



COGEMA

Mining, Inc.

October 29, 2001

ADDRESSEE ONLY: Mr. Melvyn Leach, Chief
U.S. Nuclear Regulatory Commission
Fuel Cycle Licensing Branch
Mail Stop T-8A33
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

RE: Response to Annual Surety Update Acceptance Review
License No. SUA-1341, Docket No. 40-8502
Irigaray and Christensen ISL Projects

Dear Mr. Leach:

Please find attached COGEMA Mining, Inc.'s responses to NRC's September 28, 2001 review of our August 18, 2001 annual surety update. In their review, NRC essentially asked for many of the back-up detail for unit rates used in the surety estimate. These have been provided for each of the worksheets associated with the surety estimate, as well as for Table 1, the surety summary.

Also enclosed is a copy of the most recent edition of the Wyoming Department of Environmental Quality (WDEQ), Land Quality Division's (LQD) Guideline No. 12, "Standardized Reclamation Performance Bond Format and Cost Calculation Methods", (2001 revision). This document was used for several of the worksheet unit rate calculations. This is also the document used by WDEQ when assigning the miscellaneous costs on Table 1 for items such as Project Management, Contractor Profit & Mobilization, etc.

I trust that the attached responses will assist you with the completion of the surety review. If you should have any questions, please contact me at (307) 234-5019.

Sincerely,

Donna L. Wichers
General Manager

Enclosures: COGEMA Mining responses
WDEQ/LQD Guideline No. 12

NMSSOIPublic

*Process per
Elaine
Brummett*

**Responses to NRC's September 28, 2001 Acceptance Review
Annual Surety Update, Irigaray and Christensen Ranch ISL Projects
October 29, 2001**

Table 1 – Summary of Reclamation/Restoration Bond Estimate

Table 1 is a summary of costs from individual bond worksheets. Added to the grand total of estimated spending are "miscellaneous" costs associated with the hiring of a third party contractor to actually perform the work. The specific miscellaneous costs are a requirement of the Wyoming Department of Environmental Quality (WDEQ), as outlined in the WDEQ Land Quality Division's Guideline No. 12, "Standardized Reclamation Performance Bond Format and Cost Calculation Methods", page 11 (a copy of this document is enclosed). The U.S. Nuclear Regulatory Commission (NRC) also requires that the bond estimate be based on a third party contractor. Also added to the miscellaneous costs is a standard contingency, in this case 15%. An explanation of the various miscellaneous costs and contingency for Table 1 are as follows.

Project Design

This is the cost for an independent firm to design the final reclamation project. This includes all design and engineering work through production of construction documents. Some surveying and redesign of the operator's reclamation plan to fit the current situation may be required. WDEQ reference sources place this category at 2 to 6.5% of the total bond cost. WDEQ typically uses 3%. COGEMA has been approved to use 2% for this category based on the details of our reclamation plan.

Contractor Profit & Mobilization

This percentage covers contractor costs typically not found in the basic unit rates. This percentage specifically covers contractor profit, overhead costs, mobilization costs to the site and demobilization costs after job completion. According to WDEQ, assorted references place this cost from 8% to 15% of the total bond cost. WDEQ typically uses 10%. COGEMA has been approved by the WDEQ to use 8% for this category.

Pre-construction Investigation

This item addresses all fieldwork necessary to document and mitigate dangerous and/or quickly deteriorating conditions. Any assessment under this item will be based on the WDEQ's knowledge of specific site conditions and length of time between bond forfeiture (reason for a third party contractor) and initiation of the final reclamation project. WDEQ uses 1%, and has reference sources placing this cost between 1% and 2%. COGEMA has been asked to incorporate the 1% into our bond estimate.

Project Management

This category includes the costs for an independent firm to manage the final reclamation project. It includes complete oversight of all demolition, construction and reclamation activities. Examples would include supervision of groundwater restoration, wellfield piping and structures removal, plant buildings and equipment demolition, soil sampling, byproduct waste shipments, etc. References place this cost at 3% to 4%. WDEQ typically uses 3%. However, WDEQ has required a 4% project management cost for COGEMA due to the more technical aspects of groundwater restoration. Furthermore, at the suggestion of NRC, COGEMA has included a Radiation Safety Officer as part of the project management team, bringing the percentage for this estimate up to 5%.

On-site Monitoring

This category covers the costs for any miscellaneous monitoring felt necessary by the WDEQ after the final reclamation is completed. Costs of this item typically vary, depending upon the volume of monitoring already included in the bond or the type of reclamation activity required. The WDEQ typically uses 0.5%, and this is what COGEMA is bonded for.

Site Security & Liability Assurance

This category covers the cost for the WDEQ, or third party contractor, to provide any necessary site security measures during the reclamation program, and to purchase liability insurance to cover the timeframe of the reclamation program and full bonding period. WDEQ references place this cost at about 1% of the total bond amount. The WDEQ typically uses 1%, and this is what COGEMA is bonded for.

Longterm Administration

This category applies to the period between completion of the reclamation project and final bond release which is a minimum 5 year period for uranium mines. During this time the WDEQ will incur administrative costs prior to the final bond release. WDEQ typically uses 1% to 2% for this category depending upon the scale or complexity of the reclamation and post-reclamation monitoring. COGEMA is required to use 2%.

Contingency

Contingency is included in the bond estimate to cover unknown conditions that could occur during the reclamation project. The WDEQ references place this cost at 2% to 5% of the total bond cost. Under normal circumstances WDEQ uses 4%. NRC requires a contingency of 15% regardless of the detail of the bond estimate, so COGEMA has added the 15%.

WDEQ Reference Sources: The reference sources used by WDEQ to establish the ranges of percentages used in the miscellaneous items are:

- Means Heavy Construction Cost Data (current edition), R.S. Means Company, Inc., Kingston MA
- Means Site Work Cost Data (current edition), R.S. Means Company, Inc.
- Building Construction Cost Data (current edition), R.S. Means Company, Inc.
- Handbook for Calculation of Reclamation Bond Costs, 1987, Department of Interior, Office of Surface Mining Reclamation and Enforcement, Washington, D.C.
- Wyoming DEQ Abandoned Mine Land Program contracting and reclamation practices and cumulative experience.

Worksheet 1 – Groundwater Restoration

Worksheet 1 provides the cost estimate to complete the groundwater restoration work at both the Irigaray and Christensen sites. Most of the input data and calculations are self-explanatory. Explanations for the various unit rates or factors used in the calculations are described below:

Technical Assumptions:

All of the input data provided in the technical assumptions are actual site specific information. These data are used throughout the bond estimate as needed.

Restoration Operating Assumptions:

Flowrates, pore volumes required, RO efficiencies and disposal well information are taken from the restoration plan. The remainder of the operating assumptions are calculated using the conversion factors listed and the technical assumptions.

Restoration Cost Assumptions:

Power costs are based on actual (average) installed horsepower and actual costs for electricity at each of the sites. A factor of 1.0 is used for the Kwh/Hp to account for motor efficiencies. Using these numbers, a unit rate for power (\$/Kgal) is calculated.

Chemical costs are based on actual spending (year 2001) at the Irigaray and Christensen sites. Repair and maintenance is also a unit rate based on actual 2000 through 2001 spending for this category at Irigaray and Christensen.

Sampling and Analysis has been based on taking a round of samples each pore volume and analyzing the samples for a full suite Guideline 8 (26 parameters). Assumes each established baseline well is sampled in each wellfield, \$150 per analysis, divided by the number of Kgallons in a pore volume (technical assumptions). Examples:

Irigaray Units 1-5 = $(24 \text{ wells} \times \$150) / 21,958 = \$0.164/\text{Kgal}$

Christensen Unit 4 = $(12 \times \$150) / 19,568 = \$0.092/\text{Kgal}$

An exception to this is Christensen Mine Units 5 and 6, where the pore volumes were increased the last bonding cycle. This would have significantly reduced the sampling and analysis cost per Kgallon, but this change has not been made to date.

Utility costs listed are for electricity and heating for the offices during the restoration operations. The dollars per month provided are based on the actual average G&A power cost at Irigaray and Christensen. 10% of the monthly power and propane is charged to the groundwater sweep phase, and 90% of the power and propane is charged to the reverse osmosis phase. Power and propane during the stabilization monitoring are essentially the full monthly G&A cost for these items.

Waste Disposal Well Cost Assumptions:

Operating assumptions for the waste disposal well are based on the restoration plan and historical experience (such as the brine concentration factor). Cost assumptions follow the same rationale as for restoration costs (unit rates are based on actual site spending for the power, chemicals, repair and maintenance).

Stabilization Monitoring:

Three sample sets will be taken during the 9 month stabilization monitoring period. The first set is taken three months after the beginning of stabilization monitoring. The next set is taken after six months and the last after 9 months. The cost of \$3,600 per set is based on the sampling of an average of 24 wells per wellfield, with an analysis cost of \$150/well. Currently COGEMA is paying \$130/sample for a full suite analysis (WDEQ Guideline 8). Power and utilities (propane, telephone) for maintaining the office open during stabilization monitoring are based on actual G&A site spending, as discussed above.

Labor:

Labor costs for 3.6 years of restoration operations are included. The operations crew consists of 1 supervisor, 4 operators, and 2 maintenance personnel. Operating costs for 2 vehicles are also included in this category. Unit rates for each worker category are

shown in the table. Management labor is included in the Miscellaneous category under Project Management in Table 1.

Restoration Capital Requirements:

In previous bond estimates, the construction of RO units to conduct the restoration were listed under capital. Now that all of these units are in place and operating, this item is zeroed out. The only remaining capital requirement is the plugging and abandonment of the two wastewater disposal wells. This has been listed as capital as the plugging and abandonment were included in the original capital construction estimate for the well, and this is the amount remaining. The plugging cost estimate of \$100,000 per well is based on a consultant's estimate in 1999 of approximately \$75,000 per well (placing cement plugs in accordance with Wyoming Oil & Gas Commission abandonment guidance).

Worksheet 2 – Plant Equipment Removal and Disposal

This worksheet calculates the costs to decontaminate, dismantle and remove, transport and dispose of plant process equipment. Explanations for the various unit rates or factors used in the calculations are described below:

Decontamination Cost

This cost has already been detailed to NRC in our June 15, 2001 response to questions raised during the review of the decommissioning plan. The detail is repeated below:

Decontamination unit rate of \$462/load (1994 \$):

Assumptions:

- 2 cubic feet = 6 square feet (surface)
- 2 laborers can powerwash or sandblast 10 square feet per minute, or 1.7 cubic feet per minute = 102 cubic feet/hour
- 1 load = 540 cubic feet

Labor:

- 2 laborers @ \$15/hour = \$30/hour
- 540 cubic feet/load divided by 102 cubic feet/hour = 5.29 hours/load
- 5.29 hours/load x \$30/hour = \$158.70

Equipment Rental:

- 2 pressure washers @ \$7/hour
- 1 30 HP air compressor @ \$5/hour
- 2 sandblast pots @ \$5/hour
= \$29/hour
- 5.29 hours x \$29/hour = \$153.40

Materials:

- Sand: 75 cubic feet @ \$1/foot = \$75
- 10% HCl, 440 gallons @ \$0.17/gal = \$75
- = \$150

TOTAL = \$158.70 + \$153.40 + \$150 = \$462.00/load

Inflated to 2001 \$ (19.1%) = \$550/load (current bond estimate)

Dismantling and Loading Cost

The detail of this cost was also submitted to the NRC in the June 15, 2001 response. The estimate is:

Dismantling and loading cost of \$600/load (1994 \$):

Labor Crew:	1 foreman	@ \$20/hour
	4 laborers	@ \$15/hour
	1 truck	@ \$10/hour
	1 welder	@ \$35/hour
		<u>\$125/hour</u>

Estimate: 4 hours @ \$125/hour = \$500

Equipment Rental: 1 front-end loader with operator @ \$50/hour

Estimate: 2 hours @ \$50/hour = \$100

TOTAL = \$600/load

Inflated to 2001 \$ (19.1%) = \$715/load (current bond estimate)

Oversize Charges

The cost of \$326/per truckload for oversize charges was provided to COGEMA by our former trucking firm, Key Trucking (Kaycee, Wyoming). This was their estimate of what they would be paying for permits for any loads that were larger than 15' wide, 15' high and 75' long. No other details are available. Standard charges from the Wyoming Department of Transportation, Port of Entry, are \$15 plus \$0.03/foot/mile for the oversized item. We believe that the \$326/load is very conservative based on the standard charges quoted.

Transportation & Disposal

- Cost per mile of \$2.58 for transportation of decommissioned materials is standard throughout the bond estimate. This is the actual price charged by Key Trucking for hauling materials short distances (less than 200 miles). The mileages listed in the bond are 48 miles from the project sites to the Edgerton, Wyoming industrial landfill, and 150 miles to Shirley Basin, Wyoming (tailings facility for byproduct disposal). The \$2.58 charge is based on a loaded mile (one-way).
- Landfill costs of \$12.00/cubic yard are the actual rates charged by the Edgerton, Wyoming industrial landfill.
- COGEMA Mining has a byproduct material disposal agreement with Pathfinder Mines Corporation's Shirley Basin tailings facility. The disposal fee per cubic foot for piping, process equipment, demolition waste is \$11/cubic foot.

Worksheet 3 – Plant Building(s) Demolition and Disposal

This spreadsheet provides the costs for demolition and disposal of all buildings at Irigaray and Christensen, including concrete decontamination, demolition and disposal. Also included in the spreadsheet are costs for the removal and disposal of contaminated soils under the process buildings, and at the NPDES surface discharge points (one each site). Individual cost items are:

Structural Character

- Western Water Consultants, Sheridan, Wyoming, provided factors for gutting, and estimated material weights for the Irigaray process buildings volumes. Volumes, etc., for the Christensen buildings were estimated by COGEMA's in-house staff, using the Western Water Consultants work at Irigaray.
- The demolition cost of \$0.1310/cubic foot is \$0.110/cubic foot (taken from Means Site Works, 1994) inflated to 2001\$ (19.1%).
- The building demolition disposal cost of \$35.70/ton is the charge from the Edgerton, Wyoming industrial landfill for this type of demolition debris.

Concrete Decontamination, Demolition & Disposal

- The decontamination costs of \$0.170/square foot are based on the decontamination estimate of \$550/load (\$462/load in 1994\$ inflated by 19.1% to 2001\$) discussed above for Worksheet 2. One load = 540 cubic feet; assuming 1 cubic foot = 6 square feet (surface), then \$550/load divided by 3240 square feet per load = \$0.170 per square foot.
- The concrete demolition rate of \$1.887/square foot is based on \$1.584/square foot (taken from Means Site Works, 1994) inflated to 2001\$ (19.1%).
- The disposal fee of \$3.70/cubic foot is based on the byproduct waste disposal agreement with Pathfinder Mines Corporation's Shirley Basin site. This rate is based on the agreement fee of \$100/cubic yard for soils and concrete rubble. (\$100/27 cubic feet per cubic yard = \$3.70 per cubic foot).

Soil Removal & Disposal

The estimate of contaminated soils is simply a contingency for unknowns. All unit rates associated with this contingency have previously been justified.

Radiation Survey

The cost for radiation surveys has already been detailed to NRC in our June 15, 2001 response to questions raised during the review of the decommissioning plan. The detail is repeated below:

Soil sampling and analysis cost:

- \$75/soil sample for digestion, U and Ra-226 analysis
- \$25/soil sample for labor
- Total = \$100/sample, and an average of 4 samples per acre = \$400/acre

Gamma characterization and verification survey

- \$100/acre for GPS survey
- \$50/acre for grid establishment
- \$30/acre for verification after excavation
- Total = \$180/acre

Grand Total = \$580/acre

Worksheet 4 – Pond Reclamation Costs

Worksheet 4 provides all costs for the decommissioning of evaporation ponds located at the Irigaray and Christensen site. Unit rates used for this work that have not been identified in detail for other worksheets are provided following:

Pond Sludge

Sludge handling costs per load are given as \$238/load. This is based on a 1994 cost estimate of \$200/load, provided following, then inflated to 2001\$ (19.1%):

- Front-end loader with operator @ \$50/hr (10 c.y./hr) for 2 hrs. = \$100

- Labor crew (1 hour) =

1 foreman @ \$20/hr
4 laborers @ \$15/hr
1 truck @ \$10/hr
<u> </u>
= \$90/hr = \$90

- Total = \$190/load, or \$200/load
- \$200/load inflated by 19.1% = \$238/load

Pond Liner

- Labor crew costs per hour for handling the pond liner are taken from the above estimate of \$90/hour, increased to \$100/hour for simplicity. The \$100/hour has since been inflated to a total of \$120/hour in 2001\$ (19.1% increase)

Pond Backfill

- The unit rate for backfilling of \$1.00 per cubic yard is conservative. A third party contractor at Pathfinder's Lucky Mc facility is currently charging \$0.89 per cubic yard for backfilling and regrading.

Leak Detection System Removal

- This section assumes that contamination is found in the leak detection system wherever a leak has been detected in a pond during its operating life. This is why volumes are included for only Ponds C and D at Irigaray and Pond 1 at the 517 site. Handling costs for removal of these systems are included as \$238/load, or the same as the pond liner handling costs.

Worksheet 5 – Well Abandonment

The method used for well abandonment in this bond calculation involves the placement of bentonite chips in the bottom 75 feet and upper 30 feet of each well, with the intermediate volume filled with gravel. A cement cone is placed two feet below the surface, then the surface casing is removed and the hole is backfilled with soil using a backhoe. Unit rate explanations are provided following:

- Cost of bentonite chips - \$4.50/bag is a year 2001 quote from Casper Well Products, Casper, Wyoming.
- Cost of gravel/cubic yard – two quotes were provided for sand & gravel to fill the wells for final abandonment. The first was from JTL Group (Casper, WY) for screened, washed pea gravel. The quote was \$15.75/ton delivered, with a 1.5 tons/yard conversion, or \$23.63 per yard. The second quote was from '71 Construction (Casper, WY) for clean sand/gravel mix, suitable for well abandonment. This cost came in at \$13 per ton delivered, with a 1.25 tons/yard conversion, or \$16.25 per yard. Because gravel prices vary widely depending upon the time of year, the \$17.53 per cubic yard was left unchanged in the estimate as it appears to be reasonable.
- Cost of cement cones/markers - \$4.00 each from Casper Well Products, Wyoming.
- An example of a typical well abandonment calculation for Irigaray is as follows:
Assume: well volume = 27.6 ft³; well depth = 250 ft; casing diameter = 4.5 inches
Materials per well:

Bentonite chips from 250' to 175'

Sand/gravel from 175' to 30'

Bentonite chips from 30' to 2'

Cement cone and backfill from 2' to surface

Materials/well: 15 bags bentonite chips @ \$4.00/bag = \$67.50

(65 lbs/ft³, 11.4 ft³/well, 50 lb. bags)

0.58 c.y. gravel @ \$17.53/c.y. = \$10.19

[Well T.D. - (105'-2') x 0.11($\frac{\pi r^2}{144 \text{ in}^2/\text{ft}^2}$)]

Cement cone and marker @ \$4.00 each = \$ 4.00

Labor: 1 hr./well

1 – Foreman @ \$20.00/hour

2 – Laborers @ \$15.00/hour

1 – Vehicle @ \$10.00/hour

\$60.00/hour

Inflated to 2001 \$ (19.1%) = \$70.00/hour x 1 hour/well = \$70.00

Equipment Rental: 1 backhoe @ \$35.00/hour x 1 hour/well = \$35.00

(Operator included; adjusted to 2001 costs)

TOTAL cost per well = \$186.69

Worksheet 6 – Wellfield Equipment Removal & Disposal

This spreadsheet covers the removal & disposal of all wellfield piping, submersible pumps and tubing, trunklines running from the wellfields to the plant, and manholes along the trunklines. Unit rates not addressed previously are detailed below.

Wellfield Piping Removal

The 1994 cost of \$0.162/ft to remove buried lines running from the module buildings to each individual well was used for this calculation, then inflated by 19.1% to 2001 \$ to give the current unit rate of \$0.193/ft. An example of the calculation is provided as follows:

Open Trenches:

- 300'/well, 446 wells = 133,800 linear feet of pipe
- trenches: 300'/well x 2' deep x 2' wide = 1,200 ft³ = 44 c.y./well
- 44 c.y./well x 446 wells (Christensen Unit 6) = 19,624 c.y.
- 19,624 c.y. @ 50 c.y./hour = 392 hours
- Equipment rental: 2 backhoes @ \$30/hour x 196 hours each = \$11,760
(operators included) (\$0.087/ft)

Remove Pipe, Chip and Load: (assume approximately 20,000 feet /day chipped)

- Labor: 1 – Foreman @ \$20.00/hr.
4 – Laborers @ \$15.00/hr.
1 – Vehicle @ \$10.00/hr.
\$90.00/hr. x 6 days = \$ 4,320
- Equipment Rental: 2 chainsaws @ \$2.00/hr x 3 days = \$ 12
(\$0.032/ft)

Backfill Trenches:

- 19,624 c.y. @ 100 c.y./hr. = 196 hrs.
 - Equipment rental: 2 backhoes @ \$30.00/hr. x 98 hrs each = \$ 5,880
(operators included) (\$0.043/ft)
- TOTAL= \$0.162/linear foot

Pump Removal

Submersible pumps are set in each production well for mining and restoration. The pump removal cost of \$21.44 is the 1994 cost of \$18.00 per well adjusted to 2001\$ (19.1% increase). Using Christensen Mine Unit 6 as an example, the details are as follows:

Pull pumps and tubing – 4 wells/hour, 202 production wells

- Labor: 1 – Foreman @ \$20.00/hour
2 – Laborers @ \$15.00/hour
\$50.00/hour x 50.5 hours = \$ 2,525

- Equipment Rental: 1 pulling unit @ \$22.00/hr. x 50.5 hours = \$ 1,111
\$ 3,636

TOTAL = \$3,636 / 202 wells = \$18.00/ pump or well

Inflated 19.1% = \$21.44/pump or well

Tubing Volume Reduction and Loading

Using Christensen Mine Unit 6 as an example, the details of this cost are as follows:

Tubing: 300'/well average x 202 wells = 60,600 linear feet

- Chip and load: average O.D. (inches) = 3; chipped volume reduction (ft³/ft) = 0.016; chipped volume = 970 ft³; assume approximately 20,000 feet per day chipped.

- Labor: 1 – Foreman @ \$20.00/hour
2 Laborers @ \$15.00/hour
\$50.00/hour x 3 days = \$1,200

- Equipment: shredder is owned by COGEMA

TOTAL = \$1,200 / 60,600 linear feet = \$0.02/linear foot

Inflated 19.1% = \$0.024/linear foot

Surface Piping Removal

Surface piping exists at the Irigaray site. In 1994, the cost for removing the Irigaray pipe was reduced from the \$0.162/ft (wellfield piping removal cost above) to \$0.120/ft. This was based on the removal of the \$0.04/ft. cost for backfilling. The \$0.08/ft. cost for opening trenches was kept, because portions of the surface lines are partially covered with soil, and buried in some locations. So, the removal, chipping and loading costs for surface lines (only located at Irigaray) of \$0.120, inflated to 2001\$ (19.1%), is \$0.143.

Buried Trunkline Removal

The cost of \$2.80/ft for removal of buried trunklines is the 1994 cost per foot of \$2.35, inflated to 2001\$ (19.1%). Using the buried 12" lines at Irigaray for an example, the cost for removal of buried trunklines is:

Open Trenches:

- 7,300 linear feet of pipeline
- 2' deep x 4' wide = 29.6 c.y. soil per 100 feet of trench
- 29.6 c.y. x 7,300' / 100 = 2,163 c.y. soil to be removed
- Equipment Rental: 1 Trackhoe @ \$110.00/hour x 14.4 hours = \$ 1,586
(operator included, 150 c.y./hr rate) (\$0.22/ft)

Remove Pipe, Chip and Load: Assume 500' per day

- Labor: 1 – Foreman @ \$20.00/hr
4 – Laborers @ \$15.00/hr
1 – Vehicle @ \$10.00/hr
\$90.00/hr x 14.6 days = \$10,512
(\$1.44/ft)

- Equipment Rental: 1 Chainsaw @ \$2.00/hr
1 Backhoe @ \$30.00/hr
\$32.00/hr x 14.6 days = \$ 3,738
(\$0.51/ft)

Backfill Trenches:

- Assume 50 c.y./hr x 2,163 hours = 43.3 hours
- Equipment rental: 1 backhoe @ \$30.00/hr x 43.3 hours = \$ 1,298
(\$0.18/ft)

TOTAL = \$17,134 / 7,300 linear feet = \$2.35/linear foot

Inflated to 2001\$ (19.1% increase) = \$2.80/linear foot

Manhole Removal

Manholes are present along each of the buried trunklines to permit access to valves. Removal is essentially the crushing of the 12' by 8' culvert in place and backfilling. Removal cost of \$130 per manhole is based on the 1994 cost of \$110 inflated to 2001\$ (19.1%).

▪ Labor:	1 – Foreman @ \$20.00/hr			
	2 – Laborers @ \$15.00/hr			
	1 – Vehicle @ \$10.00/hr			
		\$60.00/hr	x 1.3 hour/manhole	= \$ 80.00
▪ Equipment Rental:	1 Backhoe @ \$30.00/hr		x 1 hour/manhole	= \$ 30.00
				\$110.00
		Inflated to 2001\$		= \$130.00

In the bond estimate, it is assumed that the manhole culverts are contaminated. In reality, these culverts are not contaminated and will be left in place, or pulled and sold (after release surveys).

Worksheet 7

Worksheet 7 provides to costs to replace topsoil in areas where topsoil was stripped and stockpiled, to conduct radiation surveys & soil analysis prior to topsoil placement, then the revegetation of the topsoil or ground surface without topsoil. Unit rates used in the calculations that have not been previously detailed are described below.

Unit Cost – Grading

- \$50.00/acre – WDEQ Guideline 12 places the cost for final grading using a Caterpillar 16H Motor Grader at \$38.45 per acre (\$102.28/hr, 2.66 acres/hr). Use of the \$50.00/acre is considered conservative.

Revegetation

- \$491.71/acre – This cost has been used in past bond estimates and was taken from previous issues of the WDEQ Guideline 12. In the most recent edition of Guideline 12, operators are allowed to calculate their own revegetation costs, because the \$491.71/acre is very high. The last revegetation done at Christensen in year 2000 cost \$195/acre (seed plus drill costs). Mulching and crimping were not necessary, and will only be necessary on steep slopes. We have continued to use the \$491.71/acre as it is considered conservative.

Worksheet 8

Worksheet 8 provides all the remaining miscellaneous items that could be involved in the final reclamation. Unit rates are described below:

Fence Removal & Disposal

The unit rate of \$0.68/ft is taken from Appendix H, WDEQ – LQD Guideline 12.

Powerline Removal & Disposal, Powerpole Removal & Disposal

Distribution lines and power poles are owned by Powder River Energy Corp. (PREC) and will be removed upon request at no charge. Transmission lines and power poles which go from the main metering points to various electrical substations will also be removed by PREC at no cost for their salvage value.

Transformer Removal & Disposal

The costs for removal and disposal of transformers are based on the 1994 issue of WDEQ-LQD's Guideline No. 12. The costs for the larger transformers at Irigaray and Christensen Units 2 through 5 were \$2,040 each, inflated to 2001\$ = \$2,428. The smaller transformers used in Christensen Unit 6 are \$500 each inflated to 2001\$ = \$595 each.

Booster Pump Assembly Removal & Disposal

Removal of the booster pump assemblies along the trunklines at Christensen is based on labor, and will be non-contaminated. An internal estimate of \$200/assembly was used in 1994\$, then inflated to 2001\$ = \$298.

Culvert Removal & Disposal

The cost of \$3.48/foot of culvert is taken from the most recent edition of WDEQ-LQD Guideline 12, Appendix J.

Guardrail Removal

The cost of \$6.19/foot (2001\$) for guardrail removal is based on the 1994 edition of WDEQ-LQD Guideline 12 where the cost per foot for guardrail removal was \$5.20/foot.

Low Water Stream Crossing

In 1994, this cost was estimated as the same as the construction cost (\$7,000). Inflated to 2001\$, the cost is now \$8,330.

Utilities Cost

In 1994, the utility cost per month for heating or providing electricity during the reclamation operations was estimated at \$2,000/month for Irigaray and \$1,000/month for Christensen. These costs were simply inflated to 2001\$, or \$2,380/month for Irigaray and \$1,190/month for Christensen.

**DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION**



GUIDELINE NO. 12

**STANDARDIZED RECLAMATION
PERFORMANCE BOND FORMAT AND COST
CALCULATION METHODS**

TABLE OF CONTENTS

INTRODUCTION	iii
APPLICABLE WEQA STATUTES AND LQD RULES AND REGULATIONS	iii
I. COST EXPLANATION FOR ITEMS USED IN STANDARDIZED RECLAMATION BOND COSTS	1
Table D-1. Operating Costs and Adjusted Costs (\$/Hour w/o Operator) For Equipment in This Standardized Bond Format	2
Table D-1a. Purchase Price, Lease Cost, and Operating Costs for 56 CY Electric Shovel and 793C Trucks	3
Table D-2. Abbreviations Used in This Standardized Bond Format	4
II. STANDARDIZED RECLAMATION BOND FORMAT	4
A. Area Bond	4
1. Introduction	4
2. Backfill	4
3. Rough Grade Backfill	5
4. Final Grade Backfill	5
B. Incremental Bond	5
1. Introduction	5
2. Native Topsoil Removal From Borrow and/or Backslope Areas	5
3. Native Overburden Removal From Borrow and/or Backslope Areas	5
4. Miscellaneous Overburden Redistribution	5
5. Demolition	6
6. Removal of Monitoring Structures and Other Miscellaneous Items	6
7. Scarification or Ripping of All Compacted Surfaces	6
8. Topsoil Redistribution on All Disturbed Areas	7
9. Revegetation of All Disturbed Areas	7
10. Reclamation Status and Bond Liability Status of All Lands Within the Permit Area	7
a. Land Status Categories	7
b. Line Item Bond Costs	8
11. Coal Drilling	11
12. Miscellaneous Items	11
13. Unknown Costs	13
14. References	13
15. Maps	13
III. APPENDICES	13
Appendix A	14

Appendix B	17
Appendix C	20
Appendix D	23
Appendix E	25
Appendix F	27
Appendix G	29
Appendix H	30
Appendix I	31
Appendix I1	32
Appendix J	33
Appendix K	34
Appendix L	35
Appendix M	36
Appendix N	37
Appendix O	37
Appendix P	38
Appendix Q	39

INTRODUCTION

This document is a Guideline only. Its contents are not to be interpreted by the applicant/permittee or Wyoming Department of Environmental Quality (WDEQ) staff as mandatory. This Guideline intends to assist applicants/permittees in understanding and attaining the requirements of the Wyoming Environmental Quality Act (WEQA) and Land Quality Division (LQD) Rules and Regulations addressing bonding topics.

This Guideline was developed as a joint project of the Wyoming Mining Association (WMA) Reclamation Subcommittee and the LQD. The LQD has and intends to selectively and periodically publish updated versions of the Cost Calculation Methods as contained in the various Appendices.

APPLICABLE WEQA STATUTES AND LQD RULES AND REGULATIONS

This is a general summary of items from the WEQA.

W.S. §35-11-417:

Outlines some general provisions applying to initial bond and renewal bond values. This statute outlines the concept of Partial Bond Release.

W.S. §35-11-418:

Outlines acceptable bond vehicles.

W.S. §35-11-423:

Outlines procedures for bond release for coal and other mineral permittees.

W.S. §35-11-411(d):

Authorizes the WDEQ Director to establish the bond amount based upon information submitted in the annual report, an inspection and other materials.

These items in LQD Rules and Regulations have some applicability to bonding.

Coal Rules and Regulations, Chapter 1, Section 2.(k) and Noncoal Rules and Regulations, Chapter 1, Section 2.(i) defines bond.

Coal Rules and Regulations, Chapter 2, Section 3.(b)(xxi) requires that shared structures be cross-referenced in the bonds of applicable coal permittees.

Coal Rules and Regulations, Chapter 4, Section 2.(d)(ix) establishes a minimum ten (10) year bond period for coal permittees.

Coal Rules and Regulations, Chapter 11 and Noncoal Rules and Regulations, Chapter 6 outlines definitions and procedures for the self-bond program.

Coal Rules and Regulations, Chapter 12 applies exclusively to coal permittees. Section 2.(a) defines the Area and Incremental Bonds. Section 2.(b) elaborates further bond data requirements. Section 2.(d) explains the liability areas and periods for the Area and Incremental Bonds. Section 2.(e) distinguishes among and establishes procedures for bond adjustments versus bond reductions versus partial bond releases. Sections 2.(f) through (h) address requirements for specific bond vehicles.

Coal Rules and Regulations, Chapter 14, Section 4. and Noncoal Rules and Regulations, Chapter 8, Section 3. require a bond for exploration by drilling.

Coal Rules and Regulations, Chapter 15 outlines procedures for partial or complete release of coal permittee bonds.

Noncoal Rules and Regulations, Chapter 9, Section 2. discusses bond requirements for conversion of a non-coal Small Mine Permit to a Regular Mine Permit.

Coal Rules and Regulations, Chapter 20 and Noncoal Rules and Regulations, Chapter 12 details information on Letters of Credit used as a bond vehicle.

I. COST EXPLANATION FOR ITEMS USED IN STANDARDIZED RECLAMATION BOND COSTS

Equipment sizes (loaders, trucks, scrapers, motor graders, etc.) were selected and agreed upon by the WMA Committee and WDEQ/LQD based on the usual types of equipment contractors normally have available for use. Costs for other equipment may be calculated by using methodologies as shown in this package.

Owning and operating costs were determined, except where noted, by using the Dataquest Cost Reference Guide (DQCRG). The total owning and operating costs have been adjusted in this package to reflect wholesale prices rather than retail. To do this, a ten percent reduction has been made to DQCRG costs.

Costs for the electric shovel and the trucks associated with the shovel were determined from Western Mine Engineering, Inc. Surface Mine Estimator's Guide (2000 Version). There was no adjustment factor used for these costs since they are based on actual costs at mining operations in the United States.

A standard efficiency factor of 0.83 is incorporated into all production calculations. The factor accounts for a fifty-minute work hour as recommended by many cost references.

Labor costs were obtained from the Wyoming Department of Transportation, Wage Determination Decision (2000) with an additional 25 percent for benefits, unemployment insurance, social security, etc.

Supervision costs were determined by adding \$5.00 per hour to labor costs and also include the 25 percent add-on for benefits, etc. In most cases, only a portion of a supervisor's costs is applied to each task. Theoretically, this allows one supervisor the flexibility to oversee many jobs or pieces of equipment at the same time.

The supervisor's transportation is also divided among tasks. For example, where one-half of a supervisor's time is allotted, the same amount of time is used in calculating his transportation costs.

Where only a portion of support equipment are used in a calculation (i.e., one-half water truck), it is assumed that the equipment in question services more than one area.

Table D-1. Operating Costs and Adjusted Costs (\$/Hour w/o Operator) For Equipment in This Standardized Bond Format

Equipment Type	Equipment Name	DQCRG Book Cost (\$)	Multiplier (%)	Adj. Cost (\$)	Date
Dozer	Caterpillar D9R (SU)	125.27	90	112.74	1/2001
Blade	Caterpillar 16H	81.13	90	73.02	1/2001
Scraper	Caterpillar 657E P-P	263.36	90	237.02	1/2001
Truck (95 ton)	Caterpillar 777D	187.01	90	168.31	1/2001
Loader (13½ yd³)	Caterpillar 992G	236.24	90	212.62	1/2001
Loader (5¼ yd³)	Caterpillar 980G	76.12	90	68.51	1/2001
Dozer	Caterpillar D10R (SU)	166.67	90	150.00	1/2001
Dozer	Caterpillar D11R (U)	261.92	90	235.73	1/2001
Dozer	Caterpillar D9N (U)	112.65	90	101.39	1/2001
Backhoe Loader	Caterpillar 428B (4WD)	20.45	90	18.41	1/2001
Water Truck	14,000 Gallon	144.74	90	130.27	1/2001
Dump Truck	10-12 yd³	32.02	90	28.82	1/2001
Pickup Truck	Crew 4x4 3/4T (Gas)	10.64	90	9.58	1/2001
Pickup Truck	Crew 4x4 3/4T (Diesel)	8.99	90	8.09	1/2001
Tractor	MF 50EX 4WD 74 H.P.	10.68	90	9.61	1/2001
Towed Mower	Flail 7 ft	1.73	90	1.56	1/2001
Rubber Tired Dozer	Caterpillar 834B	109.45	90	98.51	1/2001
Scraper	Caterpillar 637E P-P	203.67	90	183.30	1/2001

Table D-1a. Purchase Price, Lease Cost, and Operating Costs for 56 CY Electric Shovel and 793C Trucks

Operators that use the truck/shovel appendix must show a regrading plan that is suitable for a large shovel/truck operation. Many backfill operations are not suited for this type operation because the cuts are not thick enough to allow the shovel optimum digging depths, highwall reduction with dozers takes up a large percentage of the required backfill, and there is insufficient backfill to justify this large shovel/truck fleet.

Operators using the shovel/truck appendix should submit suitable cut and fill isopachs that support the choice of this backfill method.

This method is not to be used for topsoil movement from native areas or from stockpiles.

The \$7,988,916.00 purchase price of the 56 CY shovel must be added to the bond costs. There is no profit or other contingency items added to this cost so it can be added to the bond cost after all the line items and add-ons have been totaled. No salvage value is allowed at the end of the project.

56 CY Electric Shovel

Purchase Price

\$8,600,000.00 (WME)

Productivity - 56 CY x 1 pass/35 sec. x 3,600 sec./hr. x 0.968 bucket fill factor = 5,576 CY/hr.
 5,576 CY/hr. x 0.8696 BCY/LCY (15% swell of BCY) = 4,849 BCY/hr.
 4,849 BCY/hr. x 0.8333 (operating efficiency) = 4,040 BCY/hr.

Hourly Costs (WME)

<u>Overhaul</u> <u>Parts</u>	<u>Overhaul</u> <u>Labor</u>	<u>Maint.</u> <u>Parts</u>	<u>Maint.</u> <u>Labor</u>	<u>Power</u>	<u>Lube</u>	<u>Wear</u> <u>Parts</u>	<u>Total</u>
\$24.09	\$20.56	\$36.13	\$30.85	\$59.27	\$24.57	\$14.50	\$209.97

Caterpillar 793C Trucks (240 Ton)

Purchase Price

\$2,384,341.00 (WME)

Monthly Lease (@600 hr./month)

\$50,000.00

Hourly Lease Cost

\$83.33

Hourly Costs (WME)

<u>Overhaul</u> <u>Parts</u>	<u>Overhaul</u> <u>Labor</u>	<u>Maint.</u> <u>Parts</u>	<u>Maint.</u> <u>Labor</u>	<u>Fuel</u>	<u>Lube</u>	<u>Tires</u>	<u>Total</u>
\$7.57	\$5.54	\$14.06	\$10.29	\$38.85	\$15.76	\$53.80	\$145.86

Table D-2. Abbreviations Used in This Standardized Bond Format

CPH -	Caterpillar Performance Handbook (Edition No. specified where appropriate)
DQCRG -	Dataquest Cost Reference Guide (date of data indicated)
WYDOT-WDD -	Wyoming Department of Transportation - Wage Determination Decision (1997 Version)
WME -	Western Mine Engineering, Inc. (Oct. 1997 Estimating Guide)
BCY -	Bank Cubic Yard
LCY -	Loose Cubic Yard
MPH -	Miles Per Hour
BHB -	Black Hills Bentonite Corporation
AML -	DEQ Abandoned Mine Land Reclamation Program

II. STANDARDIZED RECLAMATION BOND FORMAT

Individual items may be expanded as necessary or noted as not applicable based upon the specific reclamation practices approved in each permit.

A. Area Bond

The Area Bond covers the costs of backfilling and rough grading (and special reconstruction techniques when specifically approved) according to procedures and postmining topography approved in the current term permit.

1. Introduction

Present a general discussion of assumptions, calculations, procedures, methods, etc. for summarizing or documenting calculations.

2. Backfill

Describe equipment, procedures, volumes, and costs for bringing all pits to an interim/bond topography with reference to a quality, current map of the project site. The interim/bond topography must come as close as possible to the approved final topography, acknowledging that the current mine site differs from the final configuration.

Appendices A through F detail equipment fleets and costs for this reclamation activity.

Operators should clearly show cut and fill areas and the associated haul distances and grades on a map.

This section should clearly list overburden Drilling and Blasting cost at \$0.10/BCY when applicable.

3. Rough Grade Backfill

Describe procedures and costs for shaping interim/bond topography with reference to a quality map. NOTE: Depending upon permit approved backfill practices, rough grading may not be a necessary line item bond cost.

Appendices G and M detail equipment and costs for this reclamation activity.

4. Final Grade Backfill

Describe equipment, procedures, and costs for specific site tasks (e.g., drainage reconstruction or permit-specific postmining features).

