

RECLAMATION BUDGETING AND COSTS  
IN COAL EXPLORATION

Panel Discussion with:

D.M. GALBRAITH  
INTRODUCTION

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## INTRODUCTION

by

D.M. Galbraith

There is a need to determine realistic reclamation cost statistics which are related to: the type of terrain being explored; the nature of the work involved; and the sensitivity of the resources being protected. These costs are useful both for the companies in the estimating of future costs, and for the Inspection and Engineering Branch in assessing bonding under Section 9 of the Coal Mine Regulation Act.

The maximum limit of reclamation bonding is \$2,400 per ha. The actual cost of reclamation may be much higher (for example the pulling back of a road cut on steep terrain) or much lower (for example a drill site on flat terrain).

Factors which are considered in establishing bonding are:

1. Total cost of reclamation.
2. Operator's capability:
  - past record
  - current capability
  - proposed program
3. Environmental values.

Cost statistics are of value, particularly to reclamation inspectors in the field who review proposed programs and make recommendations for approval to the Chief Inspector.

In 1981, 69 programs were approved, which compares with 71 programs approved in 1980.

CROWS NEST RESOURCES LIMITED  
EXPERIENCE  
by  
E.W. Fabro and R. Aiello

ABSTRACT

Due to the minimal amount of reclamation required, exploration reclamation costs are not usually included as a separate budget item when exploration program costs are estimated for the plains and foothills. Reclamation costs are normally less than 1% of the plains programs and range from 3% to 5% of the total program costs of the foothills programs. Depending on program size, exploration reclamation in the foothills and mountains may or may not be included as a separate budget item. In these areas budgeting for exploration reclamation can be very difficult due to the number of topographic and environmental variables involved. Within Crows Nest Resources Limited to date, logistic personnel have budgeted costs for exploration and reclamation in mountainous areas by estimating costs without the benefit of detailed cost figures from previous programs for comparison. Detailed accounting sheets in use for present exploration programs will assist in budgeting for new work. Budget estimates will improve as itemized cost data is collected.

CROWS NEST RESOURCES LIMITED MAJOR PROSPECT AREAS

Crows Nest Resources Limited has under coal licence, lease or freehold title a total of 381,000 ha (941,000 acres) of coal lands in western Canada. Scattered throughout Saskatchewan, Alberta and British Columbia, the areas vary tremendously in their topography and environmental conditions, factors which can make exploration and reclamation budgeting complex and difficult.

The greatest portion of these lands have had minimal exploration done on them and we are currently in a major exploration phase with hopes to develop those that are environmentally and economically feasible.

EXPLORATION BUDGETING

The topographic, geologic and environmental variations in the various prospect areas make it difficult to estimate the cost of an exploration and reclamation program. Costs can vary tremendously in any given

situation and there is no general rule or formula that can be followed. The best estimates for these programs comes from a person who has had experience in exploration and reclamation. within CNRL, logistics personnel estimate total program costs (exploration and reclamation) with input as required from geologists and environmental personnel. Although there are great differences in the individual prospect areas we can group the properties into three topographic units; plains, foothills and mountains.

#### *PLAINS*

Exploration on the plains has in the past resulted in minimal environmental disturbance. Reclamation on these project areas consists of the spreading of drill chips from rotary holes, and seeding and fertilizing of the roads and drill sites. The reclamation expenses have been of such a low amount (less than 1% of the total exploration budget) that they have not been included as a separate item when exploration programs are estimated.

#### *FOOTHILLS*

Reclamation undertaken in the foothills consists mainly of slashing (where required), provisions for adequate drainage and erosion controls as well as seeding and fertilizing roads and drill sites.

Greater variations in the topography, and tree cover and the additional drainage control requirements in these areas result in higher costs for reclamation than what is required for the plains. However, as in the plains a separate reclamation budget item is not included in the total exploration budget due to the minimal reclamation costs relative to the overall exploration budget. Reclamation costs in the foothills are estimated at 3% to 5% of the cost of the total exploration program.

#### *MOUNTAINS*

Extremely large variations in topographic and environmental factors in the mountains creates difficulty in estimating exploration costs. Major factors which are considered by the logistic personnel in estimating exploration programs include:

1. length and slope of roads;

2. strike, dip and type of rock strata exposed or estimated to be sub surface (rock strength and orientation affects construction costs);
3. timber values (generally merchantable timber creates increased road building costs over non-merchantable timber due to increased costs of salvaging timber along narrow roadways. Non-merchantable timber is buried within the road bed and/or slashed, which results in lower costs);
4. type of equipment required to construct roads and drill sites which will minimize environmental disturbance;
5. drainage and erosion control requirements;
6. type of reclamation required and the degree to which it is carried out.

Reclamation costs are not considered as a separate budget item if the program is small and the requirement for adequate reclamation is minimal. In these cases, as in the plains and foothills areas, reclamation costs are budgeted as a part of road-building costs.

In cases where reclamation is considered to be a major consideration in the overall exploration program it is designated as a separate budget item. Logistic personnel in liaison with environmental personnel can estimate reclamation costs by examining the major factors that go into making up a reclamation program.

These factors are:

1. type of machine(s) required and the estimated number of hours for each (including operators);
2. need and extent of slash abatement required;
3. drainage and erosion control requirements;
4. cost of seed and fertilizer;
5. manhour time for seed and fertilizer spreading;

6. helicopter time (if required) for seed and fertilizer spreading;
7. various miscellaneous items.

Reclamation costs for major programs can vary from 5% to 10% of the total program budget depending on the type and amount of reclamation required.

#### RECLAMATION COSTS FOR TWO MOUNTAIN PROSPECTS IN BRITISH COLUMBIA

As indicated previously, reclamation costs can vary widely depending on the site specific conditions. Two of CNRL's prospect areas are compared to give the reader an idea of the cost differences (see Tables 1 [a] and 1[b]). The Ewin Pass area may not represent true reclamation costs for a subalpine environment as a large amount of reclamation was undertaken on prelegislation disturbances.

#### COST ACCOUNTING FOR EXPLORATION

During the course of an exploration program detailed daily costs sheets are completed that indicate where expenditures occur (Table 2). These are completed to:

1. reduce the chances for budget overruns;
2. assist in the future estimating of exploration and reclamation costs for upcoming programs in similar terrain;
3. define where expenditures lie for work credits against coal licences (required only in British Columbia as per the form, "Extending the Terms of a Coal Licence").

This basic accounting system is a modified version of the system used by our parent company, Shell Canada Resources Ltd. in their oil and gas exploration programs. Our "coal" version has not been used long enough to be of significant value when estimating budgets for new programs. As further cost data is accumulated for the various programs, better estimates will result.

TABLE 1 (a)

RECLAMATION COSTS ON TWO MOUNTAIN PROSPECT AREAS  
(1981 DOLLARS/HECTARE)

	Pine Pass Northeast B.C. Elevation <u>700 m to 1370 m</u>	Ewin Pass Southeast B.C. Elevation <u>2100 m to 2190 m</u>
Slash Abatement	\$7,600 less <u>520</u> (Timber sale) \$7,080	not required
Drainage Control	900	\$ 240
Pull back to contour	not required	9,300
Seed, fertilizer and application	380	640
Maintenance Seed and Fertilizer Application	not required	350
	<hr/>	<hr/>
Total	\$8,360	\$10,530

TABLE 1 (b)

DETAIL OF RECLAMATION UNDERTAKEN

Pine Pass

Slash abatement	Includes cutting of the road right-of-way (10 m) and decking all merchantable timber.
Drainage control	Includes culvert installation, ditching of all access roads and cross-ditching right-of-ways at the end of the season.
Seed and seed	Includes cost of labour and machinery. Fertilizer application was not required.

Ewin Pass

Drainage control	Includes the re-installation of culverts and the re-opening of existing ditches on the major existing access road at the beginning of the season and removing culverts at the end of the season to allow for unrestricted drainage during the following spring.
Pull back to contour	Includes the cost of a Caterpillar 225 backhoe and a Caterpillar D7-G dozer. Costs are high as previously constructed pre-legislation, steep gradient roads were reclaimed using the dozer to anchor the backhoe (effectively doubling the equipment costs).
Seed, fertilizer and application	Includes cost of seed, fertilizer and labour, supervision and support costs.
Maintenance seed and fertilizer	Includes the cost of seed, fertilizer, labour, helicopter, supervision and support costs.





DISCUSSION RELATING TO M. GALBRAITH'S AND G. FABRO'S PAPERS

Jack Thirgood, U.B.C.; What are your costs of your program in Alberta?

Answer, Gene Fabro; Well as I mentioned previously it is usually less than 1% in the prairies and 3% to 5% in the foothills area so depending on the general exploration program I guess probably a ball park estimate would be a figure of \$1,000 a hectare or less.

Jack Thirgood, U.B.C.; So it is less than in B.C.?

Answer, Gene Fabro; Well probably because of the topographic conditions.

Ned Pottinger, Hardy Associates! In your slash figures you mentioned \$7,000 and then you mentioned something about salvaging the timber costing you more than it was worth?

Answer, Gene Fabro; Well yes we've got the roadway so narrow that it would cost a lot of time and money to salvage the merchantable timber compared to cutting and burying the timber.

Neil Duncan, Energy Resources Conservation Board; I have a question for both men - how does the actual reclamation bond placed at the beginning compare with the actual reclamation costs?

Answer, Murray Galbraith; Well its a fairly subjective assessment because of the number of factors involved. I think that one principal that might have already been mentioned is the fact that it is probably best to start with low bonding because then you have the option of rewarding good performance. Secondly I suppose also that if other mines spent money on reclamation where it is supposed to be spent, then bonding is a secondary consideration; you can always go up, but its difficult to come down.

Jack Thirgood, U.B.C.; How can you reward good performers if you have already started with a bond that is assessed at less than the actual cost?

Answer, Murray Galbraith; Well as you saw Jack the amount of reclamation being done exceeds the legislative limit, and that is the object of the whole exercise in the first place.

Jack Thirgood, U.B.C.; Couldn't you make a case for increasing the legislative limit?

Answer, Murray Galbraith; No I don't think so because what we're trying to do is get the reclamation going and if that is done at no cost to reclamation bonding then you've achieved what you've set out to do.

Answer, Art O'Brian; The original bond is placed on the submission of the initial work so that on subsequent projects bonding can be reviewed. Bonding can then fluctuate on an annual basis depending on whether you increase or decrease your activity in sensitive areas, plus your past year's performance.

Neil Duncan, Energy Resources Conservation Board; Is there a waiting period between the actual examination and completion of reclamation and the return of the bond? Doesn't it require a long period until the natural vegetation re-establishes?

Answer, Murray Galbraith; It varies with the type of work done and the particulars of the site. The cost of recontouring is probably 80% of the total cost. If the recontouring is done then you're safe in returning the reciprocal amount of bonding.

GULF CANADA RESOURCES

EXPERIENCE

by

G. Hellyer

DISCUSSION RELATING TO GARY HELLYER'S PAPER

Jack Thirgood, U.B.C.; On the area where you reclaim for forest are you required to make productive forest land?

Answer; In the areas that we've been exploring right now we haven't been making that large a disturbance and the sites themselves are usually not far off of existing roads. We usually drill along the road allowance. We haven't done replanting of forest because of the smallness of the areas of disturbance. For what we're doing, the seeding is quite adequate.

Jack Thirgood, U.B.C.; (Distorted reading. The question related to the extent of revegetation activities.)

Answer; Not in the true sense. We're not replanting trees. The areas of disturbance really aren't large enough for a tree-planting operation.

FORDING COAL LIMITED

EXPERIENCE

by

R.J. Berdusco

Fording Coal Limited's Fording River operation lies within the East Kootenay region of British Columbia at elevations between 1,500 m and 2,500 m above sea level.

Exploration activities (access road construction, drilling and adit work) have been ongoing since 1967.

The total area disturbed by exploration to the end of 1981 was 137 ha, while the area reclaimed (including 13 ha in 1981) is 78 ha.

The balance of 59 ha represents exploration access roads required for long term use or disturbances that lie within areas to be mined in the near future.

Average road widths are 6 m running surface on average 60% side slopes.

A summary of the cost experience for 1981 reclamation activities on exploration disturbances follows:

1.	Resloping with 225 cat excavator <sup>1</sup>	\$2.29/m
2.	Ripping with D5 cat dozer <sup>1</sup>	.13/m
3.	Ditching and waterbarring with D5cat dozer	.72/m
4.	Seeding and fertilizing	
	- Seed cost	.20/m
	- Fertilizer cost	.07/m
	- Labour to seed/fertilize	
	- with backhoe operation	.27/m
	- with D5 operation	.03/m
5.	Helicopter Bell 206B (maintenance) fertilizing	
	- Machine	.13/m
	- Labour	.02/m
	- Fertilizer	<u>.15/m</u>
	Total	\$ .30/m

<sup>1</sup>Including culvert removal and watershed re-establishment.

Representative average total costs for the two major reclamation activities would then be:

1. Resloping, seeding and fertilizing:

$$\$2.29/\text{m} + \$ .20/\text{m} + \$ .07/\text{m} + \$ .27/\text{m} = \$2.83/\text{m}$$

2. Ripping, ditching, waterbarring, seeding and fertilizing:

$$\$ .13/\text{m} + \$ .72/\text{m} + \$ .20/\text{m} + \$ .07/\text{m} + \$ .03/\text{m} = \$1.15/\text{m}$$

The figures used are direct costs and do not include administrative and overhead costs.