Draft Coal Bonding Calculation Guidelines

DEQ's Mission: To champion a healthy environment for a thriving Montana

Montana Department of Environmental Quality

DEQ MONTANA

Introduction

- Applicable Rules
- Review and Purpose of Bond
- Rationale for Guidelines
- Guideline Needs
- Standard Calculation Elements
- Equipment Rates
- Reclamation Plan
- Indirect Costs
- Example Calculation

Coal Mine Bonding and Reclamation Oversight

What is MSUMRA?

- The Montana Strip and Underground Mine Reclamation Act (MSUMRA) (1973)
- Regulates surface and underground coal mining in Montana
- Ensures environmental protection and reclamation of disturbed coal mine lands
- Administered by the Montana Department of Environmental Quality (DEQ)

Coal Mine Bonding under MSUMRA

- Permittees must post a reclamation performance bond *before operations begin*
- Bond posted must cover all estimated costs to reclaim disturbed land
- Ensures DEQ can complete reclamation if the permittee is unavailable or unable to complete the reclamation
- Reviewed and adjusted as mining operations change

Purpose of Bonding

- Protects taxpayers from the costs of mine reclamation
- Requires financial commitment to ensure reclamation is completed
- Promotes long-term environmental sustainability of resource extraction

Applicable Administrative Rules of Montana (ARM)

ARM 17.24.305	**Maps**
ARM 17.24.313	**Reclamation Plan**
ARM 17.24.413	**Conditions of Permit**
ARM 17.24.416	**Permit Renewal**
ARM 17.24.1016	**Bond Requirements for Drilling Operations**
ARM 17.24.1101	**Bonding: Definitions**
ARM 17.24.1102	**Bonding: Determination of Bond Amount**
ARM 17.24.1104	**Bonding: Adjustment of Amount of Bond**
ARM 17.24.1111	**Bonding: Bond Release Application Contents**
ARM 17.24.1116	**Bonding: Criteria and Schedule for Release of Bond**

Rationale for Guidelines

- Bond calculated as cost to the State of Montana to perform reclamation per ***ARM 17.24.1102:*** *This amount is based on, but not limited to:*
  - *(1) the estimated costs submitted by the permittee in accordance with ARM 17.24.313* ***and, if applicable, costs estimated*** *by using current machinery production handbooks and publications or other documented costs* ***acceptable to the department****;*
  - *(2) the additional estimated costs to the department which may arise from applicable* ***public contracting requirements or the need to bring personnel and equipment to the permit area*** *after its abandonment by the permittee to perform reclamation, restoration, and abatement work;*

Contractor Available Equipment Basis

Standardize an equipment list for applicants to use for backfill & grading calculation

Based on contractor available equipment

Allow a larger fleet for utilization at applicable mines

Separate capitalization due to lack of normal contractor utilization

Guideline Needs

1. Create a consistent methodology and calculation practice applicable between permits
2. Consistency and Transparency
3. Financial Assurance
4. Accountability
5. Efficiency
   - Clear direction for applicants on submittal
   - Review timeframes

Goals

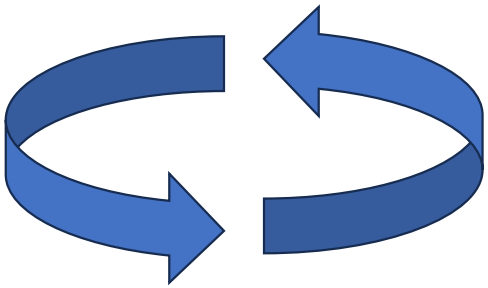
- Standardize process for bond calculation, allowable equipment, equipment rates, and direct cost elements required
- Apply appropriate indirect costs for all permits

Bond Calculation Process

Applicant

Provides data and estimated costs for department consideration

Minor Revision Process



Optimize process with Bond Calculation Guidelines

DEQ

Responsible for determining the amount of bond necessary for each permit (***ARM 17.24.1102)***

Standard Elements in Bond Calculations

Direct Costs

- Backfill and Rough Grading
- Drill and Blast
- Facilities Removal
- Scarification/Finish Grading
- Soil Redistribution
- Revegetation
- Subcategory
  - Sampling
  - Monitoring
  - Dewatering
  - Drilled Holes
  - Hazardous Waste Disposal
  - Site Management

Indirect Costs

- Mobilization and Demobilization
- Engineering Redesign
- Contractor Profit and Overhead
- Project Management
- Contingencies

*Applied as a percentage of the direct costs to account for any additional expenses DEQ may incur

Equipment Rates – EquipmentWatch

- Current utilization of EquipmentWatch
  - Based on default values
    - Provided by equipment sales
    - Broad selection of construction sized equipment
    - Data aggregation based on used rates
    - Rental rates
    - Reflection of information received
    - Based on industry average utilization
  - DEQ goal to customize data set to mining specific equipment
    - Generalized equipment selection based on size classification

EquipmentWatch's vast database of market data is diverse in nature, with values from established third-party sources including original equipment manufacturers (OEM's), reported auction prices (open and closed), reported dealer-selling prices and classified advertising.

EquipmentWatch's Statement of Valuation Methodology

Equipment Rates – Costmine Intelligence

- Guideline utilizes Costmine Intelligence Equipment Rates
  - Based on manufacture specific equipment quotes to generalize equipment classes
  - Specifically tailored to the mining industry
  - Capital cost estimating focus
  - Updated yearly
  - Proprietary databases
  - Excessive price growth flagging
- DEQ Standard list of accepted equipment is provided
  - Large equipment purchase option with separate capitalization
- Access to reliable capital and operating cost data for 3,000 equipment items commonly found at mines across the world

Who Uses the Mine & Mill Equipment Cost Calculator?