Appendix G details equipment and costs for this reclamation activity.

B. Incremental Bond

1. Introduction

The Incremental Bond covers all other costs beyond those detailed in the Area Bond.

Present a general discussion of assumptions, calculation procedures, methods for summarizing or documenting calculations, etc.

2. Native Topsoil Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, volumes, haul routes, and costs with reference to a quality, current map of the project site.

Appendices A, B, C, E, F and G detail potential equipment and costs for this reclamation activity.

3. Native Overburden Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, haul routes, volumes, and costs with reference to a quality, current map of the project site.

Appendices A through G detail potential equipment and costs for this reclamation activity.

4. Miscellaneous Overburden Redistribution

Describe equipment, haul routes, volumes, and costs (with reference to a quality map) for backfilling structures, such as:

- scoria or shale pit(s)
- diversion ditches
- access/haul road cut or fill
- railroad cuts/embankments
- sediment ponds
- sewage lagoons
- culverts
- other

Appendices A through G (excluding D) detail potential equipment and costs for this reclamation activity.

5. Demolition

Equipment, procedures, and costs for demolition and disposal of each individual structure should be described in terms of size, type of construction, etc. so that appropriate demolition costs can be estimated, such as:

- fences
- power lines, transformers
- hard-surfaced roads
- bridges
- abandoned equipment (i.e., draglines, shovels, drills and pieces of same)
- culverts
- railroads (rails, ties, ballast, scales, etc.)
- facility buildings (shops, warehouse, offices, etc.)
- mineral handling facilities (truck dumps, conveyors, silos, scales, etc.)
- support facilities (ready line, fuel tanks, water tanks, equipment yards, explosive storage sites, electrical substations)

Appendices H through K contain costs for these reclamation and demolition practices.

6. Removal of Monitoring Structures and Other Miscellaneous Items

Describe the procedures, equipment, and costs required to properly abandon or remove and disposal of items, such as:

- groundwater monitor wells
- all other operator-owned wells within the permit area
- surface water monitoring stations
- all other experimental study sites within the permit area
- meteorological/air quality monitoring sites

Appendices L through O detail equipment and costs for these reclamation practices.

7. Scarification or Ripping of All Compacted Surfaces

Describe equipment, procedures, and costs (preferably on a per acre basis) with reference to a quality, current map of the project site.

Appendices I1 and P detail costs for this reclamation practice.

8. Topsoil Redistribution on All Disturbed Areas

Describe equipment, procedures, and costs with reference to a quality, current map of the project site. The map should show haul distances and grades.

Appendices B and C detail equipment and costs for this reclamation activity.

9. Revegetation of All Disturbed Areas

Describe equipment, practices, and costs (preferably on a per acre basis), including:

- seedbed preparation
- mulch (purchase and application)
- seed (purchase and application)
- fertilizer (if required, purchase and application)
- post-seeding maintenance over the minimum bonding period (e.g., weed control, mowing, interseeding). Operators suggest that a ten percent line item should cover this issue for the entire bonding period.

Appendix Q outlines a cost calculation process for this reclamation activity. The costs must be calculated using the specific seed mixes and practices from the approved term permit.

10. Reclamation Status and Bond Liability Status of All Lands Within the Permit Area

a. Land Status Categories

The bond calculation should describe the status of all lands within the permit area. Each land status category should be clearly identified on a quality map and cross-referenced to specific reclamation cost for each category. The LQD also prefers a tabular summary of the acreage for each category.

LANDS THAT HAVE BEEN TOPSOILED AND SEEDED BUT HAVE NO BOND RELEASE MUST BE BONDED FOR RETOPSOILING, SCARIFICATION, AND REVEGETATION. [see Section 10.b.(2)(b)i)e) on page 10]

The following is a summary of generic land status categories. Section 10.(2) below details the information and calculations necessary for each of these categories.

- (1) Native lands undisturbed at the time of this specific bond calculation and which will remain undisturbed under this bond calculation (e.g., no borrow areas necessary).

(2) Lands disturbed and requiring backfilling, regrading and revegetation at the time of this specific bond calculation.

(a) Lands requiring assessment of Area Bond costs

(b) Lands requiring assessment of full or Incremental Bond costs

(c) Lands requiring assessment of partial Incremental Bond costs

i) Lands permanently reclaimed prior to December 31, 1982

ii) Lands permanently reclaimed after December 31, 1982

a) Lands with no approved Partial or Full Bond Release

b) Lands with approved 60 percent Partial Release of the Incremental Bond

c) Lands with approved larger percent Partial Release of the Incremental Bond

d) Lands with approved Full Release of Area and Incremental Bonds

b. Line Item Bond Costs

(1) The bond covers lands currently disturbed by mining and associated activities and those lands to be disturbed in the next 12-month period.

(2) The bond should include costs for the Area Bond (through backfill, rough and final grading) for all open pits, impoundments, sediment ponds, diversions, etc.

(a) Section E.1 of this Guideline and its associated appendices detail procedures and costs for the Area Bond. The bond calculation should detail costs for the operations listed in Sections E.1.B.), C) and D).

(b) Section E.2 of this Guideline and its associated appendices detail general categories and procedures for the Incremental Bond. Overall, the bond calculation should detail costs for the operations listed in Sections E.2.B) through I).

i) The bond calculation should assess the full suite of Incremental Bond tasks and costs for all disturbed lands which have not formally approved partial or full release of the Incremental Bond.

Historic LQD Administrator policy, LQD Coal Rules and Regulations Chapter 15 and W.S. §35-11-417(e) establish three (3) distinct categories of Partial Bond Release for permanently reclaimed lands.

a) Lands Permanently Reclaimed Prior to December 31, 1982

Prior to this date and prior to approval of the Wyoming State Coal Program, the LQD Administrator granted de facto Partial Bond Release for permanently reclaimed lands.

The LQD did not specifically approve or otherwise record this Partial Bond Release category, so there is generally no written approval letter.

The bond should specifically identify this Partial Bond Release category if it exists.

The bond should include a carry-over cost assessment for interseeding an appropriate, permit-approved seed mixture on these lands. These carry-over costs should include seed purchase and seed implantation.

b) 60 Percent Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5.(a)(i) allows for release of 60 percent of the Incremental Bond when the permittee has completed backfilling, regrading, topsoil replacement, and drainage control according to the approved term permit procedures.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific permit, the bond calculation should include the date of the Director's approval letter.

The bond calculation should specifically identify this category and show the appropriate units on a quality map.

The bond calculation should specifically tabulate the residual 40 percent Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As noted above, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the 40 percent Incremental Bond carry-over costs should detail all approved reclamation practices.

c) Larger Percentage of Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5.(a)(ii)(A) allows more than 60 percent release of the Incremental Bond as determined by the LQD Administrator and DEQ Director.

W.S. §35-11-423(d) mandates development of specific rules and regulations for release of coal bonds. These rules are controlling notwithstanding other provisions of W.S. §35-11-417 and §35-11-423 to the contrary.

LQD Coal Rules and Regulations, Chapter 15 is that formulation.

Coal Chapter 15 governs partial and 100 percent release of the Incremental Bond. For partial release, the amount remaining cannot be less than the cost of reseedling.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific permit, the bond calculation should identify the date of the Director's approval letter.

The bond calculation should specifically tabulate the residual percentage Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As previously noted, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the percentage Incremental Bond carry-over costs should detail all approved reclamation practices.

NOTE: The percentages of partial release of the Incremental Bond vary for Noncoal Permittees. A Noncoal Permittee seeking partial release should consult with the LQD.

d) Full Bond Release of the Area and Incremental Bonds

This category includes all land permanently reclaimed and formally released under provisions of the 1973 Environmental Quality Act and LQD Coal Rules and Regulations Chapter 15.

Full Bond Release requires formal, written approval by the DEQ Director. If this category exists for your specific permit, the bond calculation should list the date of the DEQ Director's Full Bond Release decision.

e) Lands Permanently Reclaimed After December 31, 1982

This category includes all land permanently reclaimed that has no bond release.

These reclaimed lands must be bonded to scarify, retopsoil, and reseed. There are no provisions made for where the topsoil would come from. It is assumed that topsoil would be spread at the same average depth on these lands as it is on the rest of the areas requiring topsoil. Topsoil haul distance and grade used would be the weighted average used for the rest of the reclamation. Scarification and reseedling costs would be the same per acre as those used on other lands requiring reclamation.

NOTE: The DEQ/LQD continues development of a DRAFT Guideline on Full and Partial Bond Release Procedures. Please consult with the LQD concerning the status of that Guideline, should you consider bond release for permanently reclaimed lands.

11. Coal Drilling

Describe the approximate number, depth, diameter, and location (show on inclusive map, if possible) of all holes drilled into or through coal during the current and next annual report period. A tabular format with reference to map locations may be an efficient presentation. This description should distinguish between coal drill holes which will be or have been removed by the pit advance within the annual report period versus those coal drill holes which will not be mined out in a report cycle. The operator may distinguish between abandonment/plugging procedures for the coal drill holes mined out in the report cycle versus the longer term abandoned holes. Each category should have a total line item cost entry in the bond. The LQD prefers that all coal drill hole reclamation costs be estimated according to Appendices L and M.

12. Miscellaneous Items

Each individual operator should identify these items as a line item or include each in some specific bond category. Otherwise, the LQD will enter the item as an addition to total dollar value of the Area and Incremental Bonds.

- a. **COSTS FOR AN INDEPENDENT FIRM TO DESIGN THE FINAL RECLAMATION PROJECT:** All design and engineering work (including field and office time) through production of construction documents should be included under this heading. At the least, some surveying and redesign of the operator's reclamation plan to fit the current situation would be required. Reference sources place this category at 2 to 6½ percent of the total bond cost. LQD typically uses 3 percent.
- b. **CONTRACTOR PROFIT, OVERHEAD, MOBILIZATION AND DEMOBILIZATION COSTS:** The Dataquest Cost Reference Guides used to construct the appendices do not include these costs. If an operator uses these appendices in bond calculations, there is still a need for this distinct line item cost in the bond. Assorted references place these items from 8 to 15 percent of the total bond cost. Presently LQD is using 10 percent.
- c. **PRECONSTRUCTION INVESTIGATION AND STABILIZATION:** This item addresses all field work necessary to document and mitigate dangerous and/or quickly deteriorating conditions, such as slumping highwalls or drainage problems. Any assessment under this item will be based upon the LQD's knowledge of specific site conditions and the length of time between cessation/forfeiture and initiation of the final reclamation project. When necessary, reference sources place this cost at 1 to 2 percent. LQD is using 1 percent.

- d. **COSTS FOR AN INDEPENDENT FIRM TO MANAGE THE FINAL RECLAMATION PROJECT:** This category includes complete oversight of all demolition, construction, and reclamation activities. Probable tasks would include supervision of earthmoving and reclamation, construction surveying, and soil sampling. References place this cost at 3 to 4 percent. LQD uses 3 percent.
- e. **COSTS FOR ON SITE MONITORING PROGRAMS FOR TEN YEARS AFTER COMPLETION OF THE FINAL RECLAMATION PROJECT (INCLUDES SUCH ITEMS AS UTILITIES AND GROUNDWATER SAMPLING):** Costs of this item will vary depending upon specific permit commitments. The LQD uses a range of 1/2 to 2 percent. Usually LQD uses 0.5 percent.
- f. **COSTS FOR SITE SECURITY DURING THE FINAL RECLAMATION PROJECT AND LIABILITY INSURANCE COST DURING THE FINAL RECLAMATION PROJECT AND OVER THE FULL BONDING PERIOD:** References place this cost at about 1 percent of the total bond amount.
- g. **LONG-TERM ADMINISTRATION AND ACCOUNTING COSTS:** After completion of a major reclamation project, a minimum of five years (non-coal permits) or a minimum of ten years (coal permits) will expire before the LQD can move for final bond release. The LQD will incur additional administrative costs during this extended period. The scale of some coal reclamation projects may necessitate employment of an outside contractor.
The LQD uses a range of 1 to 2 percent for this category depending upon the scale and complexity of the reclamation and post-reclamation monitoring projects. Currently LQD uses 2 percent.
- h. **ANY OTHER SITE-SPECIFIC PERMIT COMMITMENTS SHOULD ALSO BE INCLUDED HERE:** Costs will vary according to specific permit commitments.

The LQD has historically used the following sources to establish the range of percentages list in the Miscellaneous Items.

- * Means Heavy Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Means Site Work Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Building Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Handbook for Calculation of Reclamation Bond Costs, 1987, Department of Interior, Office of Surface Mining Reclamation and Enforcement, Washington, D.C.

- * Wyoming DEQ Abandoned Mine Land Program contracting and reclamation practices and cumulative experience

13. Unknown Costs

The items under L) represent the usual contingency items applied to bonds. If these items are included as line items in the bond, the only remaining category could be unknown as per W.S. §35-11-417(c)(ii). References place this cost at 2 to 5 percent of the total bond cost. Under normal circumstances LQD is using 4 percent.

14. References

List sources of information, procedures, costs, etc. which were used in the bond calculations.

15. Maps

This Guideline requests that the various tasks, operations, disturbed areas, reclamation areas, etc., be illustrated on or referenced to a **QUALITY, CURRENT MAP**. Several of the tasks may be illustrated on the same map. All maps presented in support of the bond calculations must be clear and legible contour maps or recent (with date) aerial photographs. The preferred scale is 1"=500', unless it is necessary to directly compare (e.g., overlay) a bond map to an existing permit map. In this case the scales should be identical. Each map should be of a reasonable size, generally no larger than 48" on a side.

Each map must have a complete title block, including:

- Map title
- Name and address of permittee
- Permit number and term designation
- Annual report period
- Scale, north arrow, contour interval, date of photography or date of preparation

All maps must show and clearly label:

- Legal subdivisions with section, township, and range lines
- Permit area boundary and term boundary

III. APPENDICES

The following appendices are intended for use in this standardized bond calculation package. Any references to specific equipment should not be interpreted as a recommendation of any kind by any person, company or agency for the use of specific brand-name equipment.

