

RECLAMATION OF COAL MINES  
IN THE PLAINS REGION  
- THE DIPLOMAT MINE -

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## INTRODUCTION

Reclamation of land disturbed during surface mining of coal in the plains region of Alberta has become an important issue in the last decade. This corresponds to the increasing concerns over environmental protection and land use in the plains region. To secure public and government acceptance of surface coal mining, which is largely related to electrical power generation, industry is well aware that successful land reclamation is essential.

In line with the theme of this Conference to highlight reclamation progress, the objective of this paper is to put into perspective current land reclamation practices and successes of these programs. To this end, specific reference is made to the Diplomat Mine operated by Luscar Ltd.'s subsidiary Forestburg Collieries Ltd. near Forestburg, Alberta.

## AN HISTORICAL PERSPECTIVE ON RECLAMATION

To place today's land reclamation programs into perspective, a brief review of the development of reclamation practices would be useful. The Diplomat Mine, operated for over 30 years in east central Alberta provides a good basis for such a review.

Coal mining along the Battle River in the Forestburg area dates back to 1907. Initially, coal was produced from underground mines. Surface mining was introduced to the area by 1950, providing improved production, increased coal recovery and safer working conditions. Coal production and related surface disturbances were relatively small in the early days, but increased significantly with the opening in 1956 of the Battle River Generating Station and subsequent expansions. For example, in 1950 coal production was approximately 77,000 tonnes (85,000 tons) while in recent years production has reached 908,000 tonnes (1,000,000 tons) annually requiring the yearly mining of 30 to 40 hectares (75 to 100 acres).

Reclamation practices over the life of the Diplomat Mine have gone through three distinct periods, corresponding to changes in reclamation laws and regulations. The first period, for the years up to 1963, was characterized by minimal reclamation requirements. Mining operations were relatively small at this time and environmental protection and land use were not the issues they become today. During this period the mine conducted a program of levelling off the peaks of spoil ridges, broadcasting a forage mixture and planting trees. Land use options were severely limited by the rough terrain. However, the spoil materials, consisting predominantly of clean (or salt free) glacial till, are a fairly suitable plant growth material and revegetation has generally been very successful. Approximately 65 hectares

(160 acres) remain in this condition at the mine, providing grazing lands and wildlife shelter. A further 154 hectares (380 acres) were upgraded by the County of Flagstaff and Alberta Environment in the 1970's.

The second reclamation period began in 1963 with the enactment of the Surface Reclamation Act and lasted until 1973. Standards of reclamation at this time were set by the Reclamation Council and at Diplomat required the levelling program to be increased to create rolling lands following mining. Although more accessible, the productivity of these lands is limited by the characteristics of the spoil materials which form the new "soil". Approximately 300 hectares (740 acres) are reclaimed to this standard at the mine.

Increasing concerns over protection of environmental quality and land use resulted in the re-vamping of reclamation standards in the Land Surface Conservation and Reclamation Act of 1973. This initiated the third and present reclamation era for the Diplomat Mine. This new Act, with subsequent regulations and guidelines, greatly increased the reclamation standards to, in the words of the 1976 Alberta Coal Policy, "ensure that the mined or disturbed land will be returned to a state which will support plant and animal life or be otherwise productive or useful to man at least to the degree it was before it was disturbed". The new guidelines emphasized the need for pre-development planning to integrate mining and reclamation programs. In particular, this has meant considering the characteristics of soil and overburden (materials lying between the land surface and coal seam) in terms of suitability as a root zone material and subsequently developing methods by which a productive landscape and soil could be re-established. At Diplomat this translated into a program of topsoil salvage and replacement and the careful, deep burial of unsuitable bedrock materials which are occasionally encountered. Additionally, the degree of levelling was increased such that lands are returned to contours similar to those originally existing and capable of intensive cultivated agriculture. Initially, most of these lands were seeded to a grass-legume forage crop. Encouraged by the excellent hay yields on these first areas, in 1979 the reclamation program was altered and approximately 40 hectares (100 acres) of newly levelled and topsoiled land was put immediately into cereal crop production. Wheat yields of 32 bushels per acre were obtained, production comparable to those on surrounding farms. It is noteworthy that management inputs (fertilizer, cultivation) were guided by standard recommendations and similar on the mined and unmined lands. The cereal cropping program has since been expanded to include over 113 hectares (280 acres) at the mine and yields have remained comparable to surrounding farms.

Under the current regulations, a company remains responsible to conduct reclamation until a "Reclamation Certificate" has been issued by the Land Conservation and Reclamation Council, a body

comprised of representatives from the provincial and municipal governments. In early 1980, Forestburg Collieries Ltd. applied for certification of several parcels of lands at Diplomat. Following a review lasting almost two years and including a formal "Inquiry", numerable field inspections, some touch-up work and considerable discussion, the mine was issued Reclamation Certificates covering approximately 110 hectares (270 acres) of mined lands in November, 1981. These were the first certificates issued to a surface mine in the province under the current regulations and signify that mined lands can be returned to their previous level of productivity given cooperative efforts on the part of industry and government.

Subsequently in 1982 an additional 52 hectares (130 acres) were approved, bringing the total amount of mined land certified at Diplomat to 162 hectares (400 acres).

#### PLAINS SURFACE MINING OF COAL FOR POWER GENERATION

While examining, the Diplomat Mine gives a useful historical perspective of the development of land reclamation; it provides only a partial picture of the reclamation requirements connected with a modern plains coal mine and related electrical generating facility. Coal-fired electrical generating stations, either existing or under construction, are becoming common in the plains region. These facilities today provide approximately 70 percent of Alberta's electrical power requirements. A brief review of the scale of operations connected with a facility points out the potential land use conflicts and land reclamation requirements.

An electrical generating station with a production capacity of approximately 750 megawatts requires about 2.7 to 3.6 million tonnes (3 to 4 million tons) of coal annually. Over a project life of roughly 30 years coal supply requirements would require a mine permit area of from 40 to 50 square kilometers (15 to 20 square miles), depending on characteristics of the coal reserves. Capital investment in such a project is currently in excess of \$1 billion, while the electricity generated from one plant of this size is sufficient to meet the demand of a city the size of Edmonton. The magnitude of such projects emphasizes not only the obvious need for effective land reclamation, but also that reclamation operations, the cost of which is reflected in electrical power rates, must be well planned and efficiently conducted.

## RECLAMATION PLANNING AND OPERATIONS

Securing public and governmental approval of plains coal mine developments today requires assurances of satisfactory land reclamation. Without these assurances, it has been clearly shown the projects will not "get off the ground". The review process through which a proposed project must pass is extensive, requiring detailed studies and planning. Good planning is also needed to ensure that reclamation activities are integrated as closely as possible to mining, thereby getting the most efficiency out of field operations.

In developing a reclamation plan, three major points must be examined, including: (1) existing features of the landscape (land use, soils, geology and hydrology), (2) requirements of the mine plan (characteristics of the coal deposit, production requirements, equipment capabilities, coal conservation requirements, etc.) and (3) reclamation objectives (specifically, post mining land use). After considering these points, methods must be developed to meet the reclamation objectives. These plans must at the same time be acceptable to the government approving agencies, practical from a field operation standpoint and efficient from a cost viewpoint.

Selecting the final land use objective is an important consideration in a reclamation plan. In the plains region, the strongest emphasis has generally been placed on returning or creating new agricultural land. Some accommodation for wildlife and recreational land uses is also usually made. For example, at the Diplomat Mine, provision was made to create a pond in a final mine pit. The pit was contoured, surrounding lands revegetated, and a waterbody established with depths of up to 7 meters (23 feet) and a surface area of approximately 6 hectares (15 acres). In a cooperative program, the mine, the County of Flagstaff, the Iron Creek Fish and Game Club, and the provincial Fish and Wildlife Division subsequently successfully stocked the pond with trout, creating what is becoming a popular local recreational facility on reclaimed lands.

