Kentucky Department for Natural Resources
Full-cost Bond Calculation Manual
July, 2013

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I. INTRODUCTION

A. Purpose

On March 22, 2013, the Governor signed House bill 66 into law as part of a statutory and regulatory initiative by the Energy and Environment Cabinet to improve the adequacy of performance bonds associated with coal mining operations regulated by the Department for Natural Resources. This manual has been developed to provide instruction to those permittees opting to calculate and provide full-cost bonds to the department, in accordance with provisions of that statute.

B. Overview/Statutory and Regulatory Standards

KRS 350.060(11) requires the filing of a bond by a permittee payable to the Commonwealth of Kentucky, with surety satisfactory to the cabinet, conditioned upon the faithful performance of the requirements of that chapter, the administrative regulations of the cabinet and the approved permit. This statute also provides the predominant criteria by which the amount of the bond is determined, and will be discussed later in this manual.

In addition, 405 KAR 10:015, Section 6 requires the estimate to be calculated as if the cabinet had to perform the reclamation, restoration and abatement work required of a permittee that conducts surface coal mining and reclamation operations pursuant to KRS Chapter 350, 405 KAR Chapters 7 through 24, and the approved permit. This amount is based on certain criteria provided in that regulation that will also be discussed later in this manual.

Effective March 22, 2013, 2013 Ky Acts ch. 78 established the Kentucky Reclamation Guaranty Fund, a financial resource to assist the cabinet in reclaiming permit areas for permits covered by the fund, in the event of abandonment and bond forfeitures by permittees.

Moneys in the fund are generated by tonnage and other fees, based upon types of mining operations and status (active or inactive) of permits in the fund.

Section 6(5) of the statute provides a permittee the option of withdrawing from the fund by estimating and providing full-cost bonds to the cabinet for all permits held by that permittee, thereby exempting the permittee from provisions of the statute, including the payment of fees.

As stated above, this manual is to be utilized by those permittees opting out of the fund, and shall be used for full-cost bond calculations for any type of permit action whenever the cost of reclamation requires adjustment, in accordance with 405 KAR 10:015, Section 10. Certain exclusions to the full-cost method are discussed in Part II. E., below.

Since 2013 Ky Acts ch. 78 also requires full-cost estimates to be **equivalent** to the United States Office of Surface Mining Reclamation and Enforcement's "Handbook for the Calculation of reclamation Bond Amounts", OSM Directive TSR-1, this manual has incorporated certain specific concepts and methodologies of that document.

Exclusions for certain site-specific situations will be discussed later in the manual, and users should note that the regulatory minimum bond amounts established in 405 KAR 10:015, Section 7 apply to any full-cost reclamation estimate.

II. Full-cost Reclamation Estimate

A. Statutory Criteria for Performance Bond Calculation

Prior to the submittal of a performance bond in association with the issuance of a permit application, KRS 350.060(11) provides the following site-specific considerations to be made in determining the amount of bond required:

- The character and nature of the overburden;
- The future suitable use of the land involved;
- The cost of backfilling, grading, and reclamation to be required;
- The probable difficulty of reclamation, giving consideration to such factors as topography, geology, hydrology, and revegetation potential.

For permit applications that propose coal removal operations, all of the above criteria should be considered in the bond calculation estimate. Applications that consist of mining support structures (roads, ponds, mine maintenance areas), load outs, preparation plants and refuse disposal structures, for example, may only consider the necessary criteria applicable to the method of operation for those types of operations.

There are four major steps in the full-cost reclamation bond calculation process:

- Determine the point for the worst case assumption.
- Estimate direct reclamation costs such as earthmoving, revegetation, and the removal and demolition of structures not necessary to achieve post mining land use.
- Estimate indirect reclamation costs, including contractor and equipment mobilization and demobilization charges, contingency allowances, project inspection, profit and overhead.
- Calculate the total bond amount.

B. Worst Case Assumption

The principle of a reclamation bond calculation is to ensure the cabinet has a performance bond sufficient to complete reclamation operations on any given mine site at any point in the life of a permit. Given the criteria provided above, as part of a full-cost reclamation estimate for a permit application a determination must be made as to that point projected to represent **the maximum reclamation liability to the cabinet**, should the permittee abandon the site and forfeit the bond.

This point of maximum liability is referred to as the "worst case assumption". This "assumption" is that condition when the permit or increment area has not been reclaimed and exists at its maximum extent of disturbance in regards to:

- Increased haulage distance;
- The largest volume of overburden material required to backfill coal removal areas to achieve approved post mining configurations;
- The greatest area of disturbance requiring final grading, topsoil placement and revegetation operations; and

- The inclusion of atypical mining and reclamation operations in the permit area (prime farmland, proximity to residential areas, utility lines or other regulatory protected structures and stream reconstruction).

For permit applications proposing coal removal, the identification of the point of worst case assumption is entirely dependent on the method of operation. Information to consider in evaluating and determining this point are:

- The type of mining proposed (area, single or multiple seam contour, underground);

- The number of seams proposed to be mined;

- The maximum length of highwall exposed as part of the method of operation and a contemporaneous reclamation variance, if approved;

- The number of off-bench sediment control structures.

Specifications in the proposed backfilling, grading and revegetation plans within the approved permit will determine the point of worst case assumption for applications proposing coarse or fine refuse disposal, secondary coal removal operations, coal preparation plants, permits that combine coal removal with other mining operations, and other specialized mining activities.

Again, the point of worst case assumption is determined in view of **the liability to the cabinet**, not to the permittee. The reclamation likely will be more costly to the cabinet in that further coal removal operations will not be conducted; therefore, the cabinet must obtain spoil for backfilling from locations that may not be in close proximity to highwall to be eliminated, or for such reclamation operations as covering refuse disposal structures. In addition, administrative costs such as mobilization/demobilization and contingencies are factored into the estimate.

