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# SAGE CREEK COAL
# FLATHEAD VALLEY, B.C.

## REPORT ON EXPLORATION AND GEOLOGY

JULY, 1975

Volume [illegible] of 3

## PREFACE

This report has been written to present in one report all exploratory and geological investigations carried out on the Sage Creek Property from initial work in September 1970 to the present time.

For details of the individual exploration programmes the reader is referred to previous reports by the writer and others, listed under 'References' at the back of this report.


## ACKNOWLEDGEMENTS

The writer wishes to acknowledge the assistance of C. McKenzie and W. Boyd in preparing the numerous geological sections and plans and to D. Gervais who co-ordinated the drafting and report preparation. Also to be acknowledged is D. Clarke who selected computer programmes and co-ordinated and arranged for the use of the computer to assist in generating isopach maps, contour maps, reserve determinations and correlations of density log readings to raw ash and in situ specific gravity. E. Mark and M. Tapics are also acknowledged for their contributions to the report in preparation of Appendices C and G respectively. The writer also acknowledges the supervision and suggestions of H.W. Marsh, the Manager of Exploration, and P. Bedford, the Project Manager, both of whom have contributed to the contents of this report.

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SUMMARY

The Sage Creek coal deposit occurs in the Flathead coalfield in southeast British Columbia a few miles north of the international border with Montana. The Flathead coalfield occurs at the southern end of a 200 mile belt of the coal-bearing Kootenay Formation of late Jurassic and/or early Cretaceous age. In this location the Kootenay Formation lies in the upper plate of the major Lewis Thrust Fault and has been preserved from erosion by subsequent normal faulting.

The property is underlain by a monocline enclosing strata striking north to northeast and dipping east at an average of 30°. The normal continuity of the monocline is interrupted by north to northwest trending normal faults.

Three economical coal seams occur on the property: Seam 2 which has an average thickness of 12 feet, Seam 4 which is split into two benches-Seam 4 upper with an average thickness of 27 feet and Seam 4 lower with an average thickness of 20 feet - and Seam 5, which has an average thickness of 35 feet. The raw ash of the coal is variable ranging from 14% to 40%. The average for each seam is 23% for Seam 2, 21% for Seam 4U, 25% for Seam 4L, and 27% for Seam 5 and when washed to 9.5% ash produces a medium volatile bituminous coal suitable for metallurgical use.

Exploration work carried out on the property has outlined 133 million long tons of raw coal within the proposed pit limits which will yield 70 million long tons of saleable clean coal.

## INTRODUCTION

The Sage Creek Coal Limited coal deposit lies in the Flathead Valley of southeast British Columbia some 6 air miles north of the international border with Montana and some 25 air miles southeast from the town of Fernie (Location Map Dwg. L 2692). The deposit occurs in the intermontaine area between the Clark Range to the east and the MacDonald Range to the west. All exploratory work has been confined to two hills referred to as North Hill and South Hill. The two hills are separated by an east-flowing creek known as Cabin Creek. In the deposit area both hills rise to 1,000 feet above the valley floor; however, South Hill rises a further 1,000 feet to its summit southwest of the deposit area.

Exploration of the Sage Creek Coal deposit began in October 1970 and the most recent field work was completed in December, 1975.

## EVALUATION PROGRAMME

The locations of all drill holes, adit excavations and surface workings are shown on the attached overlays Dwg. G4479-1 and Dwg. G4480-1 . To date 84,817 feet of drilling in 144 completed holes has been carried out including 18,653 feet of diamond drilling producing HQ core from 45 holes, 65,301 feet of rotary drilling producing chip samples from 98 holes, and 863 feet drilled by a hammer drill, however completing only one hole. A total of 5,041 lineal feet of drifting and cross-cutting was done in 14 adits which provided 492 tons of coal for washability, coal quality and marketability studies.

The geological information provided from the above exploration together with the geological knowledge gained from surface mapping and trenching is discussed in detail in this report. The information is further recorded on the following items:

(i) two surface geology maps at 1" to 200'
(ii) 32 cross sections at 1" to 100'
(iii) 6 structural contour plans at 1" to 400'
(iv) 10 seam thickness isopach plans at 1" to 200'
(v) 33 detailed coal lithology columnar sections
(vi) 6 coal seam correlation charts
(vii) two stratigraphic correlation charts
(viii) 14 adit plans and sections

(ix) 30 seam contour plans of in situ specific gravity, raw ash and yield.

(x) 10 reserve calculation plans.

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The spheres of investigation included:

I. Stratigraphy of the deposit area.

II. Structure of the deposit area.

III. Definitive stratigraphy of the coal seams.

IV. Coal seam quality.

V. Reserve calculations and the investigation of determining factors.

VI. Mineability of the deposit with respect to geometry and geotechnical evaluations.

The evaluation programme was carried out in four phases.