Where lands are to be returned to agricultural production, considerable emphasis is placed on describing the characteristics and distribution of soil and overburden materials to determine those which are suitable and required for re-establishing a root zone capable of sustaining agricultural production. Bedrock materials in many plains coal mining regions are unsuitable materials because of sodium and fine swelling clay content producing poor physical structure. Detailed soil surveys supplemented by deeper sampling and overburden analysis have proven to be acceptable methods of characterizing pre-mining conditions. Based on this information materials handling plans can be developed to define what soil materials will be salvaged and by which methods. Reclamation is very much an earth-moving operation. Current practices may include separate salvage and replacement of topsoil and subsoil materials to re-create a soil base. The capability of the re-established soil is to a

very large degree determined by the pre-mining characteristics of the land.

Practical constraints occur under field conditions and must also be considered in developing reclamation plans. For example, equipment size and climatic factors will influence the selectivity of topsoil salvage operations. As a result soils on reclaimed lands can be expected to be slightly different than those in the pre-mining condition, although they may not be any less productive. At the Diplomat Mine for example, farm soils are quite acidic, but through the salvage operations (wherein some subsoil is mixed with the topsoil) reclaimed soils have a pH in the more favourable neutral range. Some adjustment of farm management practices would be appropriate for these new types of soil.

#### CONCLUSION

The preceding discussion attempts to put into perspective some of the issues surrounding plains coal mining reclamation. Particular points hopefully highlighted in the discussion include:

- Effective land reclamation is viewed today by the public, government and industry as a necessity for coal mines in the plains region of Alberta.
- Reclamation technology and practices have changed dramatically, particularly in the last 5 to 10 years.
- Integration of land reclamation and mining operations has occurred due to pre-development planning and consideration of practical aspects. The result is more effective and efficient reclamation.
- Successful land reclamation, re-establishing former agricultural productivity to mined lands can be accomplished, as demonstrated at the Diplomat Mine. In this regard, coal mining can be viewed as a temporary use of the land surface.

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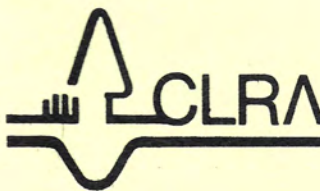
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## INTRODUCTION

Last Spring the Provincial Government's Reclamation Research Technical Advisory Committee presented a two day Reclamation Research Seminar at the Chateau Lacombe. We were surprised by the large turnout and an overwhelming majority of those in attendance indicated the desirability of an Annual Reclamation Conference for Alberta which would focus on Policy and Practice as well as Research and which would include industry, academic and government participation.

These were very sensible suggestions though their implementation would exceed the mandate and manpower of the Reclamation Research Technical Advisory Committee. So various groups were contacted to sponsor and help organize the Conference. Positive responses were received from the Canada Land Reclamation Association (CLRA) The Alberta Government's Land Conservation and Reclamation Council, The Coal Association of Canada and The Oil Sands Environmental Study Group (OSESg).

The CLRA authorized formation of an Alberta Chapter to serve as the umbrella organization with a Program Committee consisting of representatives of the Government and the two Industry groups. Through this Conference and perhaps other functions the Alberta Chapter of the CLRA can fulfill two important roles:

1. To provide an opportunity for members of the Reclamation community to meet, exchange experiences or argue and otherwise improve communications among its industry, government and academic factions.
2. To provide a public forum for reclamation activities, capabilities, issues and challenges.

This was the first function of its kind in Alberta. Special thanks are due the Sponsors, Speakers and the other Members of the organizing Committee: Jennifer Hansen, Malcolm Ross and Al Fedkenheuer. Their talents and efforts made the Conference a success.

One final word on the Speakers: they were given very short notice of the Conference and not only responded enthusiastically but prepared presentations which were of remarkable quality and consistency. We are fortunate to have individuals of this caliber working in the Field of Reclamation in Alberta.

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