Note: The point of worst case assumption must be determined for each increment, if incremental bonding is utilized by a permittee. 405 KAR 10:015, Section 4(2) requires the calculation of an independent bond amount for each increment, in the event the cabinet must reclaim a specific increment.

Users will note this regulation also provides for the independent release or forfeiture of each increment, therefore, a permittee providing full-cost bonds should carefully consider the structure of the incremental bonding plan, in view of the "worst case assumption".

Finally, the supplemental assurance provisions of 405 KAR 10:015, Section 11 will not apply to any contemporaneous variances associated with permit applications providing full-cost bond estimations.

C. Direct Reclamation Costs Estimations

The following is an excerpt from the United States Office of Surface Mining Reclamation and Enforcement's "Handbook for the Calculation of reclamation Bond Amounts", OSM Directive TSR-1. It provides detailed instructions and information regarding the calculation of a full-cost reclamation estimate. However, the content has been modified in some sections to comply with established permanent program requirements of the Department for Natural Resources.

The methodology in this Handbook reflects standard construction industry cost estimating procedures for determining demolition, earthmoving, and revegetation costs, which are the most significant elements of the reclamation cost estimate.

DATA SOURCES

There are four major sources of the information needed to calculate bond amounts:

- The reclamation and operation plans in the permit or permit application.

- Equipment productivity and performance guidebooks.

- Construction cost reference manuals.

- Contract and cost data from the Kentucky bond forfeiture reclamation program.

The reclamation and operation plans in the permit or permit application provide essential information on the type of mining to be conducted, the sequence of mining and reclamation activities within the permit area, spoil and topsoil handling, haul distances, extent of areas to be disturbed, structures needed during the mining operations, final surface configuration, revegetation standards and techniques, and post mining land use considerations (such as retention of roads, ponds, and other structures).

Equipment productivity and performance guidebooks are extremely useful when estimating earthmoving costs. Most heavy equipment manufacturers publish guidebooks containing performance data. For example, the *Caterpillar Performance Handbook* includes data on tractors, loaders, scrapers, haulage vehicles, small hydraulic shovels and excavators, in addition to a variety of other information such as estimating methodologies and heavy equipment cost accounting.

To calculate bond amounts, these guidebooks should be used in combination with a comprehensive equipment cost reference manual, such as the PRIMEDIA Information, Inc. (formerly K-Ill Directory Corp. and Dataquest, Inc.) *Cost Reference Guide for Construction Equipment* or the *Contractors Equipment Cost Guide.* These reference manuals, which are updated periodically, provide hourly ownership and non-wage operating costs for a wide range of heavy equipment. labor costs for equipment operation must reflect Davis-Bacon wage rates as established by the Department of Labor. Any wage rates provided by the Department of Labor, which are used in the reclamation estimate, should be documented to include the date, state, county, construction type and wage number.

The R. S. Means Company, Inc., also publishes construction-related cost data including *Means Building Construction Cost Data, Means Heavy Construction Cost Data,* and *Means Site Work and Landscape Cost Data.* Means guides contain an extensive array of line-item costs for building construction. These reference manuals, which are updated annually, are especially useful for estimating material acquisition costs and the costs of specific reclamation tasks such as structure demolition. Because the Handbook provides for a separate determination of profit and overhead (see Chapter 2 and Worksheet 16), only use "bare cost" data from the reference manuals. Bare costs do not include profit and overhead.

Please note: rounding is to be applied in preparing the estimates as follows:

- Equipment productivity hours are rounded to the nearest hour, and

- Total bond amounts are rounded to three significant digits.

Please refer to Part III, below for instructions for the inclusion of information in the MPA-03, MPA-07 and MPA-10.

Appendix 1 contains worksheets for the orderly completion and documentation of each step.

STEP 1: DETERMINE POINT FOR THE WORST CASE ASSUMPTION.

Since this is the most important step in the cost-estimating procedure, complete Worksheet 1 only after carefully studying the operation and reclamation plans in the permit application.

STEP 2: ESTIMATE DIRECT RECLAMATION COSTS

Reclamation of most surface coal mining operations includes the following sequence of activities:

- Structure demolition and disposal, including the removal of mining-related buildings and other structures and facilities that are not approved for retention as part of the post mining land use.

- Earthmoving, including backfilling and rough grading, spoil ridge reduction, highwall elimination, final pit elimination, pond and road reclamation, final grading, and topsoil replacement.

- Revegetation.

In addition, other tasks such as sealing mine portals and pumping and treating impounded water may be necessary as part of the reclamation process.

The following sections describe how to estimate the cost of each of these activities.

I. Structure Demolition and Disposal (Worksheet 2)

With the exception of structures approved for retention as part of the post mining land use, the regulations require the reclamation of all haul and access roads and the removal and disposal of all mining-related buildings, crushers, coal storage bunkers and silos, conveyor systems, fences, foundations, power lines, rail spurs, utilities, storage facilities for equipment and supplies, and other similar structures within the permit area.

For cost estimation purposes, removal of a structure means demolition of the structure. Below-grade foundations and buried utilities may be left in place when compatible with the approved post mining land use.

With respect to the reclamation of roads that are not approved for retention as part of the post mining land use, the structure demolition cost category includes expenses associated with the removal and disposal of bridges and culverts, as well as any road-surfacing materials that are incompatible with the post mining land use or revegetation requirements. Other road reclamation costs such as grading and scarification are more properly included in the earthmoving and revegetation cost categories.

Unless the reclamation plan documents that the pertinent solid waste disposal authority has approved on-site disposal, all structure demolition cost estimates must include transportation expenses, landfill disposal fees, and other costs associated with the disposal of demolition debris in an approved solid waste disposal facility. The approval of the solid waste disposal authority may not be necessary for the disposal of loose road-surfacing materials (shale, gravel, or crushed stone) in the backfill.