Appendix A
Calculations for Moving Materials With a Caterpillar 992G Loader and Caterpillar 777D Truck Fleet

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.10/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Loader-Truck Combination

1) Caterpillar 992G Loader	13.2 BCY	CPH 30
2) Caterpillar 777D Trucks (85 ton)	66.0 BCY	CPH 30
3) Material Density	2,850.0 LB/BCY	CPH 30
4) Operating Efficiency Factor (50 Min/Hr)	0.83 %	CPH 30
5) Rolling Resistance Factor	4.00 %	CPH 30
6) 777D Truck Operating Costs	\$168.31 Per Hour	90% of DataQuest Cost Reference Guide
7) 992G Loader Operating Costs	\$212.62 Per Hour	90% DQCRG
8) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
9) 1/2 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$77.33 Per Hour	1/2 of 90% DQCRG
10) 1 - 16H Blade for Road Work + 1 Operator	\$97.40 Per Hour	90% DQCRG + Operator
11) 1 - D9R for Misc. Work + 1 Operator	\$137.12 Per Hour	90% DQCRG + Operator
12) Supervision Labor Costs	\$14.69 Per Hour	1/2 of WYDOT-WDD
13) Supervisor Transportation	\$4.79 Per Hour	1/2 of 90% DQCRG
14) Total Fleet Hourly Costs (Except Trucks)	\$568.33	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground			Loaded (0% grade + 4% rolling = 4% total resistance)					Empty (0% grade + 4% total resistance)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.47	1.10	0.36	6.13	9.8	66	539	942	1.75	\$0.96
1000	3.50	0.70	0.78	1.10	0.56	6.64	9.0	66	495	942	1.90	\$0.99
1500	3.50	0.70	1.06	1.10	0.74	7.10	8.5	66	467	942	2.02	\$1.02
2000	3.50	0.70	1.34	1.10	0.90	7.54	8.0	66	440	942	2.15	\$1.04
2500	3.50	0.70	1.60	1.10	1.06	7.96	7.5	66	412	942	2.29	\$1.07
3000	3.50	0.70	1.86	1.10	1.22	8.38	7.2	66	396	942	2.38	\$1.09
3500	3.50	0.70	2.11	1.10	1.39	8.80	6.8	66	374	942	2.52	\$1.12
4000	3.50	0.70	2.37	1.10	1.55	9.22	6.5	66	357	942	2.64	\$1.14
4500	3.50	0.70	2.63	1.10	1.71	9.64	6.2	66	341	942	2.77	\$1.17
5000	3.50	0.70	2.89	1.10	1.88	10.07	6.0	66	330	942	2.86	\$1.19
5500	3.50	0.70	3.15	1.10	2.04	10.49	5.7	66	313	942	3.00	\$1.22
6000	3.50	0.70	3.41	1.10	2.21	10.92	5.5	66	302	942	3.12	\$1.24
6500	3.50	0.70	3.66	1.10	2.37	11.33	5.3	66	291	942	3.24	\$1.27
7000	3.50	0.70	3.92	1.10	2.53	11.75	5.1	66	280	942	3.36	\$1.29

Operating Costs = ((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Loader Productivity)

Appendix A (Continued)
Calculations for Moving Materials With a Caterpillar 992G Loader and Caterpillar 777D Truck Fleet

Material Movement By Loader-Truck Combination

Case #2: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total)					Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.38	1.10	0.41	6.09	9.9	66	544	942	1.73	\$0.96
1000	3.50	0.70	0.58	1.10	0.68	6.56	9.1	66	500	942	1.88	\$0.99
1500	3.50	0.70	0.74	1.10	0.94	6.98	8.6	66	473	942	1.99	\$1.01
2000	3.50	0.70	0.89	1.10	1.18	7.37	8.1	66	445	942	2.12	\$1.03
2500	3.50	0.70	1.05	1.10	1.43	7.78	7.7	66	423	942	2.23	\$1.06
3000	3.50	0.70	1.20	1.10	1.68	8.18	7.3	66	401	942	2.35	\$1.08
3500	3.50	0.70	1.35	1.10	1.92	8.57	7.0	66	385	942	2.45	\$1.10
4000	3.50	0.70	1.50	1.10	2.17	8.97	6.7	66	368	942	2.56	\$1.13
4500	3.50	0.70	1.66	1.10	2.42	9.38	6.4	66	352	942	2.68	\$1.15
5000	3.50	0.70	1.81	1.10	2.66	9.77	6.1	66	335	942	2.81	\$1.17
5500	3.50	0.70	1.96	1.10	2.91	10.17	5.9	66	324	942	2.91	\$1.20
6000	3.50	0.70	2.11	1.10	3.16	10.57	5.7	66	313	942	3.01	\$1.22
6500	3.50	0.70	2.27	1.10	3.40	10.97	5.5	66	302	942	3.12	\$1.24
7000	3.50	0.70	2.42	1.10	3.65	11.37	5.3	66	291	942	3.24	\$1.27

Case #3: 10% Assisting Grade			Loaded (-10% grade + 4% rolling = -6% total)					Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.35	1.10	0.49	6.14	9.8	66	539	942	1.75	\$0.96
1000	3.50	0.70	0.52	1.10	0.90	6.72	8.9	66	489	942	1.93	\$1.00
1500	3.50	0.70	0.67	1.10	1.31	7.28	8.2	66	451	942	2.09	\$1.03
2000	3.50	0.70	0.82	1.10	1.72	7.84	7.7	66	423	942	2.23	\$1.06
2500	3.50	0.70	0.97	1.10	2.13	8.40	7.1	66	390	942	2.42	\$1.10
3000	3.50	0.70	1.13	1.10	2.54	8.97	6.7	66	368	942	2.56	\$1.13
3500	3.50	0.70	1.28	1.10	2.94	9.52	6.3	66	346	942	2.72	\$1.16
4000	3.50	0.70	1.43	1.10	3.35	10.08	6.0	66	330	942	2.85	\$1.19
4500	3.50	0.70	1.59	1.10	3.76	10.65	5.6	66	308	942	3.06	\$1.23
5000	3.50	0.70	1.74	1.10	4.17	11.21	5.4	66	297	942	3.17	\$1.25
5500	3.50	0.70	1.89	1.10	4.58	11.77	5.1	66	280	942	3.36	\$1.29
6000	3.50	0.70	2.04	1.10	4.99	12.33	4.9	66	269	942	3.50	\$1.32
6500	3.50	0.70	2.20	1.10	5.40	12.90	4.7	66	258	942	3.65	\$1.35
7000	3.50	0.70	2.35	1.10	5.80	13.45	4.5	66	247	942	3.81	\$1.38

Appendix A (Continued)
Calculations for Moving Materials With a Caterpillar 992G Loader and Caterpillar 777D Truck Fleet

Material Movement by Loader-Truck Combination

Case #4: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.66	1.10	0.33	6.29	9.5	66	522	942	1.80	\$0.97
1000	3.50	0.70	1.23	1.10	0.50	7.03	8.5	66	467	942	2.02	\$1.02
1500	3.50	0.70	1.81	1.10	0.65	7.76	7.7	66	423	942	2.23	\$1.06
2000	3.50	0.70	2.38	1.10	0.81	8.49	7.1	66	390	942	2.42	\$1.10
2500	3.50	0.70	2.95	1.10	0.96	9.21	6.5	66	357	942	2.64	\$1.14
3000	3.50	0.70	3.53	1.10	1.11	9.94	6.0	66	330	942	2.85	\$1.19
3500	3.50	0.70	4.10	1.10	1.26	10.66	5.6	66	308	942	3.06	\$1.23
4000	3.50	0.70	4.68	1.10	1.42	11.40	5.3	66	291	942	3.24	\$1.27
4500	3.50	0.70	5.25	1.10	1.57	12.12	5.0	66	275	942	3.43	\$1.30
5000	3.50	0.70	5.82	1.10	1.72	12.84	4.7	66	258	942	3.65	\$1.35
5500	3.50	0.70	6.40	1.10	1.87	13.57	4.4	66	242	942	3.89	\$1.40
6000	3.50	0.70	6.97	1.10	2.03	14.30	4.2	66	231	942	4.08	\$1.44
6500	3.50	0.70	7.54	1.10	2.18	15.02	4.0	66	220	942	4.28	\$1.48
7000	3.50	0.70	8.12	1.10	2.33	15.75	3.8	66	209	942	4.51	\$1.53

Case #5: 10% Resisting Grade			Loaded (10% grade + 4% rolling = 14% total)					Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.94	1.10	0.33	6.57	9.1	66	500	942	1.88	\$0.99
1000	3.50	0.70	1.83	1.10	0.49	7.62	7.9	66	434	942	2.17	\$1.05
1500	3.50	0.70	2.72	1.10	0.64	8.66	6.9	66	379	942	2.49	\$1.11
2000	3.50	0.70	3.60	1.10	0.79	9.69	6.2	66	341	942	2.76	\$1.17
2500	3.50	0.70	4.49	1.10	0.94	10.73	5.6	66	308	942	3.06	\$1.23
3000	3.50	0.70	5.38	1.10	1.10	11.78	5.1	66	280	942	3.36	\$1.29
3500	3.50	0.70	6.26	1.10	1.25	12.81	4.7	66	258	942	3.65	\$1.35
4000	3.50	0.70	7.15	1.10	1.40	13.85	4.3	66	236	942	3.99	\$1.42
4500	3.50	0.70	8.04	1.10	1.55	14.89	4.0	66	220	942	4.28	\$1.48
5000	3.50	0.70	8.94	1.10	1.71	15.94	3.8	66	209	942	4.51	\$1.53
5500	3.50	0.70	9.81	1.10	1.86	16.97	3.5	66	192	942	4.91	\$1.61
6000	3.50	0.70	10.70	1.10	2.01	18.01	3.3	66	181	942	5.20	\$1.67
6500	3.50	0.70	11.59	1.10	2.16	19.05	3.1	66	170	942	5.54	\$1.74
7000	3.50	0.70	12.48	1.10	2.32	20.10	3.0	66	165	942	5.71	\$1.77

Appendix B
Calculations for Moving Materials With a Caterpillar 657E Push-Pull Scraper Fleet

NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX C.

Material Movement By Scrapers

1) Caterpillar 657E Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 30
3) Payload	104,000. LB	CPH 30
	35.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 30
5) Operating Efficiency Factor (50 Min./Hr.)	0.83 %	CPH 30
6) 657E PP Operating Costs	\$237.02 Per Hour	90% DQCRG
7) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$3.68 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% DQCRG
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$19.33 Per Hour	1/8 of 90% DQCRG
11) 1/8 of 1 - 16H Blade for Road Work + 1 Operator	\$12.18 Per Hour	1/8 of 90% DQCRG
12) 1/2 - D9R for Ripping Ovb. and Misc. Work + 1 Operator	\$68.56 Per Hour	1/2 of 90% DQCRG
13) Total Hourly Costs	\$366.40	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total)					Empty (0% grade + 4% rolling = 4% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.42	0.60	0.36	2.48	24.2	35.0	0.83	706	\$0.52
1000	1.10	0.68	0.60	0.57	2.95	20.3	35.0	0.83	593	\$0.62
1500	1.10	0.92	0.60	0.75	3.37	17.8	35.0	0.83	519	\$0.71
2000	1.10	1.15	0.60	0.92	3.77	15.9	35.0	0.83	464	\$0.79
2500	1.10	1.37	0.60	1.09	4.16	14.4	35.0	0.83	421	\$0.87
3000	1.10	1.59	0.60	1.26	4.55	13.2	35.0	0.83	385	\$0.95
3500	1.10	1.81	0.60	1.44	4.95	12.1	35.0	0.83	354	\$1.04
4000	1.10	2.02	0.60	1.61	5.33	11.3	35.0	0.83	328	\$1.12
4500	1.10	2.22	0.60	1.78	5.70	10.5	35.0	0.83	307	\$1.19
5000	1.10	2.43	0.60	1.95	6.08	9.9	35.0	0.83	288	\$1.27
5500	1.10	2.64	0.60	2.13	6.47	9.3	35.0	0.83	270	\$1.36
6000	1.10	2.85	0.60	2.30	6.85	8.8	35.0	0.83	255	\$1.44
6500	1.10	3.05	0.60	2.47	7.22	8.3	35.0	0.83	242	\$1.51
7000	1.10	3.26	0.60	2.64	7.60	7.9	35.0	0.83	230	\$1.59

Appendix B (Continued)
Calculations for Moving Materials With a Caterpillar 657E Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade		Loaded (-5% grade + 4% rolling = -1% total)				Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.36	0.60	0.42	2.48	24.2	35.0	0.83	706	\$0.52
1000	1.10	0.54	0.60	0.71	2.95	20.3	35.0	0.83	593	\$0.62
1500	1.10	0.71	0.60	0.98	3.39	17.7	35.0	0.83	516	\$0.71
2000	1.10	0.87	0.60	1.25	3.82	15.7	35.0	0.83	458	\$0.80
2500	1.10	1.03	0.60	1.51	4.24	14.2	35.0	0.83	413	\$0.89
3000	1.10	1.19	0.60	1.78	4.67	12.8	35.0	0.83	375	\$0.98
3500	1.10	1.36	0.60	2.05	5.11	11.7	35.0	0.83	342	\$1.07
4000	1.10	1.52	0.60	2.32	5.54	10.8	35.0	0.83	316	\$1.16
4500	1.10	1.68	0.60	2.59	5.97	10.1	35.0	0.83	293	\$1.25
5000	1.10	1.85	0.60	2.86	6.41	9.4	35.0	0.83	273	\$1.34
5500	1.10	2.01	0.60	3.12	6.83	8.8	35.0	0.83	256	\$1.43
6000	1.10	2.17	0.60	3.39	7.26	8.3	35.0	0.83	241	\$1.52
6500	1.10	2.33	0.60	3.66	7.69	7.8	35.0	0.83	228	\$1.61
7000	1.10	2.50	0.60	3.93	8.13	7.4	35.0	0.83	215	\$1.70