- Cost Estimators
- Purchasing Agents
- Geologists, Engineers, Metallurgists
- Appraisers

The Calculator is Ideal for:

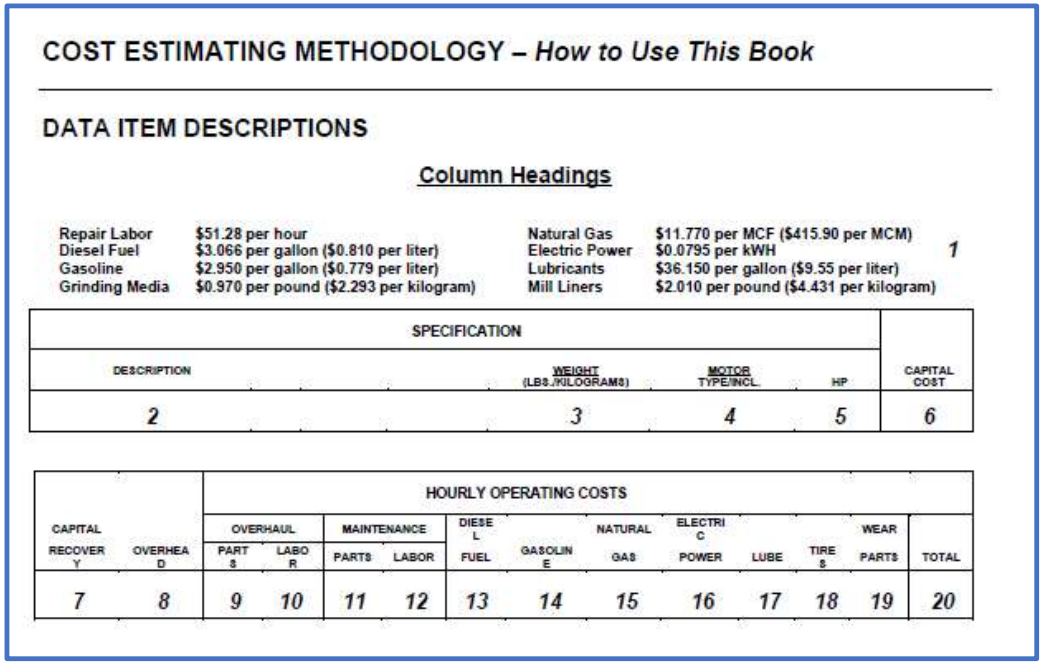
- Estimating project costs
- Developing capital and operating budgets
- Establishing baseline prices for appraisals

https://calc2024.costs.infomine.com/about.aspx

Equipment Rates – Costmine Intelligence (cont.)

- Costmine Intelligence provides documentation explaining how all rates are calculated within the Equipment Cost Calculator
  - Mine & Mill Equipment Cost Guide 2024 - Introduction

- Guidelines modify repair labor and diesel fuel to align with Montana accepted rates
  - Labor rate is based on Montana prevailing wage rates for heavy construction services
  - Fuel rate is averaged yearly from pricing provided by the Montana Department of Transportation



COST ESTIMATING METHODOLOGY – *How to Use This Book*

DATA ITEM DESCRIPTIONS

Column Headings

Repair Labor	$51.28 per hour	Natural Gas	$11.770 per MCF ($415.90 per MCM)	1
Diesel Fuel	$3.066 per gallon ($0.810 per liter)	Electric Power	$0.0795 per kWH	
Gasoline	$2.950 per gallon ($0.779 per liter)	Lubricants	$36.150 per gallon ($9.55 per liter)	
Grinding Media	$0.970 per pound ($2.293 per kilogram)	Mill Liners	$2.010 per pound ($4.431 per kilogram)	

SPECIFICATION				
DESCRIPTION	WEIGHT (LBS./KILOGRAMS)	MOTOR TYPE/INCL.	HP	CAPITAL COST
2	3	4	5	6

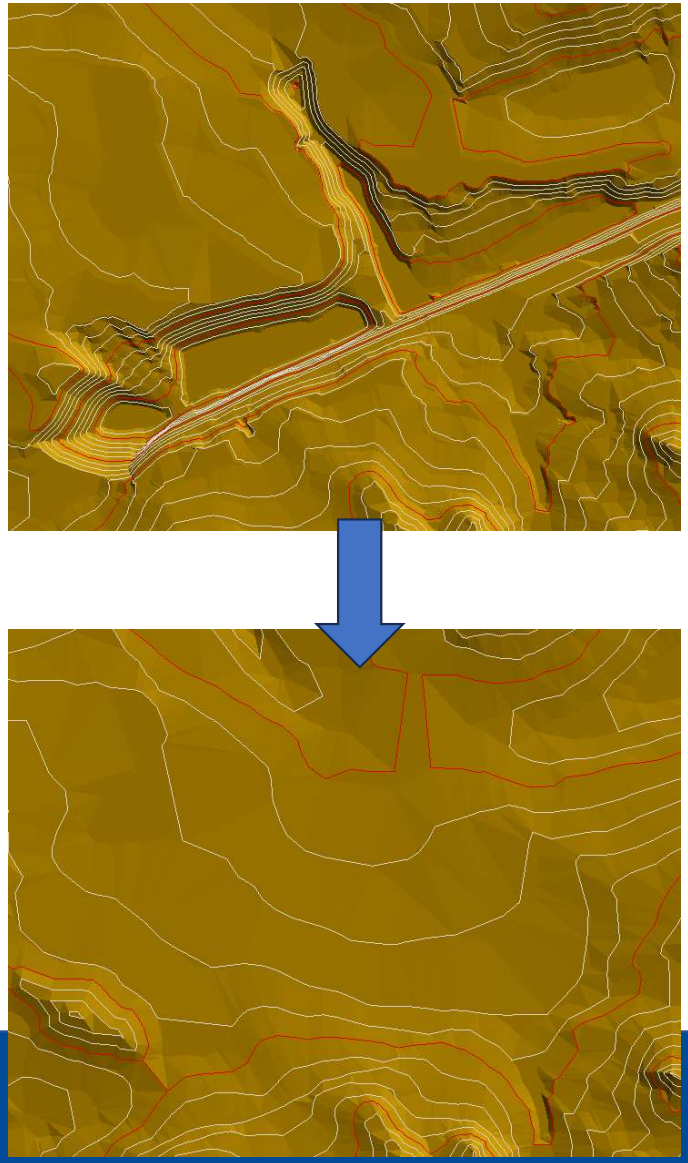
		HOURLY OPERATING COSTS											
CAPITAL		OVERHAUL		MAINTENANCE		DIESEL		NATURAL	ELECTRIC			WEAR	
RECOVERY	OVERHEAD	PARTS	LABOR	PARTS	LABOR	FUEL	GASOLINE	GAS	POWER	LUBE	TIRES	PARTS	TOTAL
7	8	9	10	11	12	13	14	15	16	17	18	19	20

Reclamation Plan

- All bond calculations must calculate to an approved reclamation plan and schedule aligning with **ARM 17.24.313(1)(b):**

  "a detailed timetable for the estimated completion of each major step in the reclamation plan;"

- The reclamation plan used in bond calculations must meet all MSUMRA requirements. The topography must be an approved postmining topography. ARM 17.27.501(6)(d) and ARM 17.24.634(1).



Indirect Costs

- **Mobilization and Demobilization**
  - Transport of Equipment
  - Equipment Setup
  - Crew Travel and Per Diem
  - Permits and Insurance
- **Engineering Redesign**
  - Postmine topography redesign and calculation
  - Engineering drawings
  - Hydrology and erosion control analysis
  - Regulatory technical support
- **Contractor Profit**
  - Business profit margin
  - Risk and liability
  - Market conditions
- **Contractor Overhead**
  - Office expenses
  - Project administration
  - Company equipment
  - Communication and Technology
- **Project Management**
  - Planning and Scheduling
  - Quality control and monitoring
  - Stakeholder communication
  - Regulatory compliance
- **Contingency**
  - Unanticipated site conditions
  - Price fluctuations
  - Change orders

Submittal Documents (ARM 17.24.313)

1. **Reclamation Plan and Supporting Narrative**
2. **Reclamation Timetable**
3. **Bond Calculation Documents**
4. **Maps (PDF and AutoCAD format)**
   - Projected Disturbance Map
   - Postmine Topography Map
   - Cut/Fill Map
   - Earthwork Map
   - Topsoil Map

Any information or data utilized in calculations must be submitted and available for DEQ validation

Guideline Appendices

- All productivity and $/LCY data compiled for various equipment
- DEQ to update yearly as cost inputs change
- All equipment related costs and assumptions must be sourced from the guideline

Table A-7. 100-Ton TSF Production with 9.0% Loaded Grade and -1.0% Empty Grade.

One-Way Haul Distance (ft)	Load Time (min)	Maneuver Time (min)	Loaded Travel Time (min)	Dump Time (min)	Empty Travel Time (min)	Total Cycle Time (min)	Trips Per Hour	Truck Payload (LCY)	Total Truck Production (LCY/hr)	Loader Production (LCY/hr)	Trucks Required	Total Cost ($/LCY)
500	3.25	0.70	0.62	1.10	0.14	5.81	10.3	75.0	775	1,149	1.5	$1.04
1,000	3.25	0.70	1.24	1.10	0.29	6.58	9.1	75.0	684	1,149	2.0	$1.15
1,500	3.25	0.70	1.86	1.10	0.43	7.34	8.2	75.0	613	1,149	2.0	$1.15
2,000	3.25	0.70	2.49	1.10	0.57	8.11	7.4	75.0	555	1,149	2.5	$1.26
2,500	3.25	0.70	3.11	1.10	0.71	8.87	6.8	75.0	507	1,149	2.5	$1.26
3,000	3.25	0.70	3.73	1.10	0.86	9.64	6.2	75.0	467	1,149	2.5	$1.26
3,500	3.25	0.70	4.35	1.10	1.00	10.40	5.8	75.0	433	1,149	3.0	$1.37
4,000	3.25	0.70	4.97	1.10	1.14	11.16	5.4	75.0	403	1,149	3.0	$1.37
4,500	3.25	0.70	5.59	1.10	1.29	11.93	5.0	75.0	377	1,149	3.5	$1.48
5,000	3.25	0.70	6.21	1.10	1.43	12.69	4.7	75.0	355	1,149	3.5	$1.48
5,500	3.25	0.70	6.84	1.10	1.57	13.46	4.5	75.0	334	1,149	3.5	$1.48
6,000	3.25	0.70	7.46	1.10	1.71	14.22	4.2	75.0	316	1,149	4.0	$1.59
6,500	3.25	0.70	8.08	1.10	1.86	14.99	4.0	75.0	300	1,149	4.0	$1.59
7,000	3.25	0.70	8.70	1.10	2.00	15.75	3.8	75.0	286	1,149	4.5	$1.69