Include costs for disposal of abandoned equipment and supplies. Because there is no reasonable means of predicting whether equipment and supplies or other materials with potential resale value will be left on site at the time of bond forfeiture, do not allow credit for the salvage value of building materials or abandoned equipment and supplies.

Use Worksheet 2 and appropriate reference manuals such as the Means guides to calculate costs associated with the demolition and removal of structures. When using reference manuals, avoid data that incorporate overhead and profit; these factors will be calculated separately in Section D., below. This value should be entered on Line (3) of the Summary Sheet.

II. Earthmoving (Worksheets 3 through 13)

a. Introduction

For most surface mining operations, earthmoving is the major reclamation cost. Necessary earthmoving activities most commonly include backfilling, grading, placement of cover materials (especially on coal refuse disposal sites), and topsoil redistribution. Backfilling consists of the mass transport of spoil to eliminate spoil piles, pits, and highwalls.

Grading commonly includes:

- Removing diversions and siltation structures,
- Reshaping road cut-and-fill slopes,
- Reconstructing stream channels,
- Re-contouring all disturbed areas to restore appropriate drainage patterns and facilitate the post mining land use,
- Preparing the site for topsoil redistribution, and
- Ripping or scarifying the regraded overburden necessary to ensure topsoil adhesion.

To estimate costs for earthmoving activities, complete Worksheets 3 through 13, following the instructions below and the examples in Appendix B. Worksheet 3, the materials handling plan, identifies and describes each type of earthmoving activity needed at the point of anticipated maximum reclamation cost liability. Worksheets 4A and 4B provide two alternatives for calculating the volumes of materials to be handled. Worksheets 5 through 12 provide a means of calculating site-specific equipment productivity data for various types and models of equipment, using the equipment productivity and performance guidebooks listed in Chapter 1.

b. Materials Handling Plan (Worksheet 3)

Use Worksheet 3 to identify and describe each specific earthmoving activity required as a result of the configuration of the operation at the point of maximum reclamation liability. The determination of equipment needs, productivity, and costs will depend on the information provided on this worksheet. Development of the materials handling plan requires determination of the volume of material to be handled, haul distances and grades, and the types of equipment to be used, as discussed below:

- Material Volume Estimates

  Using the reclamation and operation plans in the permit application, compare the pre-reclamation and post-reclamation topography of the site to determine the amount of material that must be handled. Use standard engineering methods to calculate earthmoving volumes. For example, a series of pre-reclamation and post-reclamation cross sections can be used to calculate volumes by the average-end-area method (see Worksheet 4A). Alternatively, use Worksheet 4B to estimate earthmoving needs by calculating the volume of a series of geometric shapes that resemble the difference between pre- and post-reclamation topography. You may also determine earthmoving volumes using computer programs such as Dynamic Graphics, Inc's, earthVision, Carlson Software's SurvCADD, and Civil Software Design's SEDCAD programs. This software is available from OSM's Technical Information System (TIPS). Document all calculations regardless of the method selected.

  Material volume is defined according to its state in the earthmoving process. The three measures of volume are bank cubic yards (BCY), loose cubic yards (LCY), and compacted cubic yards (CCY). Swell is the increase in volume resulting from a change from bank state to loose state; i.e., the increase in volume caused by excavation. Excavation causes fragmentation, which results in an increase in void spaces.

  All excavated materials settle over time, reducing both the void spaces and overall volume. In addition, mechanical compaction results in some immediate volume shrinkage. Hence, the loose volume of material required to backfill an open pit is greater than the pit void space (pit volume) because of the shrinkage and compaction of the loose backfill material that occurs during and after placement in the pit.

One cubic yard of material lying in its undisturbed, geologic state is 1 BCY. One cubic yard of material that has been excavated and has expanded in volume as a result of the fragmentation that occurs during excavation is 1LCY. One cubic yard of excavated material that has been subsequently compacted during placement is 1 CCY.

Most equipment productivity calculations are based on moving loose volumes of material. Therefore, convert in-place volumes to be moved to loose volumes.

The reclamation and operation plans in the permit application identify the type of overburden materials present within the permit area. Generally, they also specify swell and shrinkage factors for these materials. Verify this information by comparison with swell and shrinkage factors in appropriate equipment guidebooks or other standard engineering reference materials.

Some equipment manuals refer to a load factor, which is the loose density divided by the bank density. Multiply the loose volume of material by the load factor to determine bank volume. This calculation is necessary to estimate productivity and payloads in terms of bank cubic yards (BCY).
Use the following equation to determine the swell factor using a load factor:

$$\text{Swell Factor} = (100 + \text{load factor}) - 100$$

- <u>Haul Distance Estimates</u>

  Using the reclamation and operation plans in the permit application (including designated haul roads and routes), determine haul distances for each area where backfilling, grading, topsoil replacement, or other earthmoving activities will occur. Identify the approximate centroid (surface expression of the center of mass) of each source material and its destination and determine the centroid-to-centroid distance.

- <u>Grade Estimates</u>

  Haul grades and surface conditions greatly impact equipment productivity and may limit the type of equipment that can be used. Most equipment productivity and performance guides express these limitations in terms of the total resistance of the haul, which is the sum of the rolling resistance and grade resistance. The guides contain tables that convert rolling resistance to an equivalent percent grade for various types of road and surface conditions.

- Equipment Selection

Equipment selection for cost estimation purposes is a two-step process: First, select the type of equipment (for example, bulldozer or scraper) based on the guidance in this Handbook, information in equipment productivity and performance guides, the reclamation and operation plans in the permit application, and experience.

Second, select the model and size of equipment based on information contained in the materials handling plan (Worksheet 3), the reclamation and operation plans in the permit application, and equipment productivity and performance guides.