PHASE I October 1970 - May 1971

Preliminary investigations of the deposit commenced with mapping outcrops exposed along existing road cuts made by previous operators, and running compass traverses across both hills in search for additional outcrop. Trenching of coal seams and poorly-defined outcrops exposed along access roads was carried out to improve and enhance the quality of mapping. Two long east-west trenches were cut on South Hill for a total of 12,000 lineal feet. The mapping was plotted on a topographic base map at 1" = 400' with 25 foot contour intervals.

Three diamond drill core holes for a total of 2,599 lineal feet were drilled to provide coal samples for quality evaluation and to investigate the subsurface geology. Diamond drilling on the property at this time proved slow and core recovery was poor; because of this diamond drilling was discontinued as an effective means of exploration. Investigation of the subsurface geology and coal seam quality was continued using reverse circulation rotary drilling equipment. Seventeen holes, for a total of 10,280 lineal feet, were drilled. Rotary drilling proved to be an effective method for investigating the stratigraphy and general structure; however, it was disappointing for providing coal seam quality information. Poor recovery and contaminated samples precluded the use of the resultant information in an ultimate analysis.

All of the diamond drill and rotary holes were logged by a gamma ray/neutron probe; four of the last 6 rotary holes were also logged by a sidewall density probe and a caliper probe.

PHASE II June 1972 - April 1973

Phase II of the investigations included bulk sampling of all major seams for washability and coal quality determination, additional geological mapping along all new drill site access roads and along compass traverses, and additional drilling on the South Hill to better outline the deposit area and to better define and evaluate the structure of the deposit.

Four adits were driven for a total of 980 lineal feet: One into Seam 2, one into Seam 4, and two into Seam 5. A total of 40 tons of coal was extracted for washability and coal quality determination. All of the adits were driven into coal exposures on the south slope of North Hill.

The drilling programme consisted of 6,374 lineal feet of reverse circulation rotary drilling in 9 holes. The drilling was adequate for investigating the subsurface geology but failed to provide good coal samples for additional information on coal seam quality. All of the holes were logged with a gamma ray/neutron probe and whenever possible were logged with a sidewall density probe and a caliper probe.

PHASE III May 1973 - December 1974

Phase III of the exploration included more bulk sampling of all major seams to further test for washability and coal quality, oxidation of coal adjacent to faults and for marketability studies, and further drilling to complete a grid pattern at 800 x 800 foot spacing. Additional geological mapping was carried out along all new drill access roads to update the surface geology information.

Nine adits were driven, for a total of 3,000 lineal feet: two into Seam 2, five into Seam 4, and two into Seam 5. One adit into Seam 2 and two adits into Seam 4 were driven into coal exposures at the north end of North Hill. The remaining adits were all driven into exposures on the north slope of South Hill. A total of 308 tons of coal was extracted from these and from adits previously driven in Phase II.

The drilling programme consisted of 50 holes for a total of 31,880 feet. The drilling was carried out using conventional rotary equipment using muds and when necessary using air with reverse circulation techniques. The initial 3 holes were drilled in September 1973 to intersect designated seams in close proximity to bulk sample points. The purpose of the drilling was to determine the usefulness of utilizing the sidewall density tool for raw ash determination by comparing actual raw ash determined from the bulk samples to the calculated raw ash using the density log readings. The results of the experiments indicated the density tool could be used for raw ash determination of coal seams in rotary holes provided that the hole was full of drilling fluid or water and that the hole over the coal seam interval, was not caved. To monitor the hole wall a caliper log was run. Control on the raw ash content of the coal seams intersected in the remaining 47 drill holes was provided from the density logs whenever down-hole conditions allowed. The coal seams were cored in three of these holes to monitor the density log and to provide supplemental information on coal seam quality. Muds were used to improve stability of hole wall conditions and to minimize sloughing, thereby increasing the probability of obtaining a useable density log. All holes also were logged with a gamma ray/neutron probe and whenever possible were logged with an E-log probe.

PHASE IV July 1975 - December 1975

The final phase of exploration of the Sage Creek coal deposit included infill drilling to enhance the accuracy of fault interpretations and the surface traces of the coal seams and to establish the downdip extent of oxidation, additional bulk samples to further evaluate coal quality and washability and to provide more samples for marketability studies, trenching to establish the surface traces of coal seams and to locate faults and determine stratigraphic offset against faults, geotechnical investigations to determine slope stability in rock and overburden for pit design and to determine the mineability of coal adjacent to faults, and hydrological investigations to determine the location and nature of subsurface aquifers.