Table F-2: Ripping with CAT D10 Dozer Multi-Shank

Operation	Value	Unit	Data Source
CAT D10 Dozer Total Cost	$363.00	$/hr	CMI Equipment Cost Calculator 2024-2025
Effective Ripping Width - Multi-Shank	11.50	ft	CPH 49, 120% of multi-shank width
Ripping Pass Overlap	0.0	ft	CPH 49
Dozer Ripping Speed	1.0	mph	CPH 49
Feet Per Mile	5,280	ft/mile	
Square Feet Per Acre	43,560	sqft	
Operating Efficiency	0.664		CPH 49, 80% of 0.83 standard eff.
Effective Ripping Production	**0.93**	**acres/hr**	
CAT D10 Ripping Total Cost	**$392.19**	**$/acre**	

Example Bond Calculation

Example Bond Calculation Topics

Direct Costs

- Backfilling and Grading
- Haul Road Removal
- Facilities Removal
- Scarification/Finish Regrade
- Soil Redistribution
- Revegetation
- Subcategory Costs

Indirect Costs

- Mobilization and Demobilization
- Engineering Redesign
- Contractor Profit
- Contractor Overhead
- Project Management
- Contingency

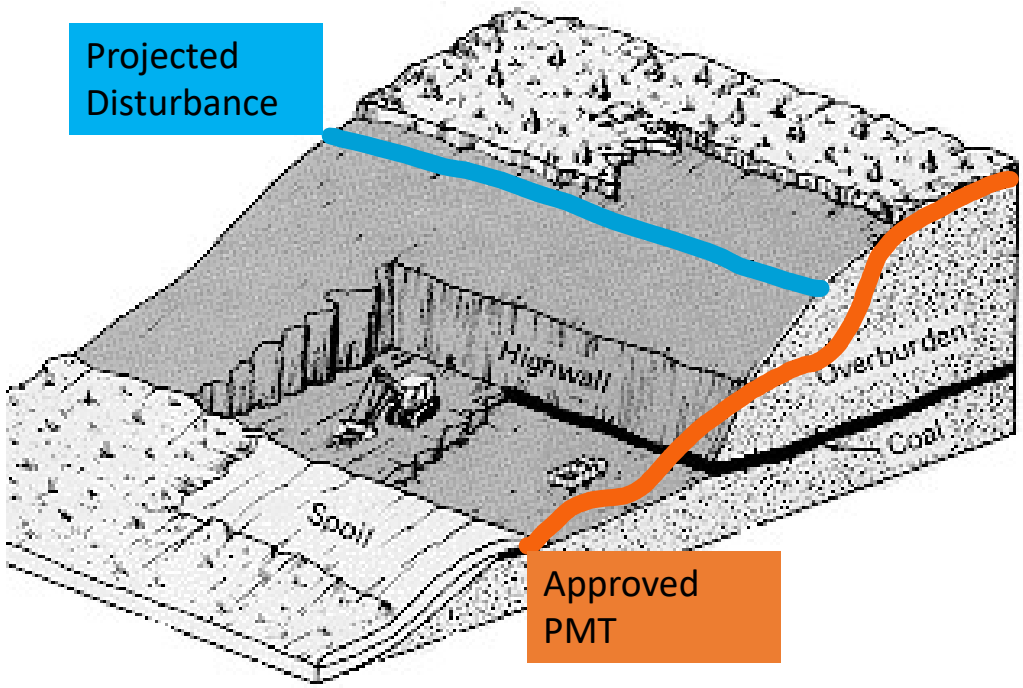
Backfilling and Grading

Calculate the total backfill/grading volume necessary to achieve PMT

All analysis must be completed between the worst-case projected disturbance surface and approved PMT