For both the first and second steps, complete Worksheets 5 through 12 for several types and models of readily available equipment to determine the most cost-effective equipment type and model or combination of equipment types and models for each earthmoving activity.

When completing Worksheet 13 (earthmoving costs), use an industry publication containing recent cost data for construction equipment to determine hourly equipment ownership costs. PRIMEDlA Information, Inc.'s *Cost Reference Guide for Construction Equipment* (CRG) is one example of such a publication.

Use Kentucky prevailing wage rate, pursuant to KRS 337.505 through 337.550, from the Kentucky Labor Cabinet on all projects above $250,000 to determine hourly labor costs. Below $250,000 other local costs may be appropriate and can be substituted for the prevailing wage rate from the Kentucky Labor Cabinet. Justify and document any substitutions from the prevailing wage rate of the Kentucky Labor Cabinet.

Equipment needs for typical earthmoving activities are described below:

Spoil Ridge Reduction: Operations that use area mining methods normally rely upon bulldozers, pans and scrapers, or truck/loader combos to move the tops of the spoil ridges into the valleys between the ridges.

Final Pit /Highwal1 Elimination: Bulldozers are usually the equipment of choice to fill the last pit with material obtained from adjacent spoil ridges or the area above the highwall (when approved in the permit). When the mining method requires the use of stockpiled overburden, scrapers or a combination of trucks and loaders are typically used to move stockpiled materials to the pit. When trucks and loaders are used, bulldozers spread the material in the pit area. If the pit is to be reconfigured for retention as a permanent impoundment, bulldozers are normally used to reduce the highwall and spoil slopes to acceptable grades.

In some cases the reclamation plan may not address this reclamation need. For example, the reclamation and operation plans for a mountaintop removal operation would assume complete removal of the top of the mountain, meaning that no highwall elimination would be necessary. However, if a highwall exists at the time of bond forfeiture, we would need to use methods such as ripping or blasting to eliminate the highwall.

Final Grading: Scrapers, bulldozers, and motor graders are commonly used to re-contour backfilled areas, excess spoil disposal structures, and other disturbed areas to facilitate proper drainage and the approved post mining land use and to prepare disturbed areas for topsoil redistribution. In some cases, especially for sites formerly used as roads or support facilities, ripping with bulldozers may be required to reduce compaction in the root zone and provide a slightly rough surface to promote topsoil adhesion.

Topsoil Redistribution: Topsoil redistribution involves the use of scrapers, front-end loaders, trucks, bulldozers, and/or graders. The choice of equipment depends on grade, the haul distance between stockpiles and placement areas, and the volume of material to be moved. Prime farmland requires more attention to equipment selection and material handling to ensure proper soil horizon placement, soil depth, and compaction.

Removal of Diversions and Siltation Structures: Bulldozers are generally adequate to grade out diversions and excavated siltation structures. In some cases, a hydraulic backhoe excavator or small dragline is required to dredge accumulated sediment.

Covering Exposed Coal Mine Waste or Other Acid- or Toxic- Forming Materials: When the reclamation and operation plans require the application of cover material prior to revegetation, the same equipment considerations as those discussed under "Topsoil Redistribution" apply to the transport and distribution of this material. Examples include the covering of coarse coal mine refuse slurry impoundments and coal stockpile pads.

c. Equipment Productivity and Costs (Worksheets 5 through 13)

As discussed above, development of the materials handling plan requires a determination of equipment productivity and earthmoving costs. Use Worksheets 5 through 12 to calculate the production of individual pieces of equipment and the hours required for the job. Use Worksheet 13 to calculate earthmoving costs.

Generally, the productivity of a piece of equipment is expressed in cubic yards per hour. Common factors governing equipment productivity are capacity, cycle time, site conditions, and material characteristics.

Reclamation jobs do not operate at 100% efficiency. Complex factors such as operator skill, repairs and adjustments, and personnel and job layout delays are either addressed individually as part of the "Operator Factor" (see Worksheet 5) or combined in an "Efficiency Factor" (see Worksheets 5 through 12). When site-specific data are not available, use the information below as guidance.

Efficiency Factor

Conditions	**Crawler Equipment**	**Rubber-tired Equipment**
Excellent	0.92 55 min/hr	0.83 50 min/hr
Average	0.83 50 min/hr	0.75 45 min/hr
Unfavorable or Night	0.75 45 min/hr	0.67 40 min/hr

To calculate the number of hours that the equipment is needed, apply productivity rates to the amount of material that must be moved. To determine the hourly cost of equipment during the reclamation operation, adjust the components of the hourly costs in the *CRG* for the number of shifts, fuel costs, etc., as applicable. This value should be entered on Line (1) of the Summary Sheet.

III. Revegetation (Worksheet 14)

Use Worksheet 14 to calculate costs associated with revegetation efforts. The initial revegetation process generally consists of seedbed preparation, including such tasks as soil sampling, application of soil amendments (fertilizer, lime, etc.), seeding, planting, and mulching. Worksheet 14 refers to this as "Initial Seeding." Calculate this cost for all disturbed areas within the worst-case scenario. The reclamation plan will specify the soil condition and species mix. It will also clarify whether irrigation and the planting of trees and shrubs are necessary. Potential sources of cost information for these requirements include the Cooperative Extension Service, agricultural supply firms, agricultural publications, revegetation contractors, landscaping services and the Kentucky bond forfeiture reclamation program.

Worksheet 14 covers the following aspects of revegetation:

- Initial seeding and planting of the worst-case scenario area.
- Vegetative failure for any other unreleased disturbed areas within the permit area (i.e., reseeding and replanting needed).

This value should be entered on Line (2) of the Summary Sheet.

IV. Other Direct Reclamation Costs (Worksheet 15)

Depending upon site conditions and applicable requirements of the reclamation and operation plans, other necessary reclamation activities may include:

- Pumping and treating impounded waters.
- Replacing wetlands.
- Sealing underground mine entries and openings.
- Plugging auger holes.
- Sealing monitoring wells and other drilled holes.
- Constructing rock drains.
- Disposing of toxic, hazardous, and other solid (noncoal) waste in accordance with state and Federal laws and local ordinances.
- Maintaining roads during reclamation including grading, surfacing, ditches and culverts, and snow removal.
- Evaluating and rehabilitating structures to be retained as part of the post mining land use (ponds, roads, diversions, etc.).

This value should be entered on Line (4) of the Summary Sheet.

D. Indirect and Total Costs Estimations

In addition to the site-specific criteria to be considered when calculating a full-cost bond, 405 KAR 10:015, Section 6 provides the following criteria for incorporating the cost to the cabinet for reclaiming a mine site into the total bond amount assessed of the permittee:

- The additional estimated costs to the cabinet that may arise from applicable public contracting requirements or the need to bring personnel and equipment to the permit area after its abandonment by the permittee to perform reclamation, restoration, and abatement work;

- All additional estimated costs necessary, expedient, and incident to the satisfactory completion of the requirements;

- An additional amount based on factors of cost changes during the previous five (5) years for the types of activities associated with the reclamation to be performed; and

- Other cost information required or available to the cabinet.

These factors can be further characterized as: Mobilization/Demobilization, Contingencies, Profit and Project Management Fee which are listed as Lines (6) through (9) on the "Full-cost Estimate Summary Sheet" (Summary Sheet), and Inflation, all of which will be discussed below. As can be seen on the Summary Sheet, Lines (6) through (8) are percentages to be applied to the total of the direct costs (Line (5) of the sheet). Line (9) is discussed below.

I. Mobilization/Demobilization

A third party contractor on behalf of the cabinet will incur expense in transporting equipment to and from the mine site to be reclaimed. The cabinet has established a standard amount of seven and five-tenths (7.5) percent of the total direct cost, to be entered on Line (6) of the Summary Sheet. This value is a based on DAML historical data.

II. Contingencies

A certain amount will be added to the overall cost of reclamation for unanticipated costs incurred during the reclamation project. The cabinet has established a standard amount of five (5) percent of the total direct cost of Line 5 of the Summary Sheet. This value is entered on Line (7) of the Summary Sheet.

III. Profit

The cabinet has established a standard value of ten (10) percent of the total direct cost as a margin of profit for a third party contractor reclaiming a mine site. This value is entered in Line (8) of the Summary Sheet.

IV. Project Management Fee

This fee will recoup a percentage of the costs to the cabinet for the management and inspection of a reclamation project for bond forfeiture by the DAML. The cabinet will apply a factor based on historical information of the DAML. The factor will be calculated as fifty (50) percent of the total reclamation project hours multiplied by fifty dollars/hour ($50.00/hr.). This value is entered on Line 10 of the Summary Sheet. The calculation for Total Project Hours should be included in the supporting documentation included in the appropriate application items discussed in Part III, below.

V. Inflation

Users will note that a factor for cost changes in the last five (5) years is not incorporated into the Summary Sheet. Inflation will be accounted for during review of subsequent mid-term reviews and revisions which alter the mining and reclamation plans or bonding scheme for previously approved permits. Annual cost values established by the DAML will be incorporated into calculations associated with these types of permitting actions.

The final line on the Summary Sheet is the Grand Total, Line (11), which is simply the sum of Lines (5) and (10).

Note: Costs associated with engineering redesigns are not included in the department's full-cost estimation methods, in that these activities are administered by the DAML on behalf of the cabinet during reclamation projects.

Similarly, no costs will be calculated for the repair or maintenance of permanent structures associated with post mining land uses. The DAML does not perform this type of remediation activity as part of a bond forfeiture reclamation project.

E. Exclusions for Certain Permit Revisions, Phase I and Phase II Bond Release Calculations

Certain provisions of 405 KAR Chapters 7 through 24 will not be modified by the utilization of full-cost reclamation estimates, and are discussed below.

I. Permits with Long-term Treatment Drainage

405 KAR 10:015, Section 8(7) provides the method of calculation for additional bond associated with permits that have been identified as producers of long-term treatment drainage. This method will continue to be utilized for revisions required to assess additional bond, in lieu of on-site remediation.

II. Phase I and II Bond Release Calculations

KRS Chapter 350.093(4) and 405 KAR 10:040, Section 2 establishes the criteria and schedule for the amount of bond released at each of the phases. These maximum amounts to be released, sixty (60) percent at Phase I and twenty-five (25) percent at Phase II, remain unchanged by the utilization of full-cost reclamation estimations.

III. TECHNICAL INFORMATION for FORMS MPA-03 and MPA-07

The above-referenced permit applications have been revised to require additional information when permittees elect to provide full-cost reclamation estimations. The "Full-cost Estimate Summary Sheet" has been added to each of the three applications as a mandatory Excel spreadsheet, as well as the Certification of Design, Form SMP-31, as required by Ky Acts ch. 78, Section 6(5). The changes to each application form are described below.

I. MPA-03, Technical Information for a Mining Permit

Item 8.2 of the "Bonding and Fees" section now includes check boxes to indicate the use of full-cost bonding and the type of bonding proposed, single area or incremental (and the number of increments). Item 8.11 contains the Summary Sheet, and the various underlying calculations for direct costs, as discussed in Part C, are to be included as attachments. This item should also include the identification and justification for the "worst case assumption" to be used in the direct costs calculations. Permittees should include a narrative as well as cross sections, site plan maps and any other site-specific information necessary to justify the selection of the assumption.