The drilling programme consisted of 65 holes for a total of 33,834 lineal feet. This included 16,194 lineal feet of diamond core drilling, 16,777 lineal feet of rotary drilling, and 863 feet of hammer drilling. The core drilling provided additional coal quality and washability information and provided additional control points for establishing the relationship between density log readings and raw ash of the coal seams. All of the rotary and diamond drill holes were logged by a gamma ray/neutron probe and whenever possible were logged by a sidewall density probe, a caliper probe and an E-log probe.

One adit was driven and five existing adits were extended for a total of 842 lineal feet of drifting and cross-cutting. The new adit was driven into Seam 5 on the south slope of North Hill. A total of 144 tons of coal were extracted for further coal quality and washability tests and for further marketability studies.

Backhoe trenching was carried out throughout both hills to expose the subcrop trace of the coal seams and to locate faults and determine stratigraphic offset against the faults. A total of 4,400 lineal feet of trenching at 30 locations was cut. The trenching proved successful in approximately 50% of the trenches cut; however, proved unsuccessful in locating faults and in determining stratigraphic offsets against the faults.

Geotechnical studies were investigated in adits, from diamond drill hole core, from rotary and hammer drill samples and from surface reconnaissance mapping and sampling. One adit driven into Seam 5 on the south slope of North Hill was continued for 56 feet into the basal sandstone to examine the stability of the proposed pit footwall. Another adit driven into Seam 4 on the north slope of South Hill was continued for 163 feet into the footwall of Seam 4L to investigate the mineability of coal adjacent to faults and the effect of a faulted zone on mineability.

Hydrological information was obtained from monitoring flowing drill holes and from piezometric studies from several holes in which piezometers were installed.

The results of the geotechnical and hydrological studies are beyond the scope of this report and will not be pursued further. A full report was prepared by Dames and Moore Consulting Engineers and is retained on file. Dames and Moore organized, supervised and evaluated the geotechnical and hydrological studies.

# GEOLOGY

## General

The Sage Creek Coal deposit (No. 1 on the Regional Geology Map Dwg. G 2736 ) occurs in the Flathead Coal Measures at the southern end of a 200 mile belt of the coal bearing Kootenay Formation. This belt includes the Canmore Coal Measures at the north end (just off the map), the Elco Coal Prospect (No. 10), the Fording Coal Mines (Nos. 8 and 9), and the Kaiser Resources Coal Mines (Nos. 5 and 6), amongst others.

The Sage Creek coal deposit occurs in a local remnant of the Kootenay Formation occupying the upper plate of the Lewis Thrust Fault and preserved from erosion by subsequent normal faulting between two resistant thrust blocks, the Clark Range to the east and the MacDonald Range to the west.

As is shown in the 'Table of Formations' (Table 1 ) the Kootenay Formation consists of non-marine sandstone, conglomeratic sandstone, siltstone, shale and coal. It is underlain by marine sediments of the Fernie Group and disconformably overlain by the non-marine sediments of the Blairmore Group.

Locally the Kootenay Formation occurs as an east dipping monocline with the enclosed strata striking north to northeast and dipping at an average of 30°.

The prevailing structure in the area are northwest-trending normal faults, generally down-thrown to the west. The most prominent of these is the Flathead Fault which projects to the surface along the west side of the Clark Range and marks the east limit of the Kootenay Formation. The displacement against this fault is approximately 20,000 feet. The Harvey Fault approximates Howell Creek in the deposit area and marks the northeast limit to the Kootenay Formation. The Harvey Fault is probably associated with, or a splay from, the Flathead Fault and has an inferred displacement of approximately 1,200 feet.

To the south and southeast the Kootenay Formation is truncated by the pre-Tertiary erosion and covered by loosely consolidated sandstones, siltstones, clay indurated gravels, clay and marl of the Kishenehn Formation and younger Quaternary deposits.

Stratigraphy

The Kootenay Formation consists of non-marine strata which lie conformably on the underlying marine shales and siltstones of the Fernie Group. Outcrop of the Formation is found on North and South Hills and extends north to Howell Creek and southwest to Burnham Creek. The downdip extension of the Formation passes underneath the valley floor of the Flathead River and is truncated against the Flathead Fault.

The thickness of the Kootenay Formation in the deposit area, determined from outcrop and drill hole data, varies from 650 feet to 900 feet. The Formation consists of sandstone, conglomeratic sandstone, siltstone, shale and coal, deposited under varying and recurring conditions (bog to turbulent) of a fluvial and/or deltaic environment. Lithological units are lenticular in shape and grade laterally into one another restricting the development of good marker horizons and making stratigