

PLANNING, ENVIRONMENTAL PROTECTION
AND RECLAMATION TECHNIQUES ON
THE SAXON PROJECT,
PEACE RIVER COAL BLOCK

Denison Coal Limited
Calgary, Alberta
Geoff Jordan and Georgia Hoffman

PLANNING, ENVIRONMENTAL PROTECTION
AND RECLAMATION TECHNIQUES ON
THE SAXON PROJECT, PEACE
RIVER COAL BLOCK

Geoff Jordan and Georgia Hoffman

ABSTRACT

The Saxon property of Denison Coal Limited is located adjacent to the Alberta Provincial Boundary in the eastern foothills of the Rocky Mountains within the Peace River Coal Block of British Columbia. Exploration on the property was first carried out in 1970, at which time drill intersections of a high quality metallurgical coking coal were made. A long range plan of exploration commenced in 1975 with a program of detailed geological mapping being followed by intensive exploration aimed at completing a feasibility study towards the end of 1977.

Long range planning has not only allowed the precise objectives of the exploration program to be determined, but also allowed strict measures for environmental protection to be imposed. Consequently, a significant reduction in the amount and cost of reclamation of disturbed surface area is anticipated.

Hand trenching, helicopter drilling, bridge construction and other techniques have already made significant contributions to reduction of surface disturbance, and new techniques are currently being employed to further reduce surface disturbance and the cost of reclamation, as well as to reduce exploration costs in some instances.

INTRODUCTION

An Exploration Reclamation Philosophy

The approach taken towards an exploration program and subsequent reclamation should be significantly different from procedures adopted for mine site and spoil dump reclamation.

In mine site developments, the movement of a large volume of material is required so that the natural resources lying beneath the surface may be economically extracted. Thus, mine site reclamation necessarily involves the recontouring and revegetation of relatively large areas of disturbed surface materials. An exploration program usually does not involve much materials transport. Subsequent development of an exploration area for mining will only take place if and when the exploration studies have demonstrated that the proposed development is economically sound.

Since the implementation of an exploration program does not guarantee mine development, the principal emphasis during exploration must be placed on environmental protection, with reclamation techniques only being applied when land disturbance is found to be necessary; all reasonable efforts should be made to keep land surface disturbance during exploration to a minimum.

Minimal surface disturbance during exploration can only be achieved by detailed long range planning combined with stringent controls upon field personnel. This approach is being applied to exploration being carried out on the Saxon Coal Project.

THE SAXON COAL PROPERTY

Denison Coal Limited, in conjunction with its Ruhrkohle Group partners, is currently conducting exploration on the Saxon property with the intention of completing a final feasibility study toward the end of 1977. The aim of the feasibility study is to demonstrate that the Saxon property is capable of supporting a coal mining operation producing up to 4 million tonnes of metallurgical coal annually from both surface and underground mines.

The Saxon property consists of 33,585 acres of coal licences located in northeastern British Columbia adjacent to the Alberta Provincial Boundary. The coal licences are located to cover the principal coal bearing unit of the area, the Gates Member of the Commotion Formation. Four coal seams of economic importance with thicknesses in excess of three metres have been located within the Gates Member, and the present studies are intended to show that sufficient reserves are available for economical mining by both surface and underground methods.

Geographically the property is located in the eastern foothills of the Rocky Mountains about 170 km. south of Dawson Creek, British Columbia. The Narraway River cuts across the central portion of the property in a northeasterly direction and the Torrens River flows in a similar direction at the southern property boundary. The eastern and western margins of the property are defined by northwesterly trending ridges separated by a broad valley floor. The high ground on the property reaches an elevation of 2200 metres while the valley floor of the Narraway River is at an elevation of 1100 metres.

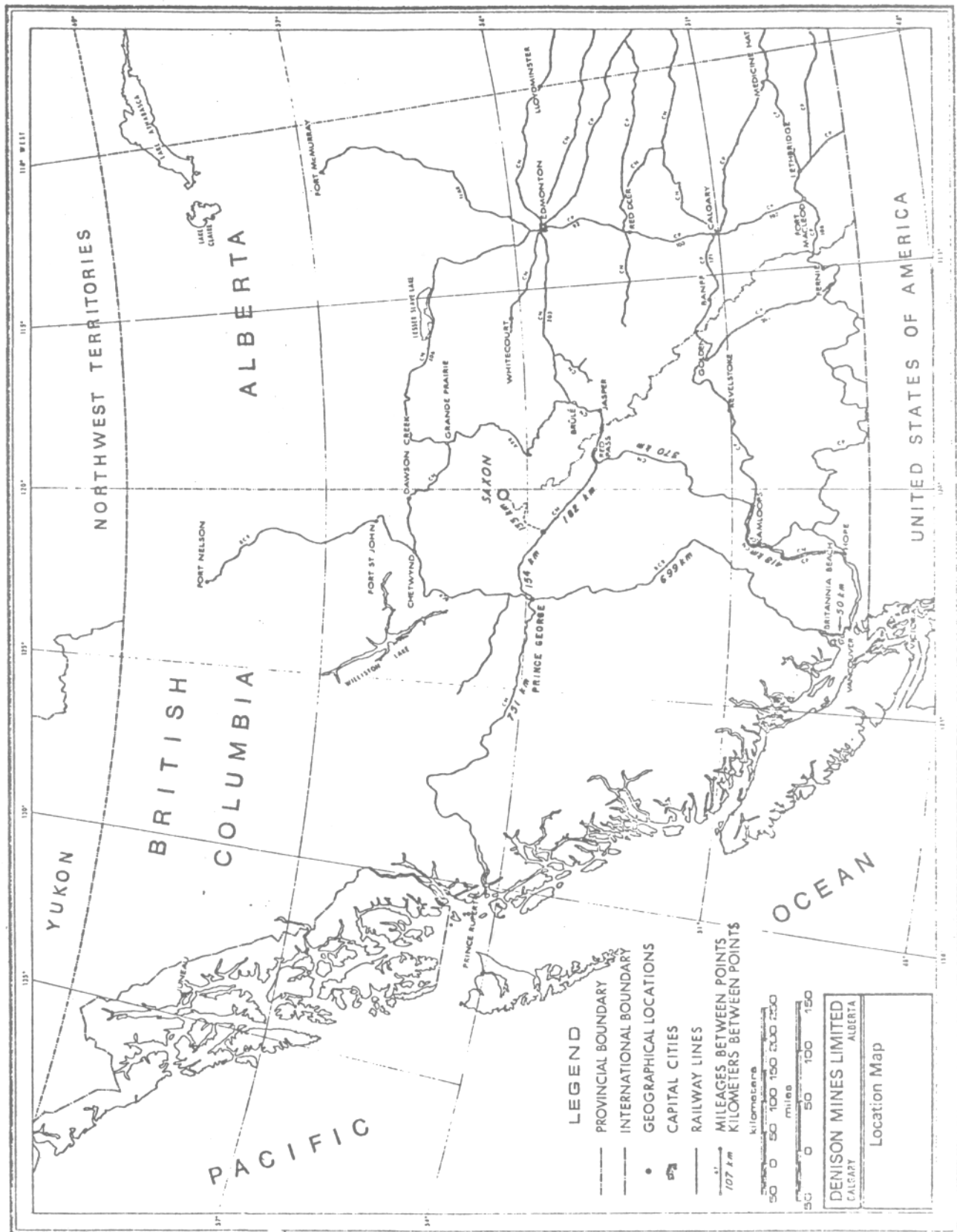
An initial environmental study of the Saxon project was recently completed by B.C. Research. This study has provided part of the basis for the discussion below by providing data on climate, and plant and animal communities.

The climate in the Saxon area is characterized by long cold winters and short growing seasons. The area is estimated to receive relatively low annual precipitation of about 35 to 40 cm., most of which occurs as snow. Strong winds blow from the west and northwest throughout the year.