II. MPA-07, Application to Transfer a Mining Permit

Historically, the department has required the submittal of a performance bond at the time of submittal of the transfer application. This bond must be "at least equivalent to the bond of the existing permittee", in accordance with 405 KAR Section 22, (4). However, in the case of a transfer of a permit from a permittee that is a participant in the Kentucky Reclamation Guaranty Fund to a permittee that has opted out of the fund, a revision would be required after the issuance of the transfer permit to provide a full-cost reclamation estimate and performance bond.

In lieu of this revision, the department has elected to defer the initial submittal of the equivalent bond and will accommodate the inclusion of a full-cost estimate in the transfer application. Item 6 of the MPA-07 has been revised for the submittal of the information required in the MPA-03, as discussed above. Accordingly, the performance bond in the amount of the estimate will be required at the conclusion of the application review, prior to issuance of the transfer permit.

The same process will apply to a transfer of a permit not covered by the fund that is being transferred to a permittee participating in the fund. However, the amount of the bond will be calculated in accordance with the provisions of 405 KAR 10:015, Sections (6), (7) and (11), as applicable. Again, submittal of the performance bond will not be required until the conclusion of the review of the transfer application.

IV. APPENDIX

BOND AMOUNT COMPUTATION

Applicant: ____

Permit Number: _____________ Permitted Acreage:_______________

Bonding Scheme (permit area, incremental, cumulative): _____________

If Incremental:

Increment Number: ___________

Increment Acreage: ___________

If Cumulative:

Acres previously authorized for disturbance: _____________

New acres proposed for disturbance: ___________

Type of Operation: ____

Location: ____

Prepared by: ____

Date: ____

Total Bond Amount: $____

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 1
DESCRIPTION OF THE WORST-CASE RECLAMATION SCENARIO

Assumptions:

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 2
STRUCTURE DEMOLITION AND DISPOSAL COSTS

Structures to be demolished:

Item	Construction Material	Volume (cubic feet)	Unit Cost Basis($)	Demolition Cost($)
			Subtotal	

Other items to be demolished (paved roads, conveyors, utility poles, rail spurs, etc.):

Subtotal = $________________

Debris Handling and Disposal Costs:

Subtotal = $________________

TOTAL DEMOLITION AND DISPOSAL = $________________

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 3
MATERIAL HANDLING PLAN SUMMARY

Earthmoving Activity	Volume (LCY)	Origin	Destination	Haul Distance (ft)	Grade* (%)	Equipment To Be Used

* Record grade resistance {% grade} here.

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 4A EARTHWORK QUANTITY

Cross-Section/ Station	Distance Between Stations (ft)	End Area (ft2)	Volume (yd3)*	Adjust-ment Factor* (%)	Adjusted Volume (LCY)
TOTALS					

*See discussion of material volume estimates in Materials Handling Plan section of this Manual. Select adjustment factor based on the state of the material to be moved.

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 4B
EARTHWORKS QUANTITY

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 5
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Characterization of Dozer Used (type, size, etc.):

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):

Productivity Calculations:

Operating Adjustment Factor = ______________ x ______________ x ______________ x ______________
(Operator factor) x (Material factor) x (Efficiency factor) x (Grade factor)

x ______________ x ______________ x ______________ x ______________ = ______________
(Weight correction factor) x (Production method/blade factor) x (Visibility factor) x (Elevation factor)

Net Hourly Production = ______________ **LCY/hr** x ______________ = ______________ **LCY/hr**
(Normal hourly production) x (Operating adjustment factor)

Hours Required = ______________ **LCY** ÷ ______________ **LCY/hr** = ______________ **hr**
(Volume to be moved) ÷ (Net hourly production)

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 6
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE-GRADING

Earthmoving Activity:

Characterization of Dozer Used (type, size, etc.):

Description of Dozer Use (% grade, effective blade width, operating speed, etc.):

Productivity Calculations:

Operating Adjustment Factor = ______________ x ______________ x ______________ x ______________
(Operator factor) x (Material factor) x (Efficiency factor) x (Grade factor)

x ______________ x ______________ x ______________ x ______________ = ______________
(Weight correction Factor) x (Production method/blade factor) x (Visibility factor) x (Elevation factor)

Hourly Production = ______________ **mi/hr** x ______________ ft x **5,280 ft/mi x 1 ac/43,560ft^2**
(Average speed) x (Effective blade width)

= ______________ **ac/hr**

Net Hourly Production = ______________ **ac/hr** x ______________ = ______________ **ac/hr**
(Hourly production) x (Operating adjustment factor)

Hours Required = ______________ **ac** ÷ ______________ **ac/hr** = ______________ **hr**
(Area to be graded) ÷ (Net hourly production)

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 7
PRODUCTIVITY AND HOURS REQUIRED FOR RIPPER-EQUIPPED DOZER USE

<u>Ripping Activity:</u>

<u>Characterization of Dozer and Ripper Use:</u>

<u>Description of Ripping (ripping depth, cut spacing, cut length, and material to be ripped):</u>

Cycle Time = (_____________ ft ÷ 88 **ft/min**) + _______________**min** = ____________________**min/pass**
Cut length [speed] Fixed turn time*

Passes/Hour = 60 min/hr ÷ ____________**min/pass** x _______________ = ___________________**passes/hr**
Cycle time Efficiency factor

Volume Cut/Pass = (________________ft x _______________ft x _______________ft) **÷ 27ft³/yd³**
Tool penetration Cut spacing Cut length

= _______________**BCY/pass**

Hourly Production = _______________**BCY/pass** x _________________**passes/hr** = _____________**BCY/hr**

Hours Required = _________________**BCY** ÷ ________________**BCY/hr** = _________________**hr**
Bank volume To be ripped** Hourly production

* Fixed turn time depends upon dozer used. 0.25 min/turn is normal.
** Remember to use the swell factor to convert from bank cubic yards to loose cubic yards when applying these data to *Worksheet* 5. Calculate separate dozer hauling of ripped material for each lift on that worksheet.

