build the CCR disposal facility, roads, pipe conveyor, borrow areas, spoil areas, laydown facilities, erosion and sedimentation/stormwater management (ES/SWM) ponds, and other ancillary facilities needed for a case study alternative. Property line information was obtained from local Property Valuation Assessment (PVA) data or existing property mapping provided by LG&E. When the impact boundary encroached at all on a property, it was assumed that the entire property would need to be purchased, with the exception of Sterling Ventures Mine, which assumes only portions of existing property encompassing the impact boundary needed to construct and operate barge unloading facility, pipe conveyor, and haul roads, would be purchased due to these parcels being large (on the order of hundreds of acres each). The total acreage of property is multiplied by the unit cost of $12,000/acre (a cost provided by LG&E based on past real estate experience[3]) to quantify the cost to acquire the property.

Line Item 2 – Clearing, Grubbing, and Site Preparation – Line Item 2 is comprised of the following two components, with unit costs given on a 'per acre' basis:

[2] Detailed cost estimates were not needed for all alternatives for purposes of a comparative, screening level analysis. For example, a number of alternatives were determined to be not practicable based on key logistical concerns (such as lack of capacity) alone.

[3] All property was assumed to be $12,000/acre. However, property value may vary based on location. For example, Lee Bottom Flying Field may be more expensive.

-Cut and Chip Trees

-Grub Stumps and Remove

A conceptual impact boundary was developed based on space required to build the CCR disposal facility, roads, pipe conveyor, borrow areas, spoil areas, laydown facilities, ES/SWM ponds, and other ancillary facilities needed. The total forested acreage within the impact boundary, defined as any area observed to have tree cover, was calculated using United States Geological Survey (USGS) and/or aerial imagery mapping. This acreage was multiplied by the unit cost of $17,000/acre to quantify the cost to clear, grub, and prepare a site for development.

Line Item 3 – Large Utility Line Relocation – To quantify the length of utility line relocation for an alternative, aerial photography was used to identify large overhead transmission lines similar to the one that crosses the existing LG&E property in Ravine B. Where these lines crossed a facility, a route around the facility was sketched and the length of the approximate rerouted line was measured.

In order to calculate a cost for Line Item 3, the total linear footage of the utility line that crossed over the facility was multiplied by the unit cost of $880/linear foot (LF).

Minor utility line relocations are not included in this analysis.

Line Item 4– Fencing – Multiple components were included in the development of the total unit cost used in Line Item 4. These components include:

- Corner posts, line posts, corner and end post bracing, top rail, rail – middle/bottom, reinforcing wire, steel t-post, barbed wire, extension arms, eye tops – 2-3/8", chain link fencing, and gates.

With a few exceptions, fencing was placed to enclose the entire project area of an alternative, resulting in the conceptual impact boundary perimeter generally being used for the quantity. Where the topography, such as steep slopes, did not necessitate fencing or where there was already an existing fence present, such as around the TC Station, fencing was not quantified.

In order to calculate a cost for Line Item 4, the total linear footage of the impact boundary perimeter was multiplied by the unit cost of $50/LF.

Line Items 5 and 6 – Environmental Wetland and Stream Mitigation

For the Ravine B alternative, actual field-verified data and location coordinates were utilized within a GIS program to determine the total stream lengths and wetland acreages that would be impacted.

Where field-verified stream and wetland data were not available, GIS mapping techniques and publically available data sources from various government agencies were utilized to estimate the lineal feet of streams and acreage of wetlands that may be impacted. An impact boundary was first established for an alternative based on predicted land disturbances from various construction and operational activities. The locations of potential wetland areas were obtained from the National Wetland Inventory (published

by the United States Fish and Wildlife Service [USFWS]). The locations of major streams were obtained from the National Hydrography Dataset (published by the United States Geological Survey [USGS]). The location of smaller streams were estimated utilizing published topographic contour data by delineating (in GIS software) streams based on the presence of ravines and high-gradient slopes. Assumptions were made concerning the stream type (ephemeral or intermittent) for these contour-based stream estimates. These assumptions were based upon knowledge of the terrain and typical stream occurrences in such areas of the Bluegrass bioregion and surrounding areas.

Under the wetland and stream compensatory mitigation Fee In-Lieu Of (FILO) program, the United States Army Corps of Engineers (USACE) directs an applicant to utilize multipliers based on the table published on the USACE's Louisville District website as presented below. To derive the amount of adjusted mitigation units (AMUs) for a specific stream reach, the multiplier is selected from the USACE's table based on the stream's flow classification (ephemeral or intermittent for this Project) and the stream's quality based on the narrative rating (good, fair, poor). The narrative rating is determined from the stream habitat score that is calculated utilizing the high-gradient stream data sheet procedure. The completion of the high-gradient stream data sheet procedure, which constitutes the rapid bioassessment protocol, is described in Kentucky Division of Water's (KDOW) Methods for Assessing Habitat in Wadeable Waters (2011).

The Kentucky Department of Fish and Wildlife Resources (KDFWR) is the state agency responsible for implementing stream and wetland restoration projects in Kentucky under the FILO program, and the agency establishes the costs per AMU for compensation purposes. The cost rate of $170 per stream AMU and $72,000 per wetland acre (based on mitigation ratio of 2.0 for all wetland acres and temporal loss factor of 1.2 as the USACE requires) was utilized to estimate mitigation fees for all alternatives for which cost estimates were developed. These AMU cost rates were in effect at the time of the initial alternatives analysis (2012) where mitigation cost estimates were initially developed for several alternatives as reported in GAI, 2014. These AMU values were applied to all cost estimates for consistency and comparison of alternatives. Note that the actual mitigation fee for an alternative will be based on the AMU cost rate in effect at the time of project implementation. For example, the KDFWR's website (accessed September 25, 2014) reports a cost per AMU of $240 for stream impacts within the Salt River Watershed area, in which all alternatives are located with the exception of Lee Bottom, Sterling Ventures, and Bethlehem Terrace. A temporal loss and cumulative impacts factor of 1.2 is also applied to the total stream and wetland AMUs for a project that utilizes the FILO program. Note that this 1.2 factor was applied to the mitigation cost estimates for all alternatives for which cost estimates were prepared (e.g., the wetland mitigation fee would therefore be $72,000 per acre). If the option of purchasing mitigation bank AMU credits is selected instead of the FILO program, then the temporal loss factor may not apply.

The cost for Line Items 5 and 6 were calculated on a site-by-site basis based on the factors discussed above.

The USACE's website includes the following mitigation calculator tools, which were accessed on September 25, 2014 (http://www.lrl.usace.army.mil/Missions/Regulatory/Mitigation/InLieuFeeProgram.aspx).

Line Item 7 – Cultural Resources (Potential Phase III data recovery) – A high level, conceptual lump sum cost was developed for each case study alternative to perform Phase I to Phase III archaeological investigations on potential archeological sites and Phase I survey and Criteria of Effect Studies for architectural/historical resources that could be affected or disturbed as a result of the project. These cost estimates are based on the number and location of previously recorded archaeological sites and architectural/historical resources and the potential to find previously unrecorded archaeological sites and architectural/historical resources. Existing data sources were consulted during this process. The data sources include aerial photographs, historic maps, and records on file at various state agencies, such as Indiana Department of Nature Resources, Historic Preservation and Archaeology (DHPA), Indiana State Historic Architectural and Archaeological Research Database (SHAARD), Kentucky Office of State Archaeology (OSA), and Kentucky Heritage Counsel (KHC). Each location had landform variables that were also considered during this process. Steep slopes, disturbed settings, and wetlands have a low potential for archaeological sites. Moderately sloping landforms with intact soils have a moderate potential for archaeological sites. Gently sloping to level areas have high potential for archaeological sites. Due to proximity to water and water-related resources, intact floodplain and terrace settings along the Ohio River have the highest potential for large prehistoric sites that have the potential to provide significant information towards our understanding of regional prehistory. Historic era domestic sites built prior to the mid-twentieth century and not impacted by later development have the highest potential to provide significant information for understanding regional history. The cost for Line Item 7 was calculated on a site-by-site basis based on the factors discussed above[4]. See Appendix III.C-1 for further description of the cultural resources process.

Line Item 8 – Indiana Bat Mitigation – The result of the Endangered Species Act Section 7(a)(2) consultation process with USFWS will likely result in requirements for compensation of lost Indiana bat habitat for any alternative involving clearing of forested areas. Until the consultation process is complete, it is unknown if USFWS will request that land be purchased through a land trust or conservation bank, deeded to a conservancy, or accepted as a deposit through the Indiana Bat Conservation Fund (IBCF). However, the USFWS Biological Opinion on Conservation Memoranda (BO) provides a methodology to estimate the cost of the mitigation. The BO suggests using a base mitigation fee equal to the average value of farm real estate as published annually by the United States Department of Agriculture (USDA) Land Values and Cash Rents report, with a multiplier based on the season of Indiana bat occupancy. The Indiana Bat mitigation fee of $5,338 per acre was applied to all cost estimates for consistency and comparison of alternatives. This mitigation fee rate was in effect at the time of the initial alternatives analysis (2012) where mitigation cost estimates were initially developed for several alternatives as reported in GAI, 2014. The mitigation rate was calculated as the average of the lowest per acre fee of $4,575 (for tree clearing between August 14th through March 31st) and the higher cost per acre fee of

[4] Extensive cultural resources investigations have occurred to date in the Ravine B area as part of project planning/design. Therefore, cultural resources costs for alternatives located in the proximity of Ravine B represent more detailed knowledge and are estimated as being more expensive than off-site alternatives (e.g. Lee Bottom). As stated above, intact floodplain and terrace settings along the Ohio River have very high potential for archaeological sites.

$6,100 (for tree clearing between April 1st through August 15th) assuming the project area was designated as a "known maternity" area for the Indiana bat. The use of this average mitigation fee rate is based on the assumption that tree clearing would need to occur at various times throughout a given year, including during the maximum mitigation fee period, for construction purposes. Note that the actual mitigation fee for an alternative will be based on the mitigation fee per acre in effect at the time of project implementation (assuming that the USACE and USFWS requires this mitigation fee approach to compensate for habitat loss). For example, the project area is now (2014) designated as a "known non-materinity" area therefore the fee per acre could actually be less. Refer to Support Document III.D-1-4 for additional information on the basis of mitigation costs.

In order to calculate a cost for Line Item 8, the unit cost of $5,338/acre was multiplied by the total forested acreage within the impact boundary, where the acreage was estimated using USGS and/or aerial imagery mapping.

Line Items 9-10 – Road Relocation (County/State Road) – GAI developed a conceptual cost estimate to relocate a county and state road for an alternative evaluated in GAI, 2014. The total project cost for each road was divided by the total length of road being relocated to create a unit cost on a linear foot basis. These costs were rounded to $350/LF of county road and $400/LF of state road. Refer to Support Document III.D-1-6 for additional information on the basis of relocation costs. The following assumptions were made in the creation of the estimate:

-County road assumed as 18 ft out-to-out width (two 8' lanes with 1' shoulders),

-State road assumed as 24 ft out-to-out width (two 10' lanes with 2' shoulders),

-Drainage approximated as 20% of Paving and Earthwork cost,

-E&S approximated as 10% of Paving and Earthwork cost,

-Maintenance & Protection of Traffic approximated as 1.5% of Paving and Earthwork cost,

-Signing, Pavement Marking, and Delineation approximated as 1.5% of Paving and Earthwork cost,

-Mobilization approximated as 5% of Total Cost,

-30% contingency added, and

-Estimates do not include Right-of-Way Acquisition, Utility Relocation/Engineering, Post Construction Stormwater Management, Construction Phase Engineering, and Quality Assurance / Quality Control (QA/QC).

If an alternative required the relocation of county or state road(s), the approximate relocation was measured at a conceptual level. To calculate a cost for Line Items 9 and 10, the unit cost per linear foot for county ($350/LF) and state ($400/LF) roads was multiplied by the total linear footage of county and state roads being relocated.

Line Items 11-13 – Pipe Conveyor Transport – The Beumer Group provided price quotes for three pipe conveyor routes in the vicinity of Ravine B based upon existing topography and difficulty of

construction. Refer to Support Document III.D-1-7 for additional information regarding these quotes. These quotes included costs for design and supply, mechanical and electrical installations, and civil and foundation work. These quotes were then developed into a unit cost on a linear foot basis, by taking total length and dividing by the total cost for each. These unit costs are $2,150/LF for a route similar to the North Ridge Top path near Ravine B (conveyor runs north along Bottom Ash Pond at TC Station, crosses to the northeast on a bridge, and runs along Wentworth Road), $2,425/LF for a route similar to the Ogden Ridge Road path near Ravine B (conveyor crosses Highway 1838 due east on a bridge, travels east up the adjacent slope and along Ogden Ridge Road), and $3,125/LF for a route similar to the South Ridge Top path near Ravine B (conveyor crosses Highway 1838 due east on a bridge and travels southeast to the ridge tops).

For each alternative, one of the three pipe conveyor routes, which most closely represented the topography of the site, was selected and the linear footage of the conceptual proposed pipe conveyor was measured. This linear foot quantity was multiplied by the route's unit cost to calculate a cost for Line Items 11-13.

Line Item 14 – Transfer Station – Additional input from the Beumer Group included direction on when a transfer station would be needed in order to turn the pipe conveyor in a new direction along its route. When the pipe conveyor contains turns of a radius less than 1000 feet or changes in direction that exceeded 90 degrees, the Beumer Group suggested the use of one transfer station in each of the quotes. They quoted the transfer station at $250,000 each. Alternatives that could not meet the design criteria of minimum pipe conveyor radius of less than 1000 feet, or that had changes in direction that exceed 90 degrees based on existing ground topography or site constraints, were assumed to require a transfer station. Alternatives that had more than one instance of not meeting the design criteria would require multiple transfer stations. The number of transfer stations was multiplied by the unit cost of $250,000 to calculate a cost for Line Item 14.

Line Item 15 – Haul Road – Off Landfill – GAI developed an estimate of probable construction costs for a haul road during a more detailed design of the Ravine B alternative. Multiple components were included in the development of the total unit cost used in Line Item 15. These components include:

-Clearing and grubbing, excavation, foreign borrow excavation, subbase-20" depth (No. 2A), subbase-8" depth (No. 2A), bituminous tack coat, bituminous concrete base course-12" depth, bituminous binder course-4" depth, bituminous wearing course-2" depth, mobilization (assume 5% of roadway total), field laboratory, inspector's field office, equipment package, 18" reinforced concrete pipe, 24" reinforced concrete pipe, geotextiles-class 2-type B, fabricform ditch lining, construction surveying, erosion and sediment pollution control, and signing and pavement marking. Estimate does not include stormwater management, right-of-way, and utility relocation costs.

In order to calculate a cost for Line Item 15, the total linear footage of the haul road required for an alternative was multiplied by the adjusted unit cost of $1,600/LF. The length of haul road was dependent upon site layout and distance from the TC Station and/or CCR transfer location (i.e. barge unloading facility or pipe conveyor discharge). Per LG&E design requirement, the haul road must also parallel the

pipe conveyor route where possible to provide ease of access to the pipe conveyor for maintenance as well as for use as primary CCR transport during outages of the pipe conveyor.

Line Item 16 – Bridge – Large (36 FT high, 440 FT long, 60 FT wide) – GAI developed an estimate of probable construction costs for a 3-span prestressed concrete I-beam bridge over KY 1838 during a more detailed design of the Ravine B alternative. Multiple components were included in the development of the total unit cost used in Line Item 16. These components include:

-Structure granular backfill, masonry coating, penetrating sealer for deck, structure excavation-common, structure excavation-solid rock, steel piles-HP14X89, pile points 14", concrete-Class A, concrete-Class AA, concrete-Class C, steel reinforcement, steel reinforcement-epoxy coated, structural steel, expansion dam 4" neoprene, approach slab, prestressed concrete I-beams, 24" PVC schedule 40, 36" steel encasement, and neoprene bearing pads.

These components have base costs in various units but were quantified and totaled to calculate a total project cost of $3,604,000, rounded to $4,000,000 for the purpose of this cost analysis. The total cost did not include the following items:

-General mobilization, clearing and grubbing, construction surveying, embankment construction, utility relocation costs, permitting costs, and traffic control costs.

A large bridge unit was used in each alternative that required an approximate 400 foot span over road, stream, or other valley feature. The unit cost of $4,000,000 was multiplied by the number of large bridges necessary for an alternative to calculate a cost for Line Item 16.

Line Item 17 – Bridge – Medium (200 FT long, 60 FT wide) – A cost per square foot (SF) for various types and spans of bridges is provided in Support Document III.D-1-11. For the medium span bridges used in various alternatives, GAI selected a concrete deck with pre-stressed girder in a continuous span, which has an estimated cost of $145/SF. A bridge 200 FT long and 60 FT wide has a total area of 12,000 SF and therefore a total estimated cost of $1,740,000. This unit cost was rounded up to $1,750,000

Medium bridge units were used in alternatives that required an approximate 200 foot span over smaller road, stream, or other valley features. The unit cost of $1,750,000 was multiplied by the number of medium bridges estimated in an alternative to calculate a cost for Line Item 17.

Line Item 18 – Perimeter Collection Channel – Fabric Form, 6-10' Bottom Width – Line Item 18 estimated the linear footage of perimeter collection channels with an approximate range of 6-10' bottom width used to convey runoff from the conceptual landfill site to an ES/SWM pond. Multiple components were included in the development of the total unit cost of $75.00/LF used in Line Item 18. These components include:

-Excavation and loading, hauling-1 mile round trip, spreading, and fabric form liner.

The channels were quantified by measuring the perimeter of the conceptual landfill layout, where water would be collected and sent to the ES/SWM pond.

The unit cost of $75.00/LF was multiplied by the total linear footage, measured around the entire conceptual landfill layout, for each alternative to calculate a cost for Line Item 18.

Line Item 19 – Upslope Drainage Diversion Channel – Fabric Form, 1-5' Bottom Width – Line Item 19 estimated the linear footage of upslope drainage diversion channels with an approximate range of 1-5' bottom width used to divert runoff around the conceptual landfill footprint and bypassing the ES/SWM pond. The diversion channels were measured around the perimeter of the conceptual landfill layout, on the outside of the collection channels, and then to the end of the ES/SWM pond. Multiple components were included in the development of the total unit cost of $50.00/LF used in Line Item 19. These components include:

-Excavation and loading, hauling-1 mile round trip, spreading, and fabric form liner.

The unit cost of $50.00/LF was multiplied by the total linear footage for an alternative to calculate a cost for Line Item 19.

Line Item 20 – Subgrade Preparation – General Earthwork – Soil Inside Footprint (3000 foot Round Trip) – A conceptual subgrade was created for landfill alternatives using a 100-foot wide Ravine floor, minimum slopes of three percent, and maximum slopes of 3 horizontal (H) to 1 vertical (V). The cut and fill volumes required to build the conceptual subgrade were estimated using AutoCAD software to compare the elevation differences between existing ground and the subgrade surface. Line Item 20 quantified material within the landfill footprint, excluding rock, that can be taken from areas of cut and used in areas where fill is required within the conceptual landfill footprint. The unit cost associated with this Line Item was developed from the following components:

-Excavating, bulk bank, hydraulic crawler, 3 CY, for loading add 15%

-Hauling, 22 CY, off-road, 15 min wait/load/unload, 10 MPH, cycle 3000 feet

-General fill, by dozer, no compaction, and

-Compaction, sheepsfoot or wobbly wheel, 12" lifts, 2 passes.

These components were totaled for a unit cost of $5.65/CY of material. To calculate a cost for Line Item 20, the unit cost was multiplied by the quantity of earthwork that could be used within the conceptual landfill limits of grading.

Line Item 21 – Subgrade Preparation – General Earthwork – Rock Blasting (3000 foot Round Trip) – Line Item 21 estimated the amount of rock material that would need to be excavated/blasted. The rock blasting quantity was estimated by taking the depth between existing ground and the proposed subgrade at points on a grid system. The top elevation of rock was assumed to be 15 feet below existing ground based on drilling programs performed in this region of Kentucky and online review of soils information in the area. The thickness of rock excavation (the depth of cut minus 15 feet) was multiplied by the area of each point on the grid. Finally, the total rock excavation volumes for all of the conceptual landfill footprint were summed. The unit cost associated with this Line Item was developed from the following components:

-Blasting and excavating/loading

-Hauling, 22 CY, off-road, 15 min wait/load/unload, 10 MPH, cycle 3000 feet

-General fill, by dozer, no compaction, and

-Compaction, sheepsfoot or wobbly wheel, 12" lifts, 2 passes.

These components were totaled to determine a unit cost of $21.72 per cubic yard of material. To calculate a cost for Line Item 21, the unit cost was multiplied by the quantity of rock material estimated to be excavated within the landfill limits of grading.

Line Items 22-25 – Subgrade Preparation – Borrowing or Spoiling Excess Material – Soil – ½, 1, 2, or 4 mile Round Trip – Line Items 22-25 estimated the amount of excess excavated material that could not be used as fill or additional borrow material brought into the landfill footprint in order to complete the subgrade construction. From Line Items 20 and 21, if excess material was produced or borrow material was needed to balance the estimated subgrade earthwork, the excess or deficit of material was quantified in Line Items 22-25. The material must be trucked to or from the landfill footprint and the distance from borrow sites spoil areas determines the hauling cost. The difference between Line Items 22-25 is the average round trip hauling distance assumed from the center of the landfill to the center of approximate borrow/spoil areas. The cost associated with this Line Item was developed from the following components:

- Excavating, bulk bank, hydraulic crawler, 3 CY, for loading add 15%

-Hauling, 22 CY, off-road, 15 min wait/load/unload, 10 MPH, cycle ½, 1, 2, or 4 miles (varies between Line Items)

-General fill, by dozer, no compaction, and

-Compaction, sheepsfoot or wobbly wheel, 12" lifts, 2 passes.

These components were totaled to determine a unit cost of $5.65/CY, $5.94/CY, $6.84/CY, and $8.36/CY of material, respectively. To calculate a cost for Line Items 22-25, the unit cost, using the appropriate mileage, was multiplied by the quantity of borrow/spoil material required to balance the site earthwork.

Line Items 26 through 28 – Landfill Composite Liner System ½ or 1.5 mile Round Trip Protective Cover / 2 or 4 mile Round Trip Drainage Layer – Multiple components were included in the development of the total unit costs used in Line Items 26, 27, and 28. These components include:

- 2 ft recompacted soil liner,

- geomembrane liner,

- cushion geotextile,

- 1 foot leachate collection system drainage layer, and

- 2 foot protective cover layer.

In order to calculate a cost for the Line Items 26 through 28, the area to be lined (i.e. the limits of the conceptual landfill grading of a site) was estimated and that acreage was multiplied by the composite unit cost of $91,000/acre, $93,000/acre, and $88,000/acre, respectively depending on the average haul distance from the center of landfill to the source of protective cover and drainage layer materials.

Line Item 29 – Groundwater Underdrain Drainage Pipes – Line Item 29 estimated the linear footage of underdrain interceptors and lateral pipes used to capture and convey groundwater from below the footprint of the landfill to areas downgradient of the landfill to the ES/SWM Pond. The unit cost for the Groundwater Underdrain Pipes was based on estimates for schedule 120 PVC pipe from previous experience on similar projects. The total cost per acre for these projects was used to develop a typical cost per acre to use for all landfill alternatives. The length of pipe estimated for each project was multiplied by its cost per linear foot and then divided by the area of the landfill in acres. This unit cost of $6,000 per acre was multiplied by the estimated conceptual landfill liner acreage to calculate a cost for Line Item 29.

Line Item 30 – Leachate Collection System Drainage Pipes – Line Item 30 estimated the linear footage of leachate collection system interceptors and lateral pipes used to convey water that infiltrates through the landfilled CCR material away from the landfill liner system and to the Leachate Pond. The unit cost for the Leachate Collection System Drainage Pipes was based on estimates for schedule 120 PVC pipe from previous experience on similar projects. The total cost per acre was calculated by multiplying the length of pipe estimated for each project by its cost per linear foot and then dividing that sum by the area of the conceptual landfill. This calculation was used to develop a typical cost per acre to use for all landfill alternatives. This unit cost of $15,000 per acre was multiplied by the estimated conceptual landfill liner acreage to calculate a cost for Line Item 30.

Line Items 31-32 – Large/Medium ES/SWM Pond and Leachate Pond – Earthwork and Liner System (~35/~20 acre-ft) – Multiple components were included in the development of the total unit costs used in Line Items 31 and 32. The unit cost of the medium pond was developed by scaling down the cost of the large pond with a ratio based on the ponds' volumes (20 acre-ft/35 acre-ft). Based on previous construction cost estimating experience on similar projects, these components include:

- Excavation and loading, hauling-1 mile round trip, hauling-3 mile round trip, spreading and compacting, rock blasting (emergency spillway), riser structure and dewatering pipe, 12" prepared subgrade, pond anchor trench. For containment in the leachate pond: 60-mil LLDPE geomembrane over the entire pond, cushion geotextile, 4" fabric form (FF) lining on side slopes, 8" FF lining in pond bottom. Pipe penetration seal (boot), mechanical pump system, electrical pump system, structural pump system, and leachate force main to pump leachate to a separate leachate treatment facility.

The use of the large or medium ponds depended on the layout and existing topography for an alternative. The cost for Line Items 31 and 32 was calculated by multiplying the unit cost of $3,000,000/pond and $2,000,000/pond, respectively, by the number of ponds to be used at a site.

For off-site CCR disposal alternatives that would require leachate collection and treatment (e.g. Lee Bottom) construction of a separate leachate treatment system local to the disposal facility site would likely be required. Costs for this leachate treatment system at offsite CCR disposal locations would likely be more expensive, but have not been included in this analysis.

Line Items 33-34 –Final Cover System – 2 or 4 Mile Round Trip (12 inches clay, 12 inches topsoil) – Multiple components were included in the development of the total unit costs used in Line Items 33 and 34. These components include:

- Excavating,

- 2 or 4 mile round trip (hauling distance determined by measuring from middle of landfill to borrow sites),

- spreading,

- compacting, and

- seeding of vegetative layer.

The difference between Line Items 33-34 is the estimated average hauling distance from the center of the landfill to identified potential borrow sites. In order to calculate a cost for Line Items 33 and 34, the total estimated acreage of the landfill footprint was multiplied by the composite unit cost of $29,000/acre and $33,000/acre, respectively, in order to determine the cost of placing final cover on the landfill.

Line Item 35 – Barge Loading Facility – Fenner Dunlop Conveyor Belting has provided a price quote that states that a barge loading facility with the capacity to handle the full CCR production rate of 910,000 CY per year would be approximately $14,200,000. This includes facility and site construction costs of ~$8.3 million and ~$5.9 million, respectively. This loading facility would be required for any alternative that has barging as a mode of transportation and would be constructed on the Ohio River at or near the TC Station.

In order to calculate a cost for Line Item 35, the unit cost of $8,300,000 was multiplied by one for any alternative using barge transportation. These costs are calculated on a 2014 dollar basis.

Line Item 36 – Barge Unloading Facility – Fenner Dunlop Conveyor Belting has provided a price quote that states that a barge unloading facility with the capacity to handle the full CCR production rate of 910,000 CY per year would be approximately $16,100,000. This includes facility and site construction costs of ~$9.97 million and ~$6.15 million, respectively. This unloading facility would be required for any alternative that has barging as a mode of transportation. The loading facility would be constructed on the Ohio River at or near the designated alternative's disposal facility.

In order to calculate a cost for Line Item 36, the unit cost of $16,100,000 was multiplied by one for any alternative using barge transportation. These costs are calculated on a 2014 dollar basis.

Line Item 37 – Ancillary Costs (Critical Spares and Office/Warehouse Space) – Fenner Dunlop Conveyor Belting has provided a price quote that states that ancillary costs for barge transportation would be approximately $1,600,000. This unit cost includes items related to support facilities for employees consisting of office space, warehouse space, and/or maintenance supplies storage space, as well as spares for critical components in case of the need for replacement.

In order to calculate a cost for Line Item 37, the unit cost of $1,600,000 was multiplied by one for any alternative using barge transportation. These costs are calculated on a 2014 dollar basis.

Line Item 38 – Additional Capital Costs – A number of components are considered to develop the total unit cost for Line Item 38. These components include:

-LG&E Overheads and Engineering Support during design and construction;

-Intermediate Cover and Benches;

-QA/QC (Subgrade, Liner, Final Cover System); and

-Borrow Area Roads and On-Landfill Haul Roads.

These individual line item costs are Lump Sum unit costs that vary between case studies. As discussed in Appendix III.B-1, the Ravine B case study has been analyzed and designed beyond the conceptual design done for the case studies included in this Supplement to the Alternatives Analysis. Capital and operating cost estimates have been prepared for Ravine B relating to the common additional capital and operating costs for landfill alternatives and are used to estimate the same component costs at other case study alternatives on an order of magnitude basis. Engineering judgment was used to compare each of the case studies vs. Ravine B and assign an "Order of Magnitude" multiplier indicating whether the cost would be similar to, (i.e. Order of Magnitude = 1.0), or some multiple of, the estimated cost of that particular line item in Ravine B (i.e. Order of Magnitude = 0.5 or 2.0). The "Order of Magnitude" was then multiplied by the total unit cost estimated in the Ravine B detailed capital cost estimate to develop Lump Sum Unit Costs of each component above for the case studies. Support Document III.D-1-17 describes how each case study was compared to Ravine B to determine an assumed "Order of Magnitude" multiplier for each line item. Table III.D-1-17-1 is included in Support Document III.D-1-17 and lists each of the above components, their assumed "Order of Magnitude" and Lump Sum unit costs estimated for the Ravine B, Sterling Ventures, Lee Bottom, and Valley View case studies. These costs are calculated on a 2013 dollar basis.

Operations and Maintenance (O&M) Costs

Line Items 39-41 – Hauling – 1, 2, or 3 Mile Round Trip (22 CY on landfill/private road) – After CCR material reaches the pipe conveyor termination point or barge unloading facility, it must be hauled via truck in order to be placed in the CCR disposal facility. Line Items 39-41 quantify a cost by multiplying the unit cost of $2.56/CY, $3.46/CY, and $4.19/CY, respectively, for distance hauled by the total volume of CCR material to be stored in the disposal facility. The difference between Line Items 39-41 is the estimated hauling distance from the conveyor endpoint or unloading facility to the approximate centroid of the conceptual CCR disposal facility. Distance varies based on facility location and layout of

an alternative. It is important to note that the Sterling Ventures tipping fee proposal did not address handling costs for CCR materials that come off the pipe conveyor. If trucking or other transport is needed to move the CCR into the mine, it is assumed these costs would be in addition to the tipping fee.

Line Item 42 – Hauling – 30 Mile Round Trip (18 CY, 35 MPH avg – Line Item 42 calculates the cost to haul CCR material from the TC Station to an offsite, existing CCR disposal facility at Valley View MSW Landfill. Valley View MSW Landfill is approximately 15 miles away (30 mile round trip). The distance between the TC Station and the off-site landfill is too far for pipe conveyor transportation to be feasible, and there are no barge or nearby rail alternatives. As a result, CCR material would need to be trucked at a cost of $11.55/CY for a 30 mile round trip.

Line Item 42 quantifies a cost by multiplying the total volume of CCR material to be stored in the offsite disposal facility by the unit cost of $11.55/CY.

Line Item 43 – Offsite CCR Disposal - Tipping Fee – Line Item 43 includes the tipping fee to dispose of CCR material from the TC Station to an offsite facility. One of two separate facilities, Valley View MSW Landfill or Sterling Ventures Mine, can be used depending on the alternative. A price quote from Republic Services of KY, LLC states it would cost $21.20/ton to dispose CCR material at Valley View MSW Landfill and a letter from Sterling Ventures, LLC quotes $10.15/ton to dispose of CCR material at Sterling Ventures Mine. It is important to note that tipping fees are subject to increases for new regulatory requirements and other changes in circumstances.

Line Item 43 quantifies a cost by multiplying the unit cost of either $21.20/ton or $10.15/ton, depending on the location of offsite CCR disposal.

Line Item 44 – Pipe Conveyor Cost of Operation – Beumer Group has provided a price quote that states that the pipe conveyor cost of operation would be $0.20/CY. This operational cost was based on the conceptual pipe conveyor routes included in the Line Items 11 through 13. For the purpose of this cost analysis it was assumed that all pipe conveyor routes will have similar cost of operation. The unit cost includes operation and power costs for an average length conveyor utilizing a reasonable cost per kilowatt hour. The price quoted by Beumer Group, and therefore this unit cost does not include salaries of people assigned to operate the conveyor.

In order to calculate a cost for the Line Item 44, the total volume of CCR material to be stored in the CCR disposal facility was multiplied by the unit cost of $0.20/CY to operate the pipe conveyor.

Line Item 45 – Barge Loading and Unloading Operations Cost – Fenner Dunlop Conveyor Belting has provided a price quote that includes the costs involved in managing and operating the barge loading and unloading facilities, including the estimated price to physically place the material onto the barge at the loading facility, and pick it up at the unloading facility.

To calculate the cost for Line Item 45, the unit cost of $1,300,000/year is multiplied by the number of years that barge transport of CCR material is anticipated for an alternative. These costs are calculated on a 2014 dollar basis.

Line Item 46 – Barge Transportation Costs – LG&E provided a price quote from a confidential source that includes the cost involved to physically transport the CCR material via barge. It is assumed that this unit cost includes labor, maintenance, and supplies to operate the push boat for the barges.

To calculate the cost for Line Item 46, the unit cost, which varies based on distance from TC Station to the alternative ($2.24/ton for Lee Bottom Landfill and $2.61/ton for Sterling Ventures Mine), is multiplied by the total amount of material to be disposed of at the CCR Disposal facility.

Line Item 47 – Additional O&M Costs – A number of components are considered to develop the total unit cost for Line Item 47. These components include:

-CCR Placement and Compaction, Survey of CCR Placement, and QA/QC of CCR Placement and Compaction;

-Cleanout/Maintenance of Haul Road, Sediment Basin and Leachate Pond, Leachate Pump Station O&M, Leachate System and Underdrain System, and Landfill Maintenance; and

-Dust Control.

These individual line item costs are Lump Sum unit costs that vary between case studies. As discussed in Appendix III.B-1, the Ravine B case study has been analyzed and designed beyond the conceptual design done for the case studies included in this Supplement to the Alternatives Analysis. Engineering judgment was used to compare each of the case studies vs. Ravine B and assign an "Order of Magnitude" multiplier indicating whether the cost would be similar to, (i.e. Order of Magnitude = 1.0), or some multiple of, the estimated cost of that particular line item in Ravine B (i.e. Order of Magnitude = 0.5 or 2.0). The "Order of Magnitude" was then multiplied by the total unit cost estimated in the Ravine B detailed O&M cost estimate to develop Lump Sum Unit Costs of each line item above for the case studies. Support Document III.D-1-17 describes how each case study was compared to Ravine B to determine an assumed "Order of Magnitude" multiplier for each line item. Table III.D-1-17-1 is included in Support Document III.D-1-17 and lists each of the above line items, their assumed "Order of Magnitude" and Lump Sum unit costs estimated for the Ravine B, Sterling Ventures, Lee Bottom, and Valley View case studies. These costs are calculated on a 2013 dollar basis.