Identify areas of applicable equipment

- Dozer
- Truck/Shovel



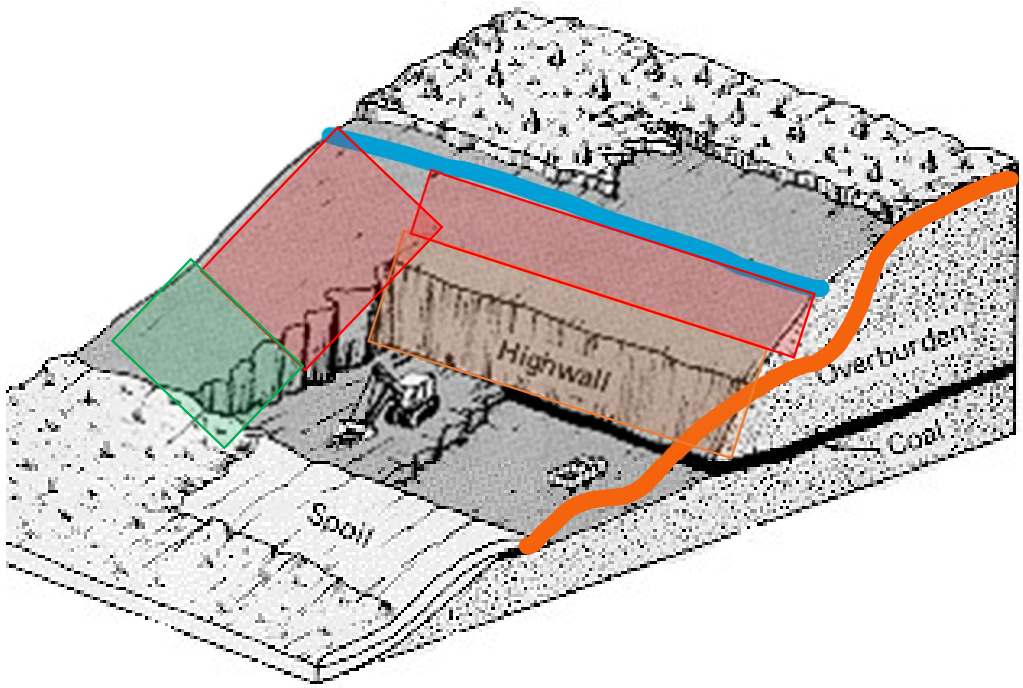
Backfilling and Grading

Total backfill/grading volume calculated – 20MCY

- 15MCY – dozer
- 5MCY – truck/shovel
- 2MCY – necessary highwall fragmentation

Associated AutoCAD calculations show additional details about the backfill and grading balance:

- Average dozer push distance and slope for each cut/fill balance polygon
- Average truck haul distance and slope for each T/S polygon



Backfilling and Grading

Determine Dozer fleet based on size consideration of necessary reclamation:

600-hp dozer production can be found in Appendix D Table D-4

Average 450 ft push with 10% grade

Table D4: Material Movement with CAT D10 Dozer

Push Distance (ft)	Unadjusted Production Rate (LCY/hr)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)
Grade:		-30%		-20%		-10%		0%		10%		20%		30%	
50	3,000	3,763	$0.10	3,337	$0.11	2,863	$0.13	2,366	$0.15	1,870	$0.19	1,302	$0.28	663	$0.55
100	1,800	2,258	$0.16	2,002	$0.18	1,718	$0.21	1,420	$0.26	1,122	$0.32	781	$0.46	398	$0.91
150	1,250	1,568	$0.23	1,390	$0.26	1,193	$0.30	986	$0.37	779	$0.47	542	$0.67	276	$1.31
200	950	1,192	$0.30	1,057	$0.34	907	$0.40	749	$0.48	592	$0.61	412	$0.88	210	$1.73
250	800	1,003	$0.36	890	$0.41	764	$0.48	631	$0.58	499	$0.73	347	$1.05	177	$2.05
300	675	847	$0.43	751	$0.48	644	$0.56	532	$0.68	421	$0.86	293	$1.24	149	$2.43
350	590	740	$0.49	656	$0.55	563	$0.64	465	$0.78	368	$0.99	256	$1.42	130	$2.79
400	510	640	$0.57	567	$0.64	487	$0.75	402	$0.90	318	$1.14	221	$1.64	113	$3.22
450	450	564	$0.64	501	$0.73	430	$0.85	355	$1.02	280	$1.29	195	$1.86	99	$3.65
500	425	533	$0.68	473	$0.77	406	$0.89	335	$1.08	265	$1.37	184	$1.97	94	$3.87
550	375	470	$0.77	417	$0.87	358	$1.01	296	$1.23	234	$1.55	163	$2.23	83	$4.38
600	350	439	$0.83	389	$0.93	334	$1.09	276	$1.31	218	$1.66	152	$2.39	77	$4.70

Backfilling and Grading

Determine T/S fleet based on size consideration of necessary reclamation:

Appendix A includes cost calculations for 100-ton T/S fleets

Assume -5.0% loaded road grade and 3,500 ft haul distance

Appendix Table A-5

Include blasting costs for all highwall reduction

Complete calculations for all T/S polygons.

Table A-3. 100-Ton TSF Appendix Table Summary (Caterpillar, 2011)[3]

Appendix Table	Loaded Road Grade	Rolling Resistance	Loaded Total Grade	Empty Total Grade
A-4	0.0%	4.0%	4.0%	4.0%
A-5	-5.0%	4.0%	-1.0%	9.0%
A-6	-10.0%	4.0%	-6.0%	14.0%
A-7	5.0%	4.0%	9.0%	-1.0%
A-8	10.0%	4.0%	14.0%	-6.0%

Table A-5. 100-Ton TSF Production with -1.0% Loaded Grade and 9.0% Empty Grade.

One-Way Haul Distance (ft)	Load Time (min)	Maneuver Time (min)	Loaded Travel Time (min)	Dump Time (min)	Empty Travel Time (min)	Total Cycle Time (min)	Trips Per Hour	Truck Payload (LCY)	Total Truck Production (LCY/hr)	Loader Production (LCY/hr)	Trucks Required	Total Cost ($/LCY)
500	3.25	0.70	0.14	1.10	0.28	5.47	11.0	75.0	823	1,149	1.5	$1.04
1,000	3.25	0.70	0.28	1.10	0.58	5.91	10.2	75.0	761	1,149	2.0	$1.15
1,500	3.25	0.70	0.42	1.10	0.83	6.30	9.5	75.0	714	1,149	2.0	$1.15
2,000	3.25	0.70	0.56	1.10	1.10	6.71	8.9	75.0	671	1,149	2.0	$1.15
2,500	3.25	0.70	0.70	1.10	1.40	7.15	8.4	75.0	629	1,149	2.0	$1.15
3,000	3.25	0.70	0.87	1.10	1.66	7.58	7.9	75.0	594	1,149	2.0	$1.15
3,500	3.25	0.70	0.98	1.10	1.91	7.94	7.6	75.0	567	1,149	2.5	$1.26
4,000	3.25	0.70	1.11	1.10	2.21	8.37	7.2	75.0	538	1,149	2.5	$1.26
4,500	3.25	0.70	1.25	1.10	2.50	8.80	6.8	75.0	511	1,149	2.5	$1.26
5,000	3.25	0.70	1.39	1.10	2.80	9.24	6.5	75.0	487	1,149	2.5	$1.26
5,500	3.25	0.70	1.53	1.10	3.08	9.66	6.2	75.0	466	1,149	2.5	$1.26
6,000	3.25	0.70	1.67	1.10	3.30	10.02	6.0	75.0	449	1,149	3.0	$1.37
6,500	3.25	0.70	1.81	1.10	3.61	10.47	5.7	75.0	430	1,149	3.0	$1.37
7,000	3.25	0.70	1.95	1.10	3.85	10.85	5.5	75.0	415	1,149	3.0	$1.37