<u>Data Source(s):</u>

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 8
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Characterization of Loader Use (type, size, etc.):

Description of Loader Use (origin, destination, grade, haul distance, etc.):

Productivity Calculations:

Cycle Time = ____________**min** + __________**min** + ____________**min** = ___________**min**
Haul time (loaded) | Return time (empty) | Basic cycle time

Net Bucket Capacity = ___________**LCY** x ___________ = ____________**LCY**
Heaped bucket Capacity | Bucket fill factor*

Hourly Production = ________**LCY** ÷ _______**min** x _______ x **60 min/hr** = _________**LCY/hr**
Net bucket capacity | Cycle time | Efficiency factor

Hours Required = ___________**LCY** ÷ ___________**LCY/hr** = _________**hr**
Volume to be Moved | Hourly production

* See loader section of equipment manual

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 9
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Characterization of Truck Use (type, size, etc.):

Description of Truck Use (origin, destination, grade, haul distance, etc.):

Productivity Calculations:

No. Loader Passes/Truck = __________**LCY** ÷ ___________**LCY** = _____________**passes**
Truck capacity* | Loader bucket Net capacity | (Round down to nearest whole number)

Net Truck Capacity = ___________**LCY** x ____________ = _______________**LCY**
Loader bucket net capacity | No. loader passes/truck

Loading Time/Truck = ____________**min** x__________________ = _____________**min**
Loader cycle time (from *Worksheet 8 or 10*) | No. loader passes

Truck Cycle Time = __________**min** +_________**min** +________**min** +________**min** = ________**min**
Haul time | Return time | Loading time | Dump and maneuver time

No. Trucks Required = ________________**min** ÷______________**min** = _________**trucks**
Trucks cycle time | Total loading time

Production Rate = _____________**LCY** x ___________ ÷_________**min** = __________**LCY/min**
Net truck capacity | No. trucks | Truck cycle time

Hourly Production = __________**LCY/min** x **60 min/hr** x ______________ = _____________**LCY/hr**
Production rate | Efficiency factor

Hours Required = ________________**LCY** ÷_______________**LCY/hr** = ____________**hr**
Volume to be moved | Hourly production

* Use the average of the struck and heaped capacities.

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 10
PRODUCTIVITY FOR HYDRAULIC EXCAVATOR USE (BACKHOE OR POWER SHOVEL)

Earthmoving Activities:

Characterization of the Excavator Used (type, size, etc.):

Description of Excavator Used (loading geometry, materials, etc.):

Productivity Calculations:

Net Bucket Capacity = ____________**LCY** x ____________ = ______________**LCY**
Heaped bucket capacity; Bucket fill factor*

Hourly Production = ___________**LCY x 60 min/hr ÷** _________**min** x __________ = _____________**LCY/hr**
Net bucket capacity; Cycle time**; Efficiency factor

Hours Required = _____________**LCY ÷** _______________**LCY/hr =** ________________**hr**
Volume to be handled; Net hourly production

* See loader section of the equipment manual.
** See excavator section of equipment manual.

Data Source(s);

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 11A
PRODUCTIVITY OF PUSH-PULL OR SELF-LOADING SCRAPER USE

Earthmoving Activities:

Characterization of the Scraper Used (type, capacity, etc.):

Description of Scraper Use (origin, destination, grade, haul distance, capacity, etc.):

Productivity Calculations:

Cycle =	_________**min** +	__________**min +**	__________**min** +	___________**min =**	___________**min**
Time	Load time (Push-pull is per pair)	Loaded trip time	Maneuver and spread time	Return trip time	(Push-pull is per pair)

Hourly Production = __________**LCY x 60 min/hr ÷** _________**min** x __________ = _____________**LCY/hr**

Capacity* — Cycle time — Efficiency Factor — (Push-pull is per pair)

Hours Required = ___________**LCY÷** ___________**LCY/hr =** ___________**hr**

Volume to be handled — Net hourly production

* The average of the struck and heaped capacities; use total for two scrapers for push-pull.

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 11B
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

Earthmoving Activity:

Characterization of Scraper Used (type, capacity, etc.):

Description of Scraper Use (origin, destination, grade, haul distance, capacity, etc.):

List Pusher Tractor(s) Used:

Describe Push Tractor Loading Method (see figure on next page):

Scraper Productivity Calculations:

Cycle Time = _________**min** + __________**min +** __________**min** + ___________**min** = ___________**min**
Load time; Loaded trip time; Maneuver and spread time; Return trip time

Hourly Production = __________**LCY x 60 min/hr ÷** _________**min** x __________ = _____________**LCY/hr**
Capacity*; Cycle time; Efficiency Factor

Hours Required = ___________**LCY÷** ___________**LCY/hr** = ___________**hr**
Volume to be handled; Hourly production

* Use the average of the struck and heaped capacities.

Push Tractor Productivity Calculations:

Pusher Cycle Time = _____________**min** x _____________ = _____________**min**
Scraper load time; Pusher factor

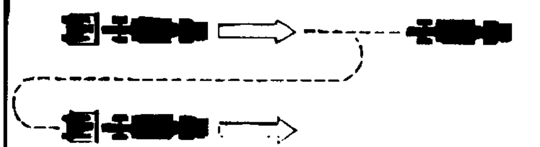
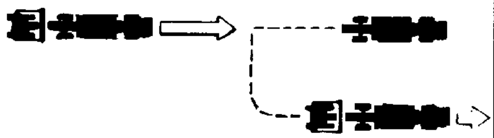
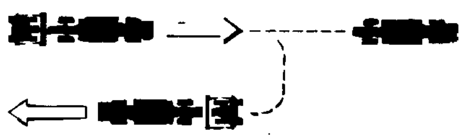
Scrapers/Pusher = _____________**min ÷** _____________**min** = ___________**scrapers**
Scraper cycle time; Pusher cycle time

Pusher Hours Required = ____________**hr** ÷ ____________ = ______________**hr**
Scraper hours; scrapers per Pushers; (Round up)

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 11B (continued)
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

PUSHER FACTORS	Single Push	Tandem Push
 A. Back Track Loading	1.5	2.0
 B. Chain Loading	1.3	1.5
 C. Shuttle Loading	1.3	1.5

Modified from Terex,1981

The following disclaimer pertains to the above illustration from Terex, "Production and Cost Estimating of Material Movement and Earthmoving Equipment"

This manual is a fundamental text on estimating the production and cost of moving materials. It is intended for people associated with the construction industry who prepare job estimates or who evaluate the performance of earthmoving equipment and related costs.