At lower elevations the property falls within the Englemann spruce-subalpine fir zone, and is forested by spruce, lodgepole pine and poplar, with dense underbrush often consisting of willow species. Transition to the alpine tundra zone takes place at elevations in excess of about 1800 metres. The main valley floor, a sub-surface water discharge zone, is commonly marshy, and the surficial material in this area is a thin veneer of glacial till covering the Cretaceous strata.

In the alpine regions, a thick cover of grasses and small shrubs is present to an elevation approximately 300 metres above treeline. At higher elevations the vegetation cover, which consists of mosses and small mat-forming alpine plants, becomes more sparse, covering usually ten to fifteen percent of the land surface except in small well protected areas which are not directly exposed to the harsh weather conditions.

In high alpine areas an environment similar in appearance to arid desert plains, such as the "gibber plains" of Australia, is often found. These more barren regions have a dense surface cover of small stones which is formed by a combination of weathering processes and wind erosion. As weathering takes place, physical, chemical and biological processes break down the rock strata producing soil materials and sand and silt sized rock particles together with coarse rock fragments. In areas where vegetation cover is sparse, wind action winnows away the fine material, leading to an accumulation of the coarser fragments which protect the finer materials beneath. The prevailing wind direction in the Saxon area is from the west and northwest, and high alpine slopes facing those directions are found to be the most susceptible to the generation of the type of environment



described above. This environment is particularly sensitive, and removal of the accumulated surfacial material can lead to increased wind erosion.

The variety of wildlife on the property is similar to that found in the eastern foothills farther towards the south. In the alpine region small herds of Rocky Mountain bighorn sheep consisting of 4 to 5 beasts have occasionally been seen and one herd of 30 sheep is known to inhabit the Mount Torrens area which lies beyond the property to the east. Moose have been observed in the swampy regions along the Narraway River and grizzly and black bears have been encountered in the alpine and forested regions. Goats, caribou, and deer are less common. Numerous smaller furbearing animals are found through the property. Baseline studies have shown that fish are only present in the Narraway River, apparently because numerous waterfalls have prevented their migration into the smaller streams of the area.

At the present time the only professional land use activities being conducted in the area are guiding by local outfitters and the operation of a trapline on the property. Small scale ranching and some logging is carried out in Alberta 10 miles downstream along the Torrens River. Occasional recreational visits by tourists, campers and hunters occur.

PROJECT PLANNING AND IMPLEMENTATION

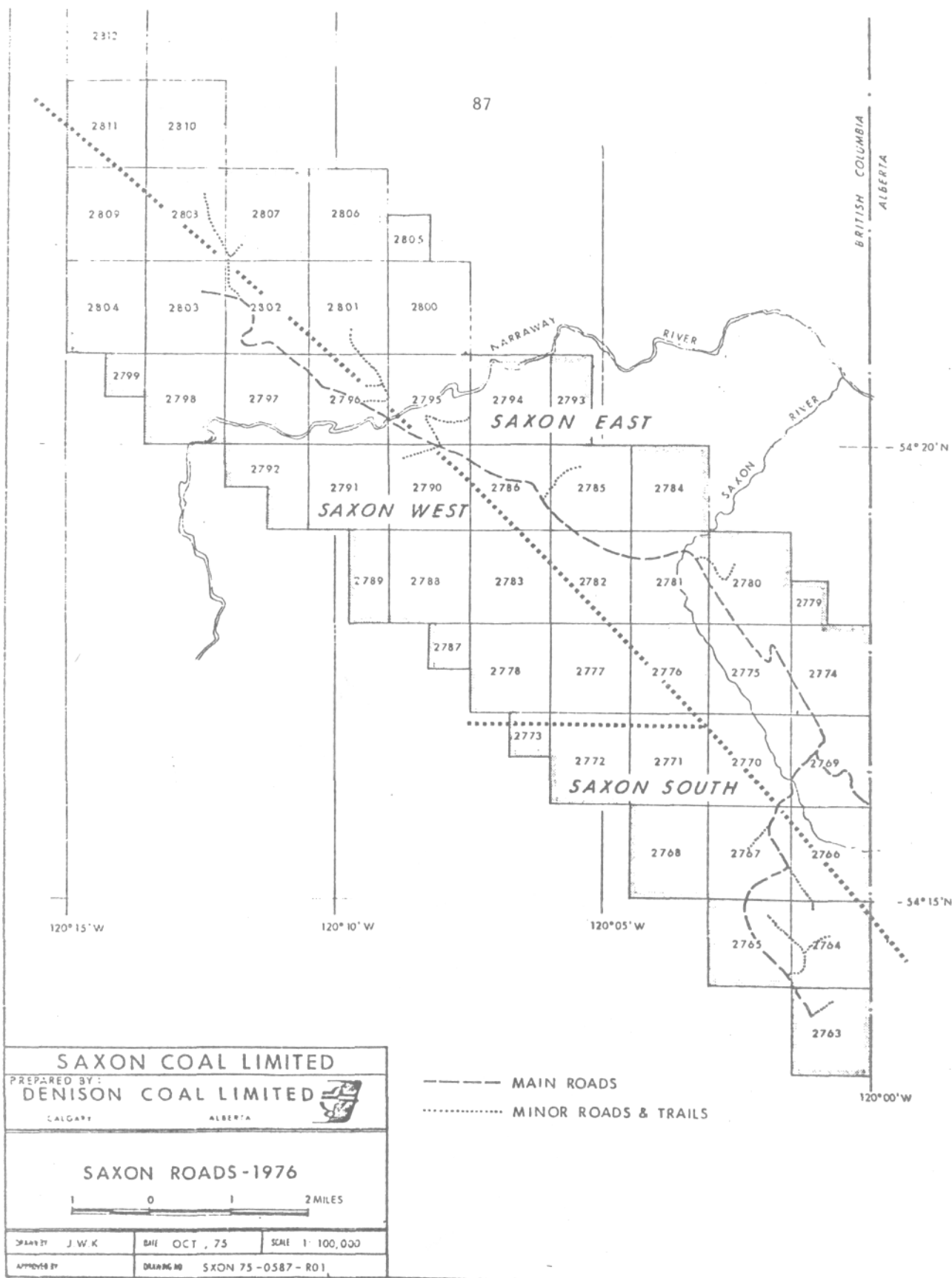
The initial period of exploration on the Saxon property took place in the period from 1970 to 1972 when a limited amount of drilling, aditing and mapping was carried out. The target for this program was the obvious Gates Member strata exposed on the northeastern ridge of the property, an area now called Saxon East, where coal was known to be present. The aim of this program was to determine whether the seams present contained sufficient tonnages of coal of a suitable quality to warrant further exploration as a mining project. Such was found to be the case, but most exploration activity began to focus, by all agencies, on projects being conducted farther north.

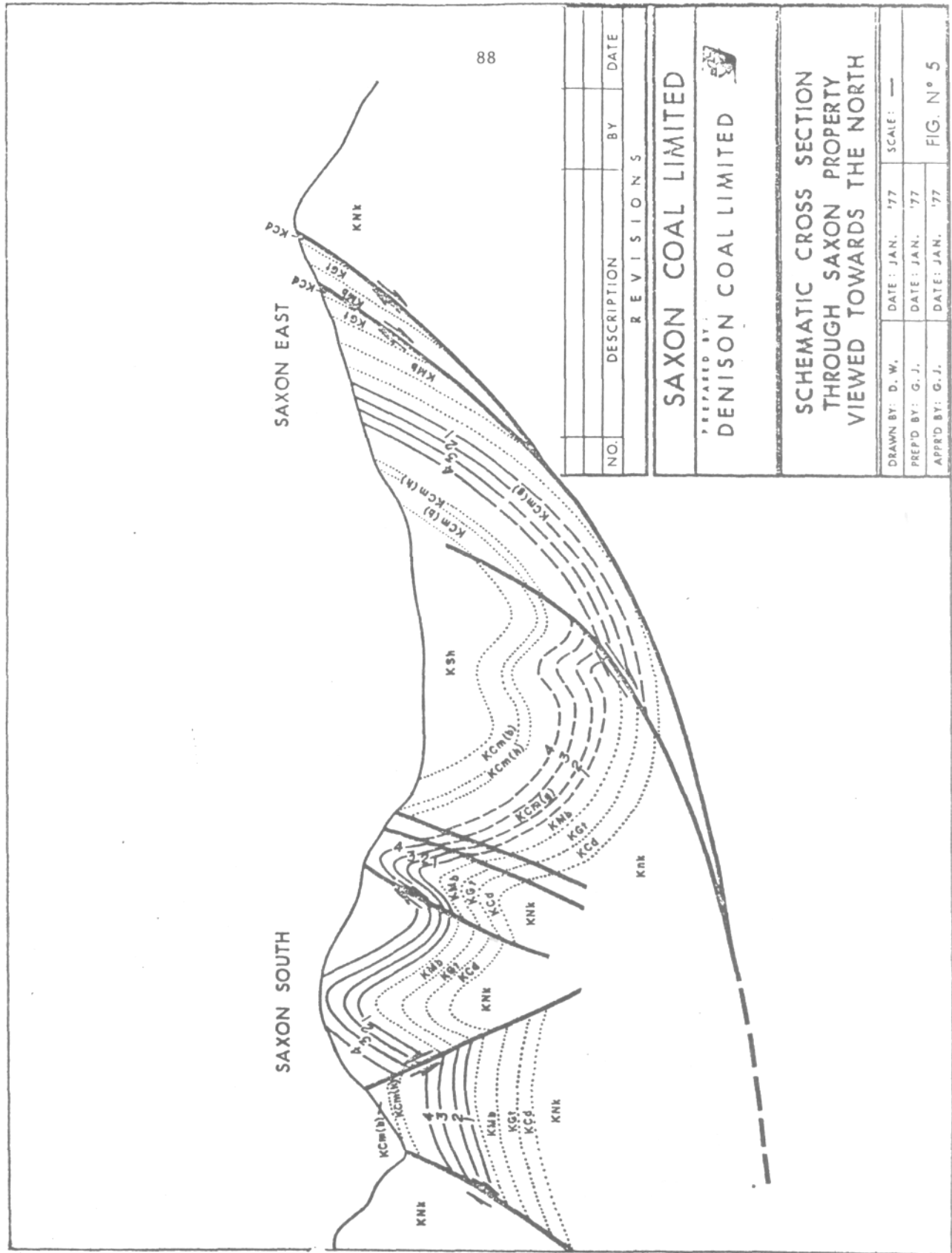
In 1974 exploration of Saxon was again considered, and a long range plan for exploration was formulated. A decision was made to carry out exploration using a three-stage approach: detailed geological surface mapping of the entire property in the first year, to be followed by two years of intensive exploration to conclude the study. Targets for the intensive exploration would be selected on the basis of the geological mapping, and areas of environmental sensitivity could be identified prior to the commencement of land disturbance.

The program of helicopter-supported geological mapping began in 1975 and was intended to determine whether additional mining possibilities could be located besides those known to be present in Saxon East, and to assess their importance before proceeding to a program involving significant land disturbance. The 1975 mapping program showed that an area of surface mining potential existed in the area called Saxon South, and that some possibilities for underground mining may be located in the densely vegetated and poorly exposed valley region called Saxon West.