Backfilling and Grading

Dozer Total
15MCY volume
450 ft average push distance
10% average slope grade
D11 dozer size equipment

+

T/S Total
5MCY volume
3,000 ft average haul distance
-5% average slope grade
100-ton fleet equipment

+

Blasting Total
2MCY volume

Contractor provided cost

=

Backfill and Grading Total
20MCY volume

Haul Road Removal

Total length of haul road that will need reclaimed before soil and seeding.

- Scoria removal
- Surface ripping
- Culvert removal (RS Means)

Use Appendix A and F to calculate costs after determining parameters

- 300k LCY volume
- 100-ton haul truck fleet
- 1,500 ft haul distance, 0.0% grade
- 30k ft of road, 80 ft width (55 acres)
- 200 ft of culvert

Table A-4

	Loaded: 0.0% road grade, 4.0% rolling resistance = **4.0% total equivalent grade**						**Empty:** 0.0% road grade, 4.0% rolling resistance = **4.0% total equivalent grade**					
One-Way Haul Distance (ft)	Load Time (min)	Maneuver Time (min)	Loaded Travel Time (min)	Dump Time (min)	Empty Travel Time (min)	Total Cycle Time (min)	Trips Per Hour	Truck Payload (LCY)	Total Truck Production (LCY/hr)	Loader Production (LCY/hr)	Trucks Required	Total Cost ($/LCY)
500	3.25	0.70	0.25	1.10	0.15	5.45	11.0	75.0	826	1,149	1.5	$1.04
1,000	3.25	0.70	0.56	1.10	0.30	5.91	10.2	75.0	761	1,149	2.0	$1.15
1,500	3.25	0.70	0.85	1.10	0.45	6.35	9.4	75.0	709	1,149	2.0	$1.15
2,000	3.25	0.70	1.13	1.10	0.60	6.78	8.8	75.0	664	1,149	2.0	$1.15
2,500	3.25	0.70	1.41	1.10	0.75	7.21	8.3	75.0	624	1,149	2.0	$1.15
3,000	3.25	0.70	1.69	1.10	0.90	7.64	7.9	75.0	589	1,149	2.0	$1.15
3,500	3.25	0.70	1.98	1.10	1.05	8.08	7.4	75.0	557	1,149	2.5	$1.26
4,000	3.25	0.70	2.26	1.10	1.20	8.51	7.1	75.0	529	1,149	2.5	$1.26
4,500	3.25	0.70	2.54	1.10	1.35	8.94	6.7	75.0	503	1,149	2.5	$1.26
5,000	3.25	0.70	2.82	1.10	1.50	9.37	6.4	75.0	480	1,149	2.5	$1.26
5,500	3.25	0.70	3.10	1.10	1.65	9.80	6.1	75.0	459	1,149	3.0	$1.37
6,000	3.25	0.70	3.39	1.10	1.80	10.24	5.9	75.0	439	1,149	3.0	$1.37
6,500	3.25	0.70	3.67	1.10	1.95	10.67	5.6	75.0	422	1,149	3.0	$1.37
7,000	3.25	0.70	3.95	1.10	2.10	11.10	5.4	75.0	405	1,149	3.0	$1.37

Table F-2: Ripping with CAT D10 Dozer Multi-Shank

Operation	Value	Unit	Data Source
CAT D10 Dozer Total Cost	$392.42	$/hr	CMI Reclamation Cost Guide 2024
Effective Ripping Width - Multi-Shank	10.56	ft	CPH 49, 120% of multi-shank gauge
Ripping Pass Overlap	0.0	ft	CPH 49
Dozer Ripping Speed	1.0	mph	CPH 49
Feet Per Mile	5,280	ft/mile	
Square Feet Per Acre	43,560	sqft	
Operating Efficiency	0.664		CPH 49, 80% of 0.83 standard eff.
Effective Ripping Production	**0.85**	**acres/hr**	
CAT D10 Ripping Total Cost	**$461.71**	**$/acre**	

Facilities Removal

All facilities and structures not approved for retention in postmining land use must be demolished and disposed of per approved permit conditions.

RS Means Cost Reference and contractor quotes are primarily utilized in calculations

- Mining related buildings (shops, warehouses, offices, etc.)
- Crushers
- Coal storage bunkers and silos
- Conveyor systems
- Fences
- Foundations
- Power lines
- Rail spurs and embankments
- Utilities
- Bridges
- Equipment and supply storage facilities
- Haul roads or hard-surface roads
- Scoria or shale pits
- Ponds and sediment traps
- Sewage lagoons
- Culverts
- Support facilities (fuel tanks, equipment ready-lines, water tanks, explosive storage tanks)

Scarification/Finish Regrade

Recontouring, scarification and drainage finish grading in preparation for topsoil placement. Add any additional costs for soil sampling based on permit commitments

Appendix E and F summarize grading and scarification costs

Disturbed Area – 4,350 acres

Soil Stockpiles – 210 acres

Phase 1 and 2 bond released areas – 1,231 acres

(Areas graded to PMT or have soil replacement with 2-years of vegetation establishment)

Total acres to be prepped for soil – 2,909 acres

Table E-3: CAT D10 Phase I Grading

Operation	Value	Unit	Data Source
CAT D10 Dozer Cost	$363.00	$/hr	CMI Equipment Cost Calculator 2024-2025
Effective Blade Width (Universal)	17.30	ft	CPH 49
Grading Pass Overlap	2.0	ft	CPH 49
Grading Speed	2.5	mph	CPH 49
Feet Per Mile	5,280	ft/mile	
Square Feet Per Acre	43,560	sqft	
Operating Efficiency	0.83		CPH 49
Effective Grading Production	**3.85**	**acres/hr**	
CAT D10 Finish Grading Total Cost	**$94.33**	**$/acre**	

Table E2: CAT 16 Finish Grading

Operation	Value	Unit	Data Source
CAT 16 Grader Total Cost	$159.21	$/hr	CMI Equipment Cost Calculator 2024-2025
Effective Blade Length (20°)	15.45	ft	CPH 49
Grading Pass Overlap	2.0	ft	CPH 49
Finish Grading Speed	2.5	mph	CPH 49
Feet Per Mile	5,280	ft/mile	
Square Feet Per Acre	43,560	sqft	
Operating Efficiency	0.83		CPH 49
Effective Grading Production	**3.38**	**acres/hr**	
CAT 16 Finish Grading Total Cost	**$47.06**	**$/acre**	

Soil Redistribution

Create CAD balance polygons describing initial soil stockpiles and destination locations

Data provided must include a soil balance spreadsheet reporting soil horizons and displaying a plan for full soil utilization throughout the permit site

Appendix A provides T/S costs for hauling while Appendix D can be utilized for dozing redistribution estimates

Table A-4

	Loaded: 0.0% road grade, 4.0% rolling resistance = **4.0%** total equivalent grade						**Empty:** 0.0% road grade, 4.0% rolling resistance = **4.0%** total equivalent grade					
One-Way Haul Distance (ft)	Load Time (min)	Maneuver Time (min)	Loaded Travel Time (min)	Dump Time (min)	Empty Travel Time (min)	Total Cycle Time (min)	Trips Per Hour	Truck Payload (LCY)	Total Truck Production (LCY/hr)	Loader Production (LCY/hr)	Trucks Required	Total Cost ($/LCY)
500	3.25	0.70	0.25	1.10	0.15	5.45	11.0	75.0	826	1,149	1.5	$1.04
1,000	3.25	0.70	0.56	1.10	0.30	5.91	10.2	75.0	761	1,149	2.0	$1.15
1,500	3.25	0.70	0.85	1.10	0.45	6.35	9.4	75.0	709	1,149	2.0	$1.15
2,000	3.25	0.70	1.13	1.10	0.60	6.78	8.8	75.0	664	1,149	2.0	$1.15
2,500	3.25	0.70	1.41	1.10	0.75	7.21	8.3	75.0	624	1,149	2.0	$1.15
3,000	3.25	0.70	1.69	1.10	0.90	7.64	7.9	75.0	589	1,149	2.0	$1.15
3,500	3.25	0.70	1.98	1.10	1.05	8.08	7.4	75.0	557	1,149	2.5	$1.26
4,000	3.25	0.70	2.26	1.10	1.20	8.51	7.1	75.0	529	1,149	2.5	$1.26
4,500	3.25	0.70	2.54	1.10	1.35	8.94	6.7	75.0	503	1,149	2.5	$1.26
5,000	3.25	0.70	2.82	1.10	1.50	9.37	6.4	75.0	480	1,149	2.5	$1.26
5,500	3.25	0.70	3.10	1.10	1.65	9.80	6.1	75.0	459	1,149	3.0	$1.37
6,000	3.25	0.70	3.39	1.10	1.80	10.24	5.9	75.0	439	1,149	3.0	$1.37
6,500	3.25	0.70	3.67	1.10	1.95	10.67	5.6	75.0	422	1,149	3.0	$1.37
7,000	3.25	0.70	3.95	1.10	2.10	11.10	5.4	75.0	405	1,149	3.0	$1.37

Volume of soil to be redistributed – 5.5MCY

Average haul distance – 3,500 ft

Average grade – 0.0%

Soil Redistribution

Redistribution of relocated soil material applied after hauling

Appendix D Table D-4 has production and cost calculations for 600-hp dozers (D10)