Case #3: 10% Assisting Grade		Loaded (-10% grade + 4% rolling = -6% total)				Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.34	0.60	0.51	2.55	23.5	35.0	0.83	686	\$0.54
1000	1.10	0.51	0.60	0.96	3.17	18.9	35.0	0.83	552	\$0.66
1500	1.10	0.67	0.60	1.41	3.78	15.9	35.0	0.83	463	\$0.79
2000	1.10	0.83	0.60	1.85	4.38	13.7	35.0	0.83	400	\$0.92
2500	1.10	0.99	0.60	2.30	4.99	12.0	35.0	0.83	351	\$1.04
3000	1.10	1.16	0.60	2.74	5.60	10.7	35.0	0.83	313	\$1.17
3500	1.10	1.32	0.60	3.19	6.21	9.7	35.0	0.83	282	\$1.30
4000	1.10	1.48	0.60	3.63	6.81	8.8	35.0	0.83	257	\$1.43
4500	1.10	1.64	0.60	4.08	7.42	8.1	35.0	0.83	236	\$1.55
5000	1.10	1.81	0.60	4.52	8.03	7.5	35.0	0.83	218	\$1.68
5500	1.10	1.97	0.60	4.97	8.64	6.9	35.0	0.83	203	\$1.80
6000	1.10	2.13	0.60	5.41	9.24	6.5	35.0	0.83	189	\$1.94
6500	1.10	2.30	0.60	5.86	9.86	6.1	35.0	0.83	177	\$2.07
7000	1.10	2.46	0.60	6.30	10.46	5.7	35.0	0.83	167	\$2.19

Appendix B (Continued)
Calculations for Moving Materials With a Caterpillar 657E Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #4: 5% Resisting Grade										
Loaded (5% grade + 4% rolling = 9% total)						Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.55	0.60	0.33	2.58	23.3	35.0	0.83	678	\$0.54
1000	1.10	1.01	0.60	0.50	3.21	18.7	35.0	0.83	545	\$0.67
1500	1.10	1.46	0.60	0.66	3.82	15.7	35.0	0.83	458	\$0.80
2000	1.10	1.92	0.60	0.83	4.45	13.5	35.0	0.83	393	\$0.93
2500	1.10	2.38	0.60	0.99	5.07	11.8	35.0	0.83	345	\$1.06
3000	1.10	2.83	0.60	1.15	5.68	10.6	35.0	0.83	308	\$1.19
3500	1.10	3.29	0.60	1.31	6.30	9.5	35.0	0.83	278	\$1.32
4000	1.10	3.75	0.60	1.48	6.93	8.7	35.0	0.83	253	\$1.45
4500	1.10	4.21	0.60	1.64	7.55	7.9	35.0	0.83	232	\$1.58
5000	1.10	4.66	0.60	1.80	8.16	7.4	35.0	0.83	214	\$1.71
5500	1.10	5.12	0.60	1.96	8.78	6.8	35.0	0.83	199	\$1.84
6000	1.10	5.58	0.60	2.13	9.41	6.4	35.0	0.83	186	\$1.97
6500	1.10	6.04	0.60	2.29	10.03	6.0	35.0	0.83	174	\$2.11
7000	1.10	6.49	0.60	2.45	10.64	5.6	35.0	0.83	164	\$2.23

Case #5: 10% Resisting Grade										
Loaded (10% grade + 4% rolling = 14% total)						Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.75	0.60	0.32	2.77	21.7	35.0	0.83	632	\$0.58
1000	1.10	1.43	0.60	0.49	3.62	16.6	35.0	0.83	483	\$0.76
1500	1.10	2.12	0.60	0.65	4.47	13.4	35.0	0.83	391	\$0.94
2000	1.10	2.81	0.60	0.81	5.32	11.3	35.0	0.83	329	\$1.11
2500	1.10	3.49	0.60	0.98	6.17	9.7	35.0	0.83	284	\$1.29
3000	1.10	4.18	0.60	1.14	7.02	8.5	35.0	0.83	249	\$1.47
3500	1.10	4.87	0.60	1.30	7.87	7.6	35.0	0.83	222	\$1.65
4000	1.10	5.56	0.60	1.46	8.72	6.9	35.0	0.83	201	\$1.82
4500	1.10	6.24	0.60	1.63	9.57	6.3	35.0	0.83	183	\$2.00
5000	1.10	6.93	0.60	1.79	10.42	5.8	35.0	0.83	168	\$2.18
5500	1.10	7.62	0.60	1.95	11.27	5.3	35.0	0.83	155	\$2.36
6000	1.10	8.31	0.60	2.12	12.13	4.9	35.0	0.83	144	\$2.54
6500	1.10	8.99	0.60	2.28	12.97	4.6	35.0	0.83	135	\$2.71
7000	1.10	9.68	0.60	2.44	13.82	4.3	35.0	0.83	127	\$2.89

Appendix C
Calculations for Moving Materials With a Caterpillar 637E Push-Pull Scraper Fleet

NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX C.

Material Movement By Scrapers

1) Caterpillar 637E Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 30
3) Payload	75,000. LB	CPH 30
	25.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 30
5) Operating Efficiency Factor (50 Min./Hr.)	0.83 %	CPH 30
6) 637E PP Operating Costs	\$183.30 Per Hour	90% DQCRG
7) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$3.68 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% DQCRG
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$19.33 Per Hour	1/8 of 90% DQCRG
11) 1/8 of 1 - 16H Blade for Road Work + 1 Operator	\$12.18 Per Hour	1/8 of 90% DQCRG
12) 1/4 - D9R for Ripping Ovb. and Misc. Work + 1 Operator	\$68.56 Per Hour	1/2 of 90% DQCRG
13) Total Hourly Costs	\$312.63	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1 - Level Ground		Loaded (0% grade + 4% rolling = 4% total)					Empty (0% grade + 4% rolling = 4% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.42	0.60	0.36	2.38	25.2	25.0	0.83	523	\$0.60
1000	1.0	0.68	0.60	0.57	2.85	21.1	25.0	0.83	438	\$0.71
1500	1.0	0.92	0.60	0.75	3.27	18.4	25.0	0.83	382	\$0.82
2000	1.0	1.15	0.60	0.92	3.67	16.3	25.0	0.83	338	\$0.92
2500	1.0	1.37	0.60	1.09	4.06	14.8	25.0	0.83	307	\$1.02
3000	1.0	1.59	0.60	1.26	4.45	13.5	25.0	0.83	280	\$1.12
3500	1.0	1.81	0.60	1.44	4.85	12.4	25.0	0.83	257	\$1.22
4000	1.0	2.02	0.60	1.61	5.23	11.5	25.0	0.83	239	\$1.31
4500	1.0	2.22	0.60	1.78	5.60	10.7	25.0	0.83	222	\$1.41
5000	1.0	2.43	0.60	1.95	5.98	10.0	25.0	0.83	208	\$1.50
5500	1.0	2.64	0.60	2.13	6.37	9.4	25.0	0.83	195	\$1.60
6000	1.0	2.85	0.60	2.30	6.75	8.9	25.0	0.83	185	\$1.69
6500	1.0	3.05	0.60	2.47	7.12	8.4	25.0	0.83	174	\$1.80
7000	1.0	3.26	0.60	2.64	7.50	8.0	25.0	0.83	166	\$1.88

Appendix C (Continued)
Calculations for Moving Materials With a Caterpillar 637E Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade		Loaded (-5% grade + 4% rolling = -1% total)					Empty (5% grade + 4% rolling = 9% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.36	0.60	0.42	2.38	25.2	25.0	0.83	523	\$0.60
1000	1.0	0.54	0.60	0.71	2.85	21.0	25.0	0.83	436	\$0.72
1500	1.0	0.71	0.60	0.98	3.29	18.2	25.0	0.83	378	\$0.83
2000	1.0	0.87	0.60	1.25	3.72	16.1	25.0	0.83	334	\$0.94
2500	1.0	1.03	0.60	1.51	4.14	14.5	25.0	0.83	301	\$1.04
3000	1.0	1.19	0.60	1.78	4.57	13.1	25.0	0.83	272	\$1.15
3500	1.0	1.36	0.60	2.05	5.01	12.0	25.0	0.83	249	\$1.26
4000	1.0	1.52	0.60	2.32	5.44	11.0	25.0	0.83	228	\$1.37
4500	1.0	1.68	0.60	2.59	5.87	10.2	25.0	0.83	212	\$1.47
5000	1.0	1.85	0.60	2.86	6.31	9.5	25.0	0.83	197	\$1.59
5500	1.0	2.01	0.60	3.12	6.73	8.9	25.0	0.83	185	\$1.69
6000	1.0	2.17	0.60	3.39	7.16	8.4	25.0	0.83	174	\$1.80
6500	1.0	2.33	0.60	3.66	7.59	7.9	25.0	0.83	164	\$1.91
7000	1.0	2.50	0.60	3.93	8.03	7.5	25.0	0.83	156	\$2.00

Case #3: 10% Assisting Grade		Loaded (-10% grade + 4% rolling = -6% total)					Empty (10% grade + 4% rolling = 14% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.34	0.60	0.51	2.45	24.5	25.0	0.83	508	\$0.62
1000	1.0	0.51	0.60	0.96	3.07	19.5	25.0	0.83	405	\$0.77
1500	1.0	0.67	0.60	1.41	3.68	16.3	25.0	0.83	338	\$0.92
2000	1.0	0.83	0.60	1.85	4.28	14.0	25.0	0.83	291	\$1.07
2500	1.0	0.99	0.60	2.30	4.89	12.3	25.0	0.83	255	\$1.23
3000	1.0	1.16	0.60	2.74	5.50	10.9	25.0	0.83	226	\$1.38
3500	1.0	1.32	0.60	3.19	6.11	9.8	25.0	0.83	203	\$1.54
4000	1.0	1.48	0.60	3.63	6.71	8.9	25.0	0.83	185	\$1.69
4500	1.0	1.64	0.60	4.08	7.32	8.2	25.0	0.83	170	\$1.84
5000	1.0	1.81	0.60	4.52	7.93	7.6	25.0	0.83	158	\$1.98
5500	1.0	1.97	0.60	4.97	8.54	7.0	25.0	0.83	145	\$2.16
6000	1.0	2.13	0.60	5.41	9.14	6.5	25.0	0.83	135	\$2.32
6500	1.0	2.30	0.60	5.86	9.76	6.2	25.0	0.83	129	\$2.42
7000	1.0	2.46	0.60	6.30	10.36	5.8	25.0	0.83	120	\$2.61

Appendix C (Continued)
Calculations for Moving Materials With a Caterpillar 637E Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #4: 5% Resisting Grade										
Loaded (5% grade + 4% rolling = 9% total)						Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.55	0.60	0.33	2.48	24.2	25.0	0.83	502	\$0.62
1000	1.0	1.01	0.60	0.50	3.11	19.3	25.0	0.83	400	\$0.78
1500	1.0	1.46	0.60	0.66	3.72	16.1	25.0	0.83	334	\$0.94
2000	1.0	1.92	0.60	0.83	4.35	13.8	25.0	0.83	286	\$1.09
2500	1.0	2.38	0.60	0.99	4.97	12.1	25.0	0.83	251	\$1.25
3000	1.0	2.83	0.60	1.15	5.58	10.8	25.0	0.83	224	\$1.40
3500	1.0	3.29	0.60	1.31	6.20	9.7	25.0	0.83	201	\$1.56
4000	1.0	3.75	0.60	1.48	6.83	8.8	25.0	0.83	183	\$1.71
4500	1.0	4.21	0.60	1.64	7.45	8.1	25.0	0.83	168	\$1.86
5000	1.0	4.66	0.60	1.80	8.06	7.4	25.0	0.83	154	\$2.03
5500	1.0	5.12	0.60	1.96	8.68	6.9	25.0	0.83	143	\$2.19
6000	1.0	5.58	0.60	2.13	9.31	6.4	25.0	0.83	133	\$2.35
6500	1.0	6.04	0.60	2.29	9.93	6.0	25.0	0.83	125	\$2.50
7000	1.0	6.49	0.60	2.45	10.54	5.7	25.0	0.83	118	\$2.65
Case #5: 10% Resisting Grade										
Loaded (10% grade + 4% rolling = 14% total)						Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.75	0.60	0.32	2.67	22.5	25.0	0.83	467	\$0.67
1000	1.0	1.43	0.60	0.49	3.52	17.0	25.0	0.83	353	\$0.89
1500	1.0	2.12	0.60	0.65	4.37	13.7	25.0	0.83	284	\$1.10
2000	1.0	2.81	0.60	0.81	5.22	11.5	25.0	0.83	238	\$1.31
2500	1.0	3.49	0.60	0.98	6.07	9.9	25.0	0.83	205	\$1.53
3000	1.0	4.18	0.60	1.14	6.92	8.7	25.0	0.83	181	\$1.73
3500	1.0	4.87	0.60	1.30	7.77	7.7	25.0	0.83	160	\$1.95
4000	1.0	5.56	0.60	1.46	8.62	7.0	25.0	0.83	145	\$2.16
4500	1.0	6.24	0.60	1.63	9.47	6.3	25.0	0.83	131	\$2.39
5000	1.0	6.93	0.60	1.79	10.32	5.8	25.0	0.83	120	\$2.61
5500	1.0	7.62	0.60	1.95	11.17	5.4	25.0	0.83	112	\$2.79
6000	1.0	8.31	0.60	2.12	12.03	4.9	25.0	0.83	102	\$3.07
6500	1.0	8.99	0.60	2.28	12.87	4.7	25.0	0.83	98	\$3.19
7000	1.0	9.68	0.60	2.44	13.72	4.4	25.0	0.83	91	\$3.44