Using the results of the geological mapping program and advice from various British Columbia government agencies, it was possible to plan the layout of access roads in the area to service all of the planned exploration to the completion of the feasibility study at the end of this year, as well as to be sufficient to allow further detailed study to be carried out in the future. In general, only short trails are required from this access for drilling purposes. The access road to Saxon South was also located along an area of previous land disturbance, and according to a route which will be suitable for mining purposes. Of the 33,585 acres that lie within the Saxon property boundaries, it is estimated that less than one percent will have been affected by exploration activities by the end of the program this year.

Although Saxon East was expected to be the area of best potential for underground mining, a limited amount of drilling was planned for Saxon West at the start of the 1976 field program to determine whether that area should





become the principal exploration target. Most of the exploration activities were planned for the two potential underground mines planned in Saxon East and the surface mining district in Saxon South. The 1976 exploration subsequently confirmed the results of the geological mapping program and showed that coal of suitable quality and in sufficient tonnages existed in these three principal mining areas.

ENVIRONMENTAL PROTECTION TECHNIQUES

To minimize the amount of land disturbance and thus reduce the cost of reclamation, a strong emphasis has been placed upon devising exploration techniques which are related to environmental protection.

Perhaps the most significant results have been gained by the use of hand trenching, as opposed to bulldozer tranching, to obtain detailed data from surface exposures of coal seams. In most exploration programs, use of surface seam data is depended upon to link surface mapping to the detailed but widely scattered data points available from drill cores. As a result, numerous seam surface data points are considered necessary to classify seam reserves in a proven category.

The intensive exploration of surface outcrops, when conducted by bulldozers, necessarily introduces comparatively large areas of surface disturbance, not only for the trenches themselves, but also to provide access for the bulldozer to the trench sites. Hand trenching, where field crew support is provided by helicopter, dramatically reduces the amount of surface disturbance.

It has been found that the hand trenches must be at least in excess of 1 metre deep to penetrate beyond the zone of surface creep to give consistent and reliable measurements of seam thicknesses and characteristics. Since the maximum practical depth of a hand trench is limited by the height of the trenchers, this technique cannot be used successfully in areas characterized by deep surface creep. At the present time it has been found that the construction of hand trenches is only practical in areas above treeline, since

the dense vegetation and thick soil and colluvium cover below treeline makes the location of the seam and construction of the trench both extremely time consuming and physically exhausting work.

During 1976 some 60 hand trenches were constructed in the alpine area of Saxon South and yielded information that has greatly increased knowledge of the seams and confidence in the reserves calculated for that area. It was also necessary to construct three bulldozer trenches in the forested area of Saxon East at critical data points. One of these sites was then used as an adit site, while a second was constructed along the edge of the existing access road.

Through experience, it has been found that the cost of hand trenching is very low by comparison with bulldozer trenching, and consequently this method of data collection is intended to be used wherever possible in future operations. Similarly, it is anticipated that the cost of reclamation of the hand trenches will be minimal.

The use of helicopters to move and service drills as a technique for environmental protection has also been extensively used on the Saxon project. In 1976 one-quarter of the program was conducted using this exploration method. Initially this technique was employed in the Saxon South area to clearly demonstrate that sufficient coal reserves would be encountered to justify the construction of an access road and the resultant environmental damage, as well as to justify further expenditure for road-accessible drilling and the construction of adits. Further helicopter-borne drilling was carried out towards the end of that program in an isolated area where a single drill hole was required. At that time it was decided that the time delay and land disturbance for road construction could not be justified to establish a single drill site. In addition, previous experience with helicopter-borne drills indicated that the total cost of that hole would be similar if conducted by either method.

Helicopter drilling is a very expensive and particularly dangerous technique

for exploration. Its use should be employed with discretion since the operation of any aircraft at close proximity to the ground, particularly in mountainous terrain, is a situation in which serious accidents can and do happen. Worker safety must be the foremost consideration when planning and conducting an exploration program. In some circumstances, such as those outlined above, the use of this exploration technique can be justified. In the 1977 exploration program some helicopter drilling is planned. In other circumstances, however, it is not intended, nor is it justified, to completely replace conventional drilling techniques by this exploration method.

During the program for 1976 several bridges were constructed over creek crossings. In all cases fording could have been carried out as occurs in many exploration programs. The bridges were constructed in an attempt to avoid stream siltation and the possibility of destruction of fish populations. Subsequent baseline studies carried out at the bridges and other locations showed that no fish were present in the streams, apparently due to the presence of waterfalls downstream. However, the bridge construction was still considered to be worthwhile so that stream siltation could be miniized and fish habitats farther downstream beyond the project area would be protected from activities carried out on the property.

Bulldozers and similar earth-moving equipment generate the greatest amount of surface disturbance on any exploration program. As a result, a very strong emphasis has been placed on operator education towards the requirement for creating minimum surface disturbance while maintaining good construction techniques. Initially the requirements were demanded and achieved by approaching the individual operator, and this was emphasized by applying pressure to his employer, the contractor. Once the early results could be seen by the operators themselves, their own pride in a job well done guaranteed that the job would be carried out in the prescribed manner. The general principles emphasized were:-

1. to make only the minimum amount of disturbance necessary;
 2. to use existing areas of disturbance wherever possible;
 3. to carry out construction along routes which it is anticipated
will ultimately be used during mining operations;
- and, most significantly,
4. to do no earth moving at all in areas where it is possible
to
simply walk the equipment over the land surface.

The latter method has been used wherever possible in the alpine areas and results in greatly reduced surface disturbance in this sensitive environment. It has been found practical for bulldozers to simply tow drills across sparsely vegetated high alpine plains, with earth moving being unnecessary.

RECLAMATION TECHNIQUES

Exploration reclamation on the Saxon property is being carried out in accordance with the current reclamation guidelines. A relatively small amount of surface disturbance has been generated to date and, with the field program for 1976 being completed in December of that year, it was decided to defer seeding until the spring to allow plant growth to become firmly established before the onset of fall. A considerable amount of surface preparation is now being undertaken in conjunction with the 1977 program so that seeding and fertilizing of disturbed areas can be rapidly carried out during the spring.

All roads, either main access or drill trails, are being properly slashed to remove the possibility of fire hazards, and extensive culverting on the access roads has been carried out to allow the current flow of surface water. Further culverting and extensive ditching of the access roads is being undertaken, not only for reclamation purposes but also to provide permanent access for operations in the area. On the Saxon South access road, partially constructed during 1976, a Caterpillar D4 with back hoe is being used to dig

substantial ditches to control drainage. When this is completed, the surface stripping will be buried in the road bed after final culverting is complete and prior to gravel surfacing material being placed on the road bed. Seeding of the road shoulders will follow in the spring.

Erosion bars will be constructed on the abandoned drill trails, and it is hoped that this aspect of the work will be complete before break-up to effectively control spring run-off.

Particular care has been taken to dispose of adit waste materials. The weathered coal and rock is hauled by truck to a carefully selected central area for burial. In Saxon South the original recommended site lay in a hollow which was later found to be a substantial water course. A nearby alternate site was selected at the crest of a small but pronounced rise. The crest of the rise was dug out, the adit waste dumped inside and the surface material replaced and recontoured to prevent any possibility of erosion of the coal spoil.

NEW TECHNIQUES

At the present time Denison is attempting to devise new techniques that may remove the necessity for bulldozer trenching below treeline. The low cost of hand trenching and the versatility of the technique above treeline would be desirable. In 1977 motorized hand augers will be used to break up the soil and vegetations along the line of trench prior to trench construction.

The company has ordered a climbing backhoe on a rental-purchase basis and will be experimenting with its use on all projects during this summer in an attempt to devise better trenching techniques involving minimal surface disturbance for this phase of exploration.

Efforts are being made to reduce surface disturbance to a minimum for this phase of exploration because it has been clearly established that it is not only an expensive procedure to reclaim disturbed areas, but it is also expensive to generate areas of surface disturbance in the first place.