SECTION 5: EXAMPLE OF LINE ITEM TOTAL COST DEVELOPMENT

After each Line Item's unit cost was developed and the magnitude (unit quantity) of each was quantified, the total cost for each Line Item for a particular alternative was determined by multiplying the unit cost by the unit quantity. For certain Line Items (i.e. Environmental Stream/Wetland Mitigation, Cemetery Relocation, Cultural Resources), costs were calculated individually on a case-by-case basis when the unit cost was expected to vary. These costs were quantified on a per alternative basis, as the degree of impact was not uniform across all sites and could not be assigned unit cost consistent across all alternatives.

An example explanation of how a particular Line Item cost is developed from the unit cost and unit quantity is provided below:

Example Line Item 2 – Clearing, Grubbing, and Site Preparation at the Sterling Ventures Mine Alternative.

Unit Cost Development:

The unit cost of $17,000 per acre consisted of two parts: "Cut and Chip Trees" and "Grub Stumps and Remove." Each of these costs were found in the *2012 RS Means Heavy Construction Cost Data* book at $14,600/acre and $7,525/acre, respectively. When multiplying the unit cost by 0.76 for the Frankfort, KY location factor (explained in Section 2.2), they become $11,111/acre for "Cut and Chip Trees" and $5,727/acre for "Grub Stumps and Remove." This totals to $16,838/acre, which was then rounded to $17,000/acre for ease of use.

Unit Quantity Development:

The quantity for Clearing, Grubbing, and Site Preparation was developed by measuring the number of forested acres assumed to be disturbed due to construction of the project. For the Sterling Ventures Mine Alternative, the only land disturbance assumed is due to construction of the pipe conveyor, haul road, and barge unloading facility. A conceptual impact boundary was developed based on a 1000 foot wide transportation corridor along the conceptual route for the pipe conveyor and haul road. The corridor is based on a conservative approximation of the limits of earthwork cut/fills required to construct a haul road and pipe conveyor system. The total forested acreage, defined as any area observed to have tree cover, within the impact boundary was calculated using USGS mapping. This was determined to be 290 acres.

290 acres multiplied by the unit cost of $17,000/acre comes to $4,930,000, which is the total cost for Line Item 2-Clearing, Grubbing, and Site Preparation in the Sterling Ventures Mine Alternative.

TRIMBLE COUNTY GENERATING STATION LANDFILL PROJECT
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TABLE APPENDIX III.D-1 - UNIT COST DEVELOPMENT[1,2,3]

		Unit Cost ($)	Unit	Source	Source Support Document	RS Means Item Number	Original Cost ($)	Original Unit	Trimble, KY Adjusted Cost ($)	Adjusted Unit	Adjustment Equation
CAPITAL COSTS											
	General Project / Permitting / Infrastructure Cost Impacts										
1	Property Acquisition	$ 12,000	Acre	LG&E Supplied Estimate	N/A	N/A	-	-	-	-	N/A
2	Clearing, Grubbing, and Site Preparation	$ 17,000	Acre	See Below	See Below	See Below	-	-	16,837	Acre	Sum of Sub-Items
	Cut and Chip Trees	*$ 11,111*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.11.10.10.0300*	*14,600*	*Acre*	*11,111*	*Acre*	*N/A*
	Grub Stumps and Remove	*$ 5,727*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.11.10.10.0350*	*7,525*	*Acre*	*5,727*	*Acre*	*N/A*
3	Large Utility Line Relocation	$ 880	LF	Inflated LG&E Supplied Estimate - Scaled from 90% TC Construction Estimate	Support Document III.D-1-2	N/A	5,954,000	Lump Sum	872	LF	$5,954,000 / 6,825 LF
4	Fencing	$ 50	LF	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-3	*See Support Document III.D-1-3*	-	-	-	-	N/A
5	Environmental Wetland Mitigation (cost based on adjusted mitigation units)	Varies	Acre	Kentucky Department of Fish and Wildlife Resources Fee In-Lieu Of Program	Support Document III.D-1-4	N/A	-	-	-	-	N/A
6	Environmental Stream Mitigation (cost based on adjusted mitigation units)	Varies	LF	Kentucky Department of Fish and Wildlife Resources Fee In-Lieu Of Program	Support Document III.D-1-4	N/A	-	-	-	-	N/A
7	Cultural Resources (Potential Phase III data recovery)	Varies	EA	GAI Cost Estimate	Support Document III.D-1-5	N/A	-	-	-	-	N/A
8	Indiana Bat Mitigation[4]	$ 5,338	Acre	GAI Cost Estimate	Support Document III.D-1-4	N/A	5,338	Acre	5,338	Acre	($4,575 + $6,100) / 2
9	Road Relocation (County Road)	$ 350	LF	GAI Cost Estimate	Support Document III.D-1-6	N/A	303	LF	350	LF	Round up
10	Road Relocation (State Road)	$ 400	LF	GAI Cost Estimate	Support Document III.D-1-6	N/A	350	LF	400	LF	Round up
	CCR Transportation										
11	Pipe Conveyor Transport (similar to North Ridge Top path at Ravine B)	$ 2,150	LF	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-7	N/A	-	-	-	-	N/A
12	Pipe Conveyor Transport (similar to Ogden Ridge Road path at Ravine B)	$ 2,425	LF	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-7	N/A	-	-	-	-	N/A
13	Pipe Conveyor Transport (similar to South Ridge Top path at Ravine B)	$ 3,125	LF	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-7	N/A	-	-	-	-	N/A
14	Transfer Station	$ 250,000	EA	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-8	N/A	-	-	-	-	N/A
15	Haul Road - Off Landfill	$ 1,600	LF	Scaled from Recent Haul Road Construction Package Cost Estimate	Support Document III.D-1-9	N/A	10,487,982	Lump Sum	1,565	LF	$10,487,982 / 6,700 LF
16	Bridge - Large (36 FT high, 440 FT long, 60 FT wide)	$ 4,000,000	EA	Scaled from Recent Haul Road Construction Package Cost Estimate	Support Document III.D-1-10	N/A	3,965,000	EA	4,000,000	EA	Round up
17	Bridge - Medium (200 FT long, 60 FT wide)	$ 1,750,000	EA	Scaled from Recent Haul Road Construction Package Cost Estimate	Support Document III.D-1-11	N/A	145	SF	1740000	EA	$/SF * SF
	Landfill Preparation										
18	Perimeter Collection Channel - Fabric Form, 6-10' Bottom Width	$ 75.00	LF	Recent Construction Bid Price or Supplier Quote on Similar Project	N/A	N/A	-	-	-	-	N/A
19	Upslope Drainage Diversion Channel - Fabric Form, 1-5' Bottom Width	$ 50.00	LF	Recent Construction Bid Price or Supplier Quote on Similar Project	N/A	N/A	-	-	-	-	N/A
20	Subgrade Preparation - General Earthwork - Soil Inside Footprint (3000 ft R.T.)	$ 5.65	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	7.42	CY	5.65	CY	N/A
21	Subgrade Preparation - General Earthwork - Rock Blasting (3000 ft R.T.)	$ 21.72	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	28.54	CY	21.72	CY	N/A
22	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1/2 Mile RT	$ 5.65	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	7.42	CY	5.65	CY	N/A
23	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 1 Mile RT	$ 5.94	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	7.81	CY	5.94	CY	N/A
24	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 2 Miles RT	$ 6.84	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	8.99	CY	6.84	CY	N/A
25	Subgrade Preparation - Borrow or Spoiling Excess Material - Soil - 4 Miles RT	$ 8.36	CY	2012 RS Means Heavy Construction Cost Data	Support Document III.D-1-12	*See Support Document III.D-1-12*	10.99	CY	8.36	CY	N/A
26	Landfill Composite Liner System - 0.5 mi Round Trip (RT) Protective Cover/4 mi RT Drainage Layer	$ 91,000	Acre	See Below	See Below	See Below	-	-	90,682	Acre	Sum of Sub-Items-rounded to $91,000
	Protective Cover - 24 Inch Layer (Trimble CCRs)	***$ 17,139***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***17,139***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 4,543*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*4,543*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling Protective Cover Layer - 0.5 Mile Round Trip	*$ 7,317*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5090*	*2.98*	*CY*	*7,317*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Leachate Collection Drainage Layer - 12 Inch Layer (Trimble Bottom Ash)	***$ 12,830***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***12,830***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 2,271*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*2,271*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Hauling Drainage Layer - 4.0 Mile Round Trip	*$ 7,919*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5120*	*6.45*	*CY*	*7,919*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Spreading	*$ 2,640*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*2,640*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	10 OZ/SY Cushion Geotextile	***$ 4,985***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*1.03*	*SY*	***4,985***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	60-mil LLDPE Geomembrane	***$ 32,670***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*6.75*	*SY*	***32,670***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	Recompacted Soil Liner (RSL) - 24 Inch Layer	***$ 23,057***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***23,057***	*Acre*	***Sum of Sub-Items***
	Excavation & Loading	*$ 4,076*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.0300*	*1.66*	*CY*	*4,076*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling RSL Layer - 1.0 Mile Round Trip	*$ 11,172*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5110*	*4.55*	*CY*	*11,172*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 1,891*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5720*	*0.77*	*CY*	*1,891*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 638*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5060*	*0.26*	*CY*	*638*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
27	Landfill Composite Liner System - 1.5 mi RT Protective Cover/4 mi RT Drainage Layer	$ 93,000	Acre	See Below	See Below	See Below	-	-	93,088	Acre	Sum of Sub-Items-rounded to $93,000

TRIMBLE COUNTY GENERATING STATION LANDFILL PROJECT
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TABLE APPENDIX III.D-1 - UNIT COST DEVELOPMENT[1,2,3]

		Unit Cost ($)	Unit	Source	Source Support Document	RS Means Item Number	Original Cost ($)	Original Unit	Trimble, KY Adjusted Cost ($)	Adjusted Unit	Adjustment Equation
CAPITAL COSTS											
	Protective Cover - 24 Inch Layer (Trimble CCRs)	***$ 19,546***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***19,546***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 4,543*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*4,543*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling Protective Cover Layer - 1.5 Mile Round Trip	*$ 9,724*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5090*	*3.96*	*CY*	*9,724*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Leachate Collection Drainage Layer - 12 Inch Layer (Trimble Bottom Ash)	***$ 12,830***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***12,830***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 2,271*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*2,271*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Hauling Drainage Layer - 4.0 Mile Round Trip	*$ 7,919*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5120*	*6.45*	*CY*	*7,919*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Spreading	*$ 2,640*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*2,640*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	10 OZ/SY Cushion Geotextile	***$ 4,985***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*1.03*	*SY*	***4,985***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	60-mil LLDPE Geomembrane	***$ 32,670***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*6.75*	*SY*	***32,670***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	Recompacted Soil Liner (RSL) - 24 Inch Layer	***$ 23,057***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***23,057***	*Acre*	***Sum of Sub-Items***
	Excavation & Loading	*$ 4,076*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.0300*	*1.66*	*CY*	*4,076*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling RSL Layer - 2.0 Mile Round Trip	*$ 11,172*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5110*	*4.55*	*CY*	*11,172*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 1,891*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5720*	*0.77*	*CY*	*1,891*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 638*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5060*	*0.26*	*CY*	*638*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
28	Landfill Composite Liner System - 0.5 mi RT Protective Cover/2 mi RT Drainage Layer	$ 88,000	Acre	See Below	See Below	See Below	-	-	88,349	Acre	Sum of Sub-Items-rounded to $88,000
	Protective Cover - 24 Inch Layer (Trimble CCRs)	***$ 17,139***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***17,139***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 4,543*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*4,543*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling Protective Cover Layer - 0.5 Mile Round Trip	*$ 7,317*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5090*	*2.98*	*CY*	*7,317*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Leachate Collection Drainage Layer - 12 Inch Layer (Trimble Bottom Ash)	***$ 10,497***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***10,497***	*Acre*	***Sum of Sub-Items***
	Loading	*$ 2,271*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.1350*	*1.85*	*CY*	*2,271*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Hauling Drainage Layer - 2.0 Mile Round Trip	*$ 5,586*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5110*	*4.55*	*CY*	*5,586*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	Spreading	*$ 2,640*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*2,640*	*Acre*	*$/CY * 1FT/3FT * 43560CF/9SF*
	10 OZ/SY Cushion Geotextile	***$ 4,985***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*1.03*	*SY*	***4,985***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	60-mil LLDPE Geomembrane	***$ 32,670***	*Acre*	***GAI Cost Estimate from Past Project***	***Support Document III.D-1-13***	***N/A***	*6.75*	*SY*	***32,670***	*Acre*	*$/SY * 1SY/9SF * 43560SF/Acre*
	Recompacted Soil Liner (RSL) - 24 Inch Layer	***$ 23,057***	*Acre*	***See Below***	***See Below***	***See Below***	-	-	***23,057***	*Acre*	***Sum of Sub-Items***
	Excavation & Loading	*$ 4,076*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.0300*	*1.66*	*CY*	*4,076*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Hauling RSL Layer - 2.0 Mile Round Trip	*$ 11,172*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5110*	*4.55*	*CY*	*11,172*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 1,891*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5720*	*0.77*	*CY*	*1,891*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Compacting	*$ 638*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5060*	*0.26*	*CY*	*638*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
29	Groundwater Underdrain Drainage Pipes	$ 6,000	Acre	GAI Cost Estimate	Support Document III.D-1-14	N/A	-	-	-	-	N/A
30	Leachate Collection System Drainage Pipes	$ 15,000	Acre	GAI Cost Estimate	Support Document III.D-1-14	N/A	-	-	-	-	N/A
	Erosion and Sediment / Stormwater Management (ES/SWM) and Leachate Ponds[5]										
31	Large ES/SWM Pond and Leachate Pond - Earthwork and Liner System (~35 acre-ft)	$ 3,000,000	EA	GAI Cost Estimate	Support Document III.D-1-15	N/A	-	-	-	-	N/A
32	Medium ES/SWM Pond and Leachate Pond - Earthwork and Liner System (~20 acre-ft)	$ 2,000,000	EA	Scaled from GAI Cost Estimate	Support Document III.D-1-15	N/A	1,847,253	EA	2,000,000		Round up
	Landfill Cap Cover System										
33	Final Cover System - 2 Mile RT (12 Inches Clay; 12 Inches Topsoil)	$ 29,000	Acre	See Below	Support Document III.D-1-1	See Below	-	-	28,233	Acre	Sum of Sub-Items
	Seeding of Vegetative Layer	*$ 3,507*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*32.92.19.14.4600*	*80.50*	*M.S.F*	*3,507*	*Acre*	*$ / 1000 S.F * 43560*
	Excavating	*$ 6,532*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.0300*	*2.66*	*CY*	*6,532*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	2.0 Mile RT	*$ 11,172*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5110*	*4.55*	*CY*	*11,172*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	Compacting	*$ 1,743*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5040*	*0.71*	*CY*	*1,743*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
34	Final Cover System - 4 Mile RT (12 Inches Clay; 12 Inches Topsoil)	$ 33,000	Acre	See Below	Support Document III.D-1-1	See Below	-	-	32,899	Acre	Sum of Sub-Items
	Seeding of Vegetative Layer	*$ 3,507*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*32.92.19.14.4600*	*80.50*	*M.S.F*	*3,507*	*Acre*	*$ / 1000 S.F * 43560*
	Excavating	*$ 6,532*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.16.42.0300*	*2.66*	*CY*	*6,532*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	4.0 Mile RT	*$ 15,838*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.20.5120*	*6.45*	*CY*	*15,838*	*Acre*	*$/CY * 2FT/3FT * 43560CF/9SF*
	Spreading	*$ 5,279*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.17.0020*	*2.15*	*CY*	*5,279*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	Compacting	*$ 1,743*	*Acre*	*2012 RS Means Heavy Construction Cost Data*	*Support Document III.D-1-1*	*31.23.23.23.5040*	*0.71*	*CY*	*1,743*	*Acre*	*$/CY * 1CY/27CF * 2FT * 43560AC*
	Barge Transport										