Appendix D
Calculations for Moving Materials With a 56 CY Electric Cable Shovel and Caterpillar 240T (793C) Trucks

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.10/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Shovel-Truck Combination

1) 56 CY Shovel	56.0 LCY Heaped	
2) Caterpillar 793B - 240-Ton End Dumps	193.0 LCY/156.8 BCY	
3) Material Density	2,850.0 LB/BCY	CPH 30
4) Operating Efficiency Factor	0.83 %	CPH 30
5) Rolling Resistance Factor	4.00 %	CPH 30
6) 56 CY Shovel Operating Costs (No Ownership Cost)	\$209.97	WME
7) 793C Lease + Operating Costs	\$229.19	WME
8) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
9) 1/4 of 1 - 14,000 Gal. Water Truck + 1 Operator	\$77.33 Per Hour	1/2 of 90% DQCRG + Operator
10) 1 - 16H Blade + 1 Operator	\$97.40 Per Hour	90% DQCRG + Operator
11) 1 - D9R + 1 Operator	\$137.12 Per Hour	90% DQCRG + Operator
12) 1 834B Rubber Tired Dozer + 1 Operator	\$122.89 Per Hour	90% DQCRG + Operator
13) Supervision Labor Costs	\$14.69 Per Hour	1/2 of WYDOT-WDD
14) Supervisor Transportation	\$4.79 Per Hour	1/2 of 90% DQCRG
15) Total Fleet Hourly Costs (Except Trucks)	\$688.57 Per Hour	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground			Loaded (0% grade + 4% rolling = 4% total resistance)					Empty (0% grade + 4% = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.4	1.20	0.2	4.1	14.6	156.8	1912	4040	2.11	\$0.303
1000	1.70	0.60	0.7	1.20	0.4	4.6	13.0	156.8	1704	4040	2.37	\$0.319
1500	1.70	0.60	1.0	1.20	0.6	5.1	11.8	156.8	1537	4040	2.63	\$0.336
2000	1.70	0.60	1.3	1.20	0.7	5.5	10.9	156.8	1425	4040	2.83	\$0.348
2500	1.70	0.60	1.6	1.20	0.9	6.0	10.0	156.8	1307	4040	3.09	\$0.364
3000	1.70	0.60	1.9	1.20	1.1	6.5	9.2	156.8	1206	4040	3.35	\$0.381
3500	1.70	0.60	2.2	1.20	1.3	7.0	8.6	156.8	1120	4040	3.61	\$0.397
4000	1.70	0.60	2.4	1.20	1.5	7.4	8.1	156.8	1059	4040	3.81	\$0.410
4500	1.70	0.60	2.7	1.20	1.7	7.9	7.6	156.8	992	4040	4.07	\$0.426
5000	1.70	0.60	3.0	1.20	1.9	8.4	7.1	156.8	933	4040	4.33	\$0.442
5500	1.70	0.60	3.2	1.20	2.1	8.8	6.8	156.8	891	4040	4.53	\$0.455
6000	1.70	0.60	3.5	1.20	2.3	9.3	6.5	156.8	843	4040	4.79	\$0.471
6500	1.70	0.60	3.8	1.20	2.5	9.8	6.1	156.8	800	4040	5.05	\$0.487
7000	1.70	0.60	4.1	1.20	2.7	10.3	5.8	156.8	761	4040	5.31	\$0.504

Operating Costs = (((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Shovel Productivity)

Appendix D (Continued)
Calculations for Moving Materials With a 56 CY Electric Cable Shovel and Caterpillar 240T (793C) Trucks

Material Movement By Shovel-Truck Combination

Case #2: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total resistance)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.8	1.20	0.4	4.7	12.8	156.8	1668	4040	2.42	\$0.322
1000	1.70	0.60	1.4	1.20	0.7	5.6	10.7	156.8	1398	4040	2.89	\$0.352
1500	1.70	0.60	2.2	1.20	1.0	6.7	9.0	156.8	1170	4040	3.45	\$0.387
2000	1.70	0.60	2.9	1.20	1.3	7.7	7.8	156.8	1019	4040	3.96	\$0.419
2500	1.70	0.60	3.6	1.20	1.6	8.7	6.9	156.8	902	4040	4.48	\$0.452
3000	1.70	0.60	4.3	1.20	1.9	9.7	6.2	156.8	810	4040	4.99	\$0.484
3500	1.70	0.60	5.0	1.20	2.2	10.7	5.6	156.8	731	4040	5.52	\$0.517
4000	1.70	0.60	5.7	1.20	2.5	11.7	5.1	156.8	669	4040	6.04	\$0.550
4500	1.70	0.60	6.4	1.20	2.8	12.7	4.7	156.8	615	4040	6.57	\$0.583
5000	1.70	0.60	7.1	1.20	3.2	13.8	4.4	156.8	570	4040	7.09	\$0.615
5500	1.70	0.60	7.8	1.20	3.5	14.8	4.1	156.8	531	4040	7.61	\$0.648
6000	1.70	0.60	8.5	1.20	3.8	15.8	3.8	156.8	497	4040	8.14	\$0.681
6500	1.70	0.60	9.2	1.20	4.1	16.8	3.6	156.8	467	4040	8.66	\$0.714
7000	1.70	0.60	9.9	1.20	4.4	17.8	3.4	156.8	440	4040	9.17	\$0.746

Case #3: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total resistance)					Empty (5% grade + 4% = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.4	1.20	0.3	4.2	14.3	156.8	1867	4040	2.16	\$0.306
1000	1.70	0.60	0.7	1.20	0.5	4.7	12.7	156.8	1662	4040	2.43	\$0.323
1500	1.70	0.60	1.0	1.20	0.8	5.3	11.3	156.8	1479	4040	2.73	\$0.342
2000	1.70	0.60	1.3	1.20	1.0	5.8	10.3	156.8	1344	4040	3.00	\$0.359
2500	1.70	0.60	1.6	1.20	1.3	6.4	9.4	156.8	1227	4040	3.29	\$0.377
3000	1.70	0.60	1.9	1.20	1.6	7.0	8.6	156.8	1128	4040	3.58	\$0.395
3500	1.70	0.60	2.2	1.20	1.8	7.5	8.0	156.8	1044	4040	3.87	\$0.413
4000	1.70	0.60	2.5	1.20	2.1	8.1	7.4	156.8	972	4040	4.16	\$0.432
4500	1.70	0.60	2.8	1.20	2.3	8.6	7.0	156.8	909	4040	4.44	\$0.449
5000	1.70	0.60	3.2	1.20	2.6	9.3	6.5	156.8	845	4040	4.78	\$0.471
5500	1.70	0.60	3.5	1.20	2.8	9.8	6.1	156.8	797	4040	5.07	\$0.489
6000	1.70	0.60	3.8	1.20	3.1	10.4	5.8	156.8	754	4040	5.36	\$0.507
6500	1.70	0.60	4.1	1.20	3.4	11.0	5.5	156.8	715	4040	5.65	\$0.525
7000	1.70	0.60	4.4	1.20	3.6	11.5	5.2	156.8	681	4040	5.93	\$0.543

Appendix E
Calculations for Moving Material With a Caterpillar D9N Dozer

Material Movement By Dozing

1) Caterpillar D9N Dozer With U Blade		
2) Operating Costs	\$101.39 Per Hour	90% of DQCRG
3) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
5) Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% of DQCRG
6) Total Hourly Costs	\$130.65 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2100	1.0	1.0	0.90	0.83	1.00	1575	\$0.083
100	1200	1.0	1.0	0.90	0.83	1.00	900	\$0.145
150	900	1.0	1.0	0.90	0.83	1.00	675	\$0.194
200	700	1.0	1.0	0.90	0.83	1.00	525	\$0.249
250	570	1.0	1.0	0.90	0.83	1.00	428	\$0.305
300	480	1.0	1.0	0.90	0.83	1.00	360	\$0.363
350	410	1.0	1.0	0.90	0.83	1.00	308	\$0.424
400	370	1.0	1.0	0.90	0.83	1.00	278	\$0.470
450	350	1.0	1.0	0.90	0.83	1.00	263	\$0.497
500	340	1.0	1.0	0.90	0.83	1.00	255	\$0.512

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2100	1.0	1.0	0.90	0.83	1.20	1890	\$0.069
100	1200	1.0	1.0	0.90	0.83	1.20	1080	\$0.121
150	900	1.0	1.0	0.90	0.83	1.20	810	\$0.161
200	700	1.0	1.0	0.90	0.83	1.20	630	\$0.207
250	570	1.0	1.0	0.90	0.83	1.20	513	\$0.255
300	480	1.0	1.0	0.90	0.83	1.20	432	\$0.302
350	410	1.0	1.0	0.90	0.83	1.20	369	\$0.354
400	370	1.0	1.0	0.90	0.83	1.20	333	\$0.392
450	350	1.0	1.0	0.90	0.83	1.20	315	\$0.415
500	340	1.0	1.0	0.90	0.83	1.20	306	\$0.427

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix E (Continued)
Calculations for Moving Material With a Caterpillar D9N Dozer

Material Movement By Dozing

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2100	1.0	1.0	0.90	0.83	1.40	2205	\$0.059
100	1200	1.0	1.0	0.90	0.83	1.40	1260	\$0.104
150	900	1.0	1.0	0.90	0.83	1.40	945	\$0.138
200	700	1.0	1.0	0.90	0.83	1.40	735	\$0.178
250	570	1.0	1.0	0.90	0.83	1.40	599	\$0.218
300	480	1.0	1.0	0.90	0.83	1.40	504	\$0.259
350	410	1.0	1.0	0.90	0.83	1.40	431	\$0.303
400	370	1.0	1.0	0.90	0.83	1.40	389	\$0.336
450	350	1.0	1.0	0.90	0.83	1.40	368	\$0.355
500	340	1.0	1.0	0.90	0.83	1.40	357	\$0.366

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2100	1.0	1.0	0.90	0.83	0.75	1181	\$0.111
100	1200	1.0	1.0	0.90	0.83	0.75	675	\$0.194
150	900	1.0	1.0	0.90	0.83	0.75	506	\$0.258
200	700	1.0	1.0	0.90	0.83	0.75	394	\$0.332
250	570	1.0	1.0	0.90	0.83	0.75	321	\$0.407
300	480	1.0	1.0	0.90	0.83	0.75	270	\$0.484
350	410	1.0	1.0	0.90	0.83	0.75	231	\$0.566
400	370	1.0	1.0	0.90	0.83	0.75	208	\$0.628
450	350	1.0	1.0	0.90	0.83	0.75	197	\$0.663
500	340	1.0	1.0	0.90	0.83	0.75	191	\$0.684

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F
Calculations For Moving Material With a Caterpillar D11R Dozer

Material Movement By Dozing With D11R

1) Caterpillar D11R Dozer With U Blade (Operating Costs) \$223.85 per DataQuest		
2) Operating Costs	\$235.73 Per Hour	90% of DQCRG
3) Labor Costs	\$24.38 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
5) Supervisor Transportation	<u>\$1.20 Per Hour</u>	1/8 of 90% of DQCRG
6) Total Hourly Costs	\$264.99 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	3200	1.0	1.0	0.90	0.83	1.00	2400	\$0.111
100	2700	1.0	1.0	0.90	0.83	1.00	2025	\$0.131
150	1800	1.0	1.0	0.90	0.83	1.00	1350	\$0.196
200	1400	1.0	1.0	0.90	0.83	1.00	1050	\$0.252
250	1150	1.0	1.0	0.90	0.83	1.00	863	\$0.307
300	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.353
350	850	1.0	1.0	0.90	0.83	1.00	638	\$0.415
400	750	1.0	1.0	0.90	0.83	1.00	563	\$0.471
450	670	1.0	1.0	0.90	0.83	1.00	503	\$0.527
500	600	1.0	1.0	0.90	0.83	1.00	450	\$0.589

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	3200	1.0	1.0	0.90	0.83	1.20	2880	\$0.092
100	2700	1.0	1.0	0.90	0.83	1.20	2430	\$0.109
150	1800	1.0	1.0	0.90	0.83	1.20	1620	\$0.164
200	1400	1.0	1.0	0.90	0.83	1.20	1260	\$0.210
250	1150	1.0	1.0	0.90	0.83	1.20	1035	\$0.256
300	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.294
350	850	1.0	1.0	0.90	0.83	1.20	765	\$0.346
400	750	1.0	1.0	0.90	0.83	1.20	675	\$0.393
450	670	1.0	1.0	0.90	0.83	1.20	603	\$0.440
500	600	1.0	1.0	0.90	0.83	1.20	540	\$0.491

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F (Continued)
Calculations For Moving Material With a Caterpillar D11R Dozer

Material Movement By Dozing With D11R

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	3200	1.0	1.0	0.90	0.83	1.40	3360	\$0.079
100	2700	1.0	1.0	0.90	0.83	1.40	2835	\$0.094
150	1800	1.0	1.0	0.90	0.83	1.40	1890	\$0.140
200	1400	1.0	1.0	0.90	0.83	1.40	1470	\$0.180
250	1150	1.0	1.0	0.90	0.83	1.40	1208	\$0.219
300	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.252
350	850	1.0	1.0	0.90	0.83	1.40	893	\$0.297
400	750	1.0	1.0	0.90	0.83	1.40	788	\$0.336
450	670	1.0	1.0	0.90	0.83	1.40	704	\$0.376
500	600	1.0	1.0	0.90	0.83	1.40	630	\$0.421

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	3200	1.0	1.0	0.90	0.83	0.75	1800	\$0.147
100	2700	1.0	1.0	0.90	0.83	0.75	1519	\$0.175
150	1800	1.0	1.0	0.90	0.83	0.75	1013	\$0.262
200	1400	1.0	1.0	0.90	0.83	0.75	788	\$0.336
250	1150	1.0	1.0	0.90	0.83	0.75	647	\$0.410
300	1000	1.0	1.0	0.90	0.83	0.75	563	\$0.471
350	850	1.0	1.0	0.90	0.83	0.75	478	\$0.554
400	750	1.0	1.0	0.90	0.83	0.75	422	\$0.628
450	670	1.0	1.0	0.90	0.83	0.75	377	\$0.703
500	600	1.0	1.0	0.90	0.83	0.75	338	\$0.784