Volume of soil to be redistributed – 5.5MCY

Average push distance – 150 ft

Average grade – 0.0%

Push Distance (ft)	Unadjusted Production Rate (LCY/hr)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)	Modified Production Rate	Costs ($/LCY)
Grade:		-30%		-20%		-10%		0%	
50	3,000	3,763	$0.10	3,337	$0.11	2,863	$0.13	2,366	$0.15
100	1,800	2,258	$0.16	2,002	$0.18	1,718	$0.21	1,420	$0.26
150	1,250	1,568	$0.23	1,390	$0.26	1,193	$0.30	986	$0.37
200	950	1,192	$0.30	1,057	$0.34	907	$0.40	749	$0.48
250	800	1,003	$0.36	890	$0.41	764	$0.48	631	$0.58
300	675	847	$0.43	751	$0.48	644	$0.56	532	$0.68
350	590	740	$0.49	656	$0.55	563	$0.64	465	$0.78
400	510	640	$0.57	567	$0.64	487	$0.75	402	$0.90
450	450	564	$0.64	501	$0.73	430	$0.85	355	$1.02
500	425	533	$0.68	473	$0.77	406	$0.89	335	$1.08
550	375	470	$0.77	417	$0.87	358	$1.01	296	$1.23
600	350	439	$0.83	389	$0.93	334	$1.09	276	$1.31

Soil Redistribution

T/S Total
5.5MCY volume
3,500 ft average push distance
0.0% average haul grade
100-ton fleet equipment

Dozer Total
5.5MCY volume
150 ft average haul distance
0.0% average slope grade
D10 dozer size equipment

Soil Redistribution Total
5.5MCY volume

Revegetation

Calculations for revegetation should consist of seedbed preparation, soil sampling, soil amendment application, seeding, planting and mulching

Historic site-specific costs based on contracted work

Seed bed prep

Seeding equipment and planting cost

Disturbed Area – 4,350 acres

Phase 3 bond released areas – 345 acres

(Areas with 10-years of established vegetation)

Total revegetation acres – 4,005 acres

Subcategory Reclamation Costs

Hydrocarbon sampling

Facilities sampling post removal

Site monitoring

Well Maintenance, sensor monitoring

Pit Dewatering

Dewatering before backfill

Drilled Holes

Monitoring wells, prospecting holes

Hazardous Waste Disposal

Landfarm material, facilities hazardous material

Post-Mining Site Management

Personnel travel, engineering

Additional costs for items necessary to successful reclamation should be considered

Total Direct Costs

Reclamation Item	Cost per Item
Backfill and Grading	$ 15,050,000
Haul Road Removal	$ 460,000
Facilities Removal	$ 1,210,000
Scarification/Finish Regrade	$ 470,000
Soil Redistribution	$ 9,190,000
Revegetation	$ 1,200,000
Subcategory Reclamation Costs	$ 920,000
Total Direct Costs	*$ 28,500,000*

EXAMPLE COSTS

Inflation Factor (RS Means City Cost Index for 2024-2025)

Reclamation Item	Cost per Item
Backfill and Grading	$ 15,305,850
Haul Road Removal	$ 467,820
Facilities Removal	$ 1,230,570
Scarification/Finish Regrade	$ 477,990
Soil Redistribution	$ 9,346,230
Revegetation	$ 1,220,400
Subcategory Reclamation Costs	$ 935,640
Total Direct Costs Including Inflation	*$ 28,984,500*

Inflation factor based on bond calculation permit renewal cycle (RS Means City Cost Index 2024-2025)

Total Indirect Costs

Reclamation Item	Cost per Item
Backfill and Grading	$ 15,305,850
Haul Road Removal	$ 467,820
Facilities Removal	$ 1,230,570
Scarification/Finish Regrade	$ 477,990
Soil Redistribution	$ 9,346,230
Revegetation	$ 1,220,400
Subcategory Reclamation Costs	$ 935,640
Total Direct Costs Including Inflation	*$ 28,984,500*

Indirect Cost Item	Percentage of Total Inflated	Cost per Item
Mobilization and Demobilization	3.0%	$ 869,535
Engineering Redesign	4.0%	$ 1,159,380
Contractor Profit and Overhead	20.0%	$ 5,796,900
Project Management	3.0%	$ 869,535
Contingencies	5.0%	$ 1,449,225
Total Indirect Costs	*35.0%*	*$ 10,144,575*

Bond Calculation Summary

Summary table of all calculated items

EXAMPLE COSTS

Reclamation Item	Quantity	Units	$/Unit	Cost per Item
Direct Costs				
Backfill and Grading	20,000,000	LCY	$ 0.75	**$ 15,050,000**
Haul Road Removal				**$ 460,000**
Facilities Removal				**$ 1,210,000**
Scarification/Finish Regrade	2,909	acres	$ 161.57	**$ 470,000**
Soil Redistribution	5,500,000	LCY	$ 1.67	**$ 9,190,000**
Revegetation	4,005	acres	$ 299.63	**$ 1,200,000**
Subcategory Reclamation Costs				**$ 920,000**
Total Direct Costs				***$ 28,500,000***
Inflation Factor	1.7%			**$ 484,500**
Total Inflated Direct Costs				***$ 28,984,500***
Indirect Costs				
Mobilization and Demobilization	3.0%			**$ 869,535**
Engineering Redesign	4.0%			**$ 1,159,380**
Contractor Profit and Overhead	20.0%			**$ 5,796,900**
Project Management	3.0%			**$ 869,535**
Contingencies	5.0%			**$ 1,449,225**
Total Indirect Costs				***$ 10,144,575***
Closure Cost Total				**$ 39,129,075**
TOTAL BOND AMOUNT (round up to nearest $50,000)				**$ 39,150,000**

Connect with us!

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Comments accepted through October 20, 2025
https://deq.mt.gov/News/publicmeetings-folder/CoalBondGuidelines082125

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