TRIMBLE COUNTY GENERATING STATION LANDFILL PROJECT
SUPPLEMENT TO ALTERNATIVES ANALYSIS
TABLE APPENDIX III.D-1 - UNIT COST DEVELOPMENT[1,2,3]

		Unit Cost ($)	Unit	Source	Source Support Document	RS Means Item Number	Original Cost ($)	Original Unit	Trimble, KY Adjusted Cost ($)	Adjusted Unit	Adjustment Equation
CAPITAL COSTS											
35	Barge Loading Facility	$ 14,200,000	EA	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-16	N/A	-	-	-	-	N/A
36	Barge Unloading Facility	$ 16,100,000	EA	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-16	N/A	-	-	-	-	N/A
37	Ancillary Costs (Critical Spares and Office/Warehouse Space)	$ 1,600,000	EA	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-16	N/A	-	-	-	-	N/A
	Additional Capital Costs										
38	Additional Capital Costs[6]	Varies	LUMP	See Below	Support Document III.D-1-17	-	-	-	-	-	Sum of Sub-Items
	LG&E Overheads and Engineering Support	*Varies*	*LUMP*	*LG&E Supplied Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
	Intermediate Cover and Benches	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
	QA/QC (Subgrade, Liner, Final Cover System)	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
	Borrow Area Haul Roads and On-Landfill Haul Roads	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
OPERATION AND MAINTENANCE (O&M) COSTS											
	Landfill / Pipe Conveyor Operating Costs										
39	Hauling - 1 Mile Round Trip (22 CY on landfill/private road)	$ 2.56	CY	2012 RS Means Heavy Construction Cost Data	*Support Document III.D-1-1*	31.23.23.20.5100	3.37	CY	2.56	CY	N/A
40	Hauling - 2 Mile Round Trip (22 CY on landfill/private road)	$ 3.46	CY	2012 RS Means Heavy Construction Cost Data	*Support Document III.D-1-1*	31.23.23.20.5110	4.55	CY	3.46	CY	N/A
41	Hauling - 3 Mile Round Trip (22 CY on landfill/private road)	$ 4.19	CY	2012 RS Means Heavy Construction Cost Data	*Support Document III.D-1-1*	31.23.23.20.5110/5120	5.50	CY	4.19	CY	N/A
42	Hauling - 30 Mile Round Trip (18 CY, 35 MPH avg)	$ 11.55	CY	2012 RS Means Heavy Construction Cost Data	*Support Document III.D-1-1*	31.23.23.20.9670/9704	11.55	CY	11.55	CY	N/A
43	Offsite CCR Disposal - Tipping Fee[7]	Varies	TON	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-18	N/A	-	-	-	-	N/A
44	Pipe Conveyor Cost of Operation	$ 0.20	CY	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-19	N/A	-	-	-	-	N/A
	Barge Transport										
45	Barge Loading and Unloading Operations Costs	$ 1,100,000	YR	Recent Vendor/Contractor Supplied Estimate	Support Document III.D-1-16	N/A	-	-	-	-	N/A
46	Barge Transportation Costs	Varies	TON	Confidential Source	N/A	N/A	-	-	-	-	N/A
	Additional O&M Costs										
47	Additional O&M Costs[6]	Varies	LUMP	See Below	Support Document III.D-1-17	-	-	-	-	-	Sum of Sub-Items
	CCR Placement, Compaction, Survey, and QA/QC	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
	Cleanout / Maintenance (Haul Roads, Ponds, LCS, Underdrain, and Landfill)	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*
	Dust Control	*Varies*	*LUMP*	*GAI Cost Estimate*	*Support Document III.D-1-17*	-	-	-	-	-	*N/A*

NOTES:

1. Costs are for comparison of Site Alternatives only as described in Section III of the report. Contingencies were not applied except as noted in Appendix III.D-1.
2. Costs were developed including only line items which are anticipated to be significantly different between Site Alternatives. "Common Cost" items anticipated to be similar in cost for all Site Alternatives are not included (i.e. project management or the conditioning and treatment of CCR prior to transit from TC Station). Minor construction and operations costs are not included due to the conceptual nature of the design. Examples of these minor cost items include: minor utility line relocations, minor erosion and sedimentation/stormwater management controls, surface and groundwater testing, mowing.
3. Costs are calculated on 2012 dollar basis (except as noted in Appendix III.D-1). No inflation or discount rates included.
4. Assumes average cost ($5,338 per acre) for Indiana Bat Mitigation as described in Support Document III.D-1-4.
5. Does not include costs for leachate treatment or transport system. See Appendix III.D-1 for more information.
6. Additional Capital and O&M costs include costs previously omitted from (GAI 2014) Cost Analysis but added to the Case Study Analysis due to comparison of landfill vs. non-landfill (e.g. mine) alternatives. See Appendix III.D-1 for more information.
7. Cost varies with location of disposal. At Valley View, tipping fee is $21.20/ton. At Sterling Ventures Mine, tipping fee is $10.15/ton.