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix G
Calculations for Final Grading With a Caterpillar 16H Motor Grader

Final Grading

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
Caterpillar 16H Motor Grader		
Speed in Miles Per Hour (Second Gear)	3.3 Miles/Hour	CPH 30
Width of Grading Per Pass	8 Feet	CPH 30
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83 %	CPH 30
Operating Costs	\$73.02 Per Hour	90% of DQCRG
Labor Costs	\$24.38 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% of DQCRG
Total Hourly Costs	\$102.28	
Grading Rate		
$(3.3 \text{ Miles/Hour}) \times (5,280 \text{ Ft./Mile}) \times (8 \text{ Ft./Pass})$	139,392 Ft ² /Hour	
$(139,392 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	3.2 Acres/Hour	
$(3.2 \text{ Acres/Hour}) \times (0.83 \text{ Efficiency Factor})$	2.66 Acres/Hour	
Operating Costs		
$(\$102.28/\text{Hour}) / (2.66 \text{ Acres/Hour})$	\$38.45 Per Acre	

Appendix H
Cost Estimates for Handling Wire Fencing and Electrical Power Lines

FENCING		SOURCES
Construction 4-Strand Barbed	Overall Average - \$1.15/LF	Wyoming Highway Department Weighted Average Bid Prices, 1997
Removal	Overall Average - \$0.68/LF	Wyoming Highway Department, Average Bid Prices, 1997
	Power Line Removal	
Distribution Lines:	No Charge	From: Tri-County Electric
Transmission Lines:	No Charge	From: Tri-County Electric

Note: Cost estimates for power line removal are based on phone contact with Tri-County Electric. Distribution lines are owned by Tri-County Electric and would be removed upon request at no charge by Tri-County Electric. Transmission lines (lines which go from the main metering point to various electrical substations and are not owned by Tri-County Electric) would be removed by Tri-County Electric at no cost for their salvage value.

Appendix I
Cost Estimate for Ripping Asphalt Using a Caterpillar D9R Dozer

Asphalt Ripping (3"-4" Mat)

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
Caterpillar D9R Dozer With 3 Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 30
Width of Ripping Pass	3 Feet	CPH 30
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83 %	CPH 30
Operating Costs	\$112.74 Per Hour	90% of DQCRG
Labor Costs	\$24.38 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% of DQCRG
Total Hourly Costs	\$142.00	
Ripper Productivity		
(1.0 Mile/Hour)x(5,280 Ft./Mile)x(3 Ft./Pass)	15,840 Ft ² /Hour	
(15,840 Ft ² /Hour)/(43,560 Ft ² /Acre)	0.36 Acres/Hour	
(0.36 Acres/Hour)x(0.83 Efficiency Factor)	0.299 Acres/Hour	
Operating Costs		
(\$142.00/Hour)/(0.299 Acres/Hour)	\$474.92 Per Acre	

Appendix I1
Cost Estimate for Ripping Overburden Using a Caterpillar D10R Dozer

Overburden Ripping

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
Caterpillar D10R Dozer With Single Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 30
Width of Ripping Pass	3 Feet	CPH 30
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.75 %	CPH 30
Rip Depth	2 Feet	CPH 30
Operating Costs	\$150.00 Per Hour	90% of DQCRG
Labor Costs	\$24.38 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% of DQCRG
Total Hourly Costs	\$179.26	
Ripper Productivity		
$(1.0 \text{ Mile/Hour}) \times (5,280 \text{ Ft./Mile}) \times (3 \text{ Ft./Pass})$	15,840 Ft ² /Hour	
$(15,840 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	0.36 Acre/Hour	
$(0.36 \text{ Acre/Hour}) \times (0.75 \text{ Efficiency Factor})$	0.27 Acre/Hour	
Operating Costs		
$(\$179.26/\text{Hour}) / (0.27 \text{ Acre/Hour})$	\$663.93 Per Acre	

Note: A 75 percent Efficiency Factor was used to account for slowing, raising ripper, maneuvering and turn time.

Appendix J
Cost Estimate for Culvert Removal

Culvert Removal

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Average Length of CMP Section	20 Feet	
Assumed Culvert Diameter	48 Inches	
Time to Cut One Band	10 Minutes	
Time to Load One 20' Section (2 People)	20 Minutes	
Average Haul, Dump and Return Time	30 Minutes	
Number of Sections of CMP Per Load	2	
Operating Efficiency Factor 50 Min./Hr.	0.83 %	
Labor	\$24.38 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$28.82 Per Hour	90% of DQCRG
Caterpillar 980F Front-End Loader	\$68.51 Per Hour	90% of DQCRG
Cost to Remove One 20' Section of CMP		
Labor Cost x Time to Cut One Band	\$4.05	
+ ((Labor Cost x 2) + FEL Cost) x Time to Load 1 Section	\$39.05	
+ (Labor Cost + Truck Cost) x Haul Time	\$26.60	
Cost to Remove One 20' Section of CMP (not including dirt removal)	\$69.70 - 3.48/ft.	

Note: Culverts may be smashed and buried in place when feasible.

Appendix K
Cost Estimates for Demolition and Removal of Railroad Spurs and Facilities Buildings

TASK	COST PER UNIT (\$)	REGIONAL COST ADJUSTMENT¹	ADJUSTED COST PER UNIT (\$)
Track Removal	6.11/lin. ft.	82.6%	5.05/lin. ft.
Ballast Removal	2.68/cy	82.6%	2.21/cy
Building Demolition and Disposal^{1, 2, 3}			
Mixture of Types	0.20/ft ³	82.6%	0.165/ft ³
Explosive Demolition, Concrete or Steel	0.20/ft ³	82.6%	0.165/ft ³
Disposal	6.58/cy	82.6%	5.44/cy
City Landfill Dump Charges	\$55.00/ton	82.6%	\$45.43/ton
Concrete Footings and Foundations			
6" Thick With Rebar	3.69/sq. ft.	82.6%	3.05/sq. ft.
Footings - 2' Thick, 3' Wide	13.50/lin. ft.	82.6%	11.15/lin. ft.
Concrete Disposal On-Site	5.00/cy	82.6%	4.13/cy

Note: Operators may also provide a verifiable cost estimate from a qualified contractor for these demolition tasks. This estimate may be used for one to three consecutive years, assuming few substantial changes in mine facilities.

¹ Costs From: 2001 Means Heavy Construction Cost Data

² Based on Total Volume of Building, does not include disposal cost

³ Based on Concrete Structures Volume Only, does not include disposal cost

Appendix L
Abandonment and Sealing of Cased Drill Holes and Monitor Wells

TASKS	UNIT COST	UNITS	TOTAL COST
DRILL HOLE RECLAMATION COSTS			
Site Locating	\$10.00/site		
Sealing Using High-Solids Bentonite Grout ^{1,2} ≤ 500' deep ≤ 1,000' deep	\$4.00/lin. ft. \$6.28/lin. ft.		
Capping Using a Pre-cast Concrete Cap (if needed)	\$7.50/hole		
Site Grading	\$30.00/site		
Seeding - Small Site (15' x 25')	\$1.00/site		
Contouring & Seeding - Large Sites (100' x 100')	\$250.00/site		
MONITORING WELL RECLAMATION COSTS			
Site Locating	\$10.00/site		
Removal of Top Few Feet of Casing (Backhoe & Welder)	\$15.00/well		
Sealing Using High-Solids Bentonite Grout ^{1,2} ≤ 500' deep ≤ 1,000' deep	\$4.00/lin. ft. \$6.28/lin. ft.		
Site Smoothing (Hand Work) & Seeding	\$5.00/site		

Costs based on industry sources.

¹ Assumes a hole/well size of 5" diameter.

² Gassy or artesian wells would require class G neat cement plugging @ \$6.46/ft. for wells up to 500' deep and \$7.64/ft. for holes over 500' deep.

Appendix M
Cost Estimate for Rough Grading Backfill Using
Caterpillar D9R Dozer or Caterpillar 834B

ITEMS	CATERPILLAR D9R DOZER	CATERPILLAR 834B RUBBER TIRED DOZER	COMMENT/SOURCE
Speed in Miles Per Hour (First Gear)	2.0 Miles/Hour	4.0 Miles/Hour	CPH 30
Width of Dozer Pass	14 Feet	14 Feet	CPH 30
Feet Per Mile	5,280 Feet	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83 %	0.83 %	CPH 30
Operating Costs	\$112.74 Per Hour	\$98.51 Per Hour	90% of DQCRG
Labor Costs	\$24.38 Per Hour	\$24.38 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$3.68 Per Hour	\$3.68 Per Hour	1/8 of 90% of DQCRG
Supervisor Transportation	\$1.20 Per Hour	\$1.20 Per Hour	1/8 of 90% of DQCRG
Total Hourly Costs	\$142.00	\$127.77	
SCARIFICATION RATE			
(2.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ¹	147,840 Ft ² /Hour	295,680 Ft ² /Hour	
(4.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ²			
(147,840 Ft ² /Hour)/(43,560 Ft ² /Acre) ¹ (295,680 Ft ² /Hour)/(43,560 Ft ² /Acre) ²	3.39 Acres/Hour	6.79 Acres/Hour	
(3.39 Acres/Hour)x(0.83 Efficiency Factor) ¹ (6.79 Acres/Hour)x(0.83 Efficiency Factor) ²	2.82 Acres/Hour	5.66 Acres/Hour	
OPERATING COSTS			
(\$142.00/Hour)/(2.82 Acres/Hour) ¹ (\$127.77/Hour)/(5.66 Acres/Hour) ²	\$50.35 Per Acre	\$22.57 Per Acre	

¹ Caterpillar D9R Dozer

² Caterpillar 834B Rubber Tired Dozer

Appendix N

Cost Estimates for Demolition and Removal of One "Standard" Surface Water Monitoring Station

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	8 Hours	
Labor	\$24.38 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$28.82 Per Hour	90% of DQCRG
Caterpillar 980F Front-End Loader	\$68.51 Per Hour	90% of DQCRG
Cost to Remove One Surface Water Station = (Labor Cost x Time to Remove Station)	\$195.04	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$425.60	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$743.12	
Cost to Remove One Surface Water Station =	\$1363.76	

Appendix O

Cost Estimates for Demolition and Removal of One "Standard" Meteorological or Air Quality Monitoring Site

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	4 Hours	
Labor	\$24.38 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$28.82 Per Hour	90% of DQCRG
Caterpillar 428B (2WD) Front-End Loader	\$18.41 Per Hour	90% of DQCRG
Cost to Remove One Meteorological or Air Quality Station = (Labor Cost x Time to Remove Station)	\$97.52	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$212.80	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$171.16	
Cost to Remove One Meteorological or Air Quality Station =	\$481.48	

Appendix P
Cost Estimate for Scarification of Compacted Surfaces

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
CATERPILLAR 16H MOTOR GRADER		
Speed in Miles Per Hour (First Gear)	2.4 Miles/Hour	CPH 30
Width of Scarifying Pass	12 Feet	CPH 30
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83 %	CPH 30
Operating Costs	\$73.02 Per Hour	90% of DQCRG
Labor Costs	\$24.38 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$3.68 Per Hour	1/8 of 90% of DQCRG
Supervisor Transportation	\$1.20 Per Hour	1/8 of 90% of DQCRG
Total Hourly Costs	\$105.28	
SCARIFICATION RATE		
$(2.4 \text{ Miles/Hour}) \times (5,280 \text{ Ft./Mile}) \times (12 \text{ Ft./Pass})$	152,064 Ft ² /Hour	
$(152,064 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	3.49 Acres/Hour	
$(3.49 \text{ Acres/Hour}) \times (0.83 \text{ Efficiency Factor})$	2.90 Acres/Hour	
OPERATING COSTS		
$(\$105.28/\text{Hour}) / (2.90 \text{ Acres/Hour})$	\$36.30 Per Acre	

Appendix Q Revegetation Tasks and Costs

The permittee should fill in the cost per acre for each mine-specific Revegetation Activity as listed in the approved permit document. If a permittee does not use a specific Revegetation Activity, there should be no cost entry. The permittee should add these costs together to obtain a total cost per acre for revegetation. A flat estimate per acre for revegetation costs is not acceptable. The LQD may request verification of submitted revegetation costs (W.S. § 35-11-417(c)(i)).

General Revegetation Activity	Calculate According To Specific Permit Commitments
1) Seedbed Preparation	
Ripping	\$
Chisel Plowing	\$
Disking	\$
Harrowing or Cultipacking	\$
2) Drill Seed Stubble Mulch Mix	
Seed Costs	\$
Drill Seeding	\$
Mowing Prior to Planting Permanent Seed Mix	\$
3) Seeding Permanent Mixes: Detail for each seed mix, if different seed mixes will be applied. The costs/acre for each individual mix should then be proportioned on the basis of acreage per parcels to derive a single weighted average cost/acre.	
Drill Seeding	\$
Broadcast Seeding	\$
Seed Costs	\$
4) Mulching	
Mulch Purchase	\$
Hydromulch Application	\$
Straw Mulch Placement and Crimping	\$
5) Fertilizer	
Fertilizer Purchase by Defined Composition	\$
Application	\$
6) Fencing	
Construction	\$
Removal	\$
Subtotal	\$
7) Maintenance Operations at 10% of Total Revegetation Costs: This cost addresses standard husbandry practices applied over the minimum 10-year bonding period, such as remedial seeding, mowing, selective weed treatment, etc. The 10 percent figure is derived from historical operator experience for the Powder River Basin.	\$
Total Revegetation Cost Per Acre	\$