The manual can be used as a supplementary text in those schools and colleges offering formal training in earthmoving techniques. A metric version of this manual is also available.

It will also serve as a reference for those professional consulting engineers who prepare complete job analyses, of which the earthmoving fundamentals covered in this text are only one element

Estimating the production and costs of earthmoving equipment is not an exact science. While this manual outlines the basic factors or parameters on which estimates can be made, the user must make judgments, and must apply his own experience and know-how to temper the estimate.

Data Source(s): TEREX AMERICAS, Tulsa, OK 74107, (918) 445-5802.

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 12
PRODUCTIVITY AND HOURS REQUIRED FOR MOTORGRADER USE

Earthmoving Activity:

Characterization of Grader Used (type, size capacity, etc.):

Description of Grader Route (push distance, grade, effective blade width, operating speed, etc.):

Productivity Calculations:

Hourly Production = ___________**mi/hr x** ___________**ft x 5,280 ft/mi x 1 ac/43,560 ft**^{2}
Average speed Effective blade width

x _____________ = ______________**ac/hr**
Efficiency factor

Hours Required = ______________**ac ÷** _____________**ac/hr** = ____________**hr**
Area to be graded Hourly production

Scarification

Hourly Production = ___________**mi/hr x** ___________**ft x 5,280 ft/mi x 1 ac/43,560 ft**^{2}
Average speed Scarifier width

x _____________ = ______________**ac/hr**
Efficiency factor

Hours Required= ______________**ac ÷** _____________**ac/hr** = ____________**hr**
Area to be scarified Hourly production

Total Hours Required

Total Hours = ____________________ + ________________________ = __________**hr**
Grading hours required Scarification hours required

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 13
SUMMARY CALCULATION OF EARTHMOVING COSTS

Equipment*	Ownership & Operation Cost ($/hr)	Labor Cost ($/hr)	Total Hours Required**	Total Cost*** ($)
			Grand Total	

* Include all necessary attachments and accessories for each item of equipment. Also, add support equipment such as water wagons and graders to match total project time as appropriate.

** Account for multiple units in truck and/or scraper teams.

*** To compute Total Cost: Add Ownership & Operation Cost and Labor Cost columns then multiply by Total Hours Required column.

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 14
REVEGETATION COSTS

Name and Description of Area To Be Revegetated:

Description of Revegetation Activities:

Cost Calculation for Individual Revegetation Activities:

Initial Seeding

________________**ac** x ($____________**/ac + $**_______________**/ac**) = $______________

Area to be seeded | Seedbed preparation | Seeding, fertilizing & mulching

Planting Trees and Shrubs

________________**ac** x ($____________**/ac + $**_______________**/ac**) = $______________

Area to be planted | Planting | Herbicide treatment

Reseeding

________________**ac** x ___________ x ($____________**/ac + $**_______________**/ac**) = $______________

Area to be seeded & unreleased disturbed areas | Failure rate* | Seedbed preparation | Seeding, fertilizing & mulching

Replanting Trees and Shrubs

________________**ac** x ___________ x ($____________**/ac + $**_______________**/ac**) = $______________

Area to be planted & unreleased disturbed areas | Failure rate* | Planting | Herbicide treatment

Other Necessary Revegetation Activities

(Examples of other activities that may be necessary include soil sampling, irrigation, and rill and gully repair. Describe each activity and provide a cost estimate with documentation. Use additional worksheets if necessary.)

Other Costs = $ ________________

Total Revegetation Cost = $________________

* Identify failure rate and basis. If anticipated failure rates vary within the area proposed for disturbance, use a separate worksheet for the area subject to each failure rate.

Data Source(s):

Project: ____________________
Date: ____________________
Prepared by: ____________________

WORKSHEET 15
OTHER RECLAMATION ACTIVITY COSTS

(Subsidence damage repair costs, water supply replacement costs, funds required to support long-term treatment of unanticipated acid or ferruginous mine drainage, etc.)

Description of Reclamation, Repair or Pollution Abatement Activity:

Assumptions:

Cost Estimate Calculations:

TOTAL COSTS = $________________

Other Documentation or Notes:
(Include additional sheets, maps, calculations, etc., as necessary to document estimate.)

Data Source(s):

Full-cost Estimate Summary Sheet

Permittee Number	____________
Increment Number	____________

Permittee Name: ____

Direct Cost

(1)	Total Yardage / Distance Costs	$	____________
(2)	Total Revegetation Costs	$	____________
(3)	Total Demolition/Disposal Costs	$	____________
(4)	Other Reclamation Costs	$	____________
(5)	Total Direct Costs (Sum of 1 through 4)	$	____________

Indirect Costs

(6)	Mobilization/Demobilization (7.5% of line 5)	$	____________
(7)	Contingencies (5% of Line 5)	$	____________
(8)	Profit (10% of Line 5)	$	____________
(9)	Project Management Fee (50% of Total Project (Hours x $50.00/hr))	$	____________
(10)	Total Indirect Costs (Sum of Lines 6 through Line 9)	$	____________
(11)	Grand Total (Sum of Lines 5 and 10)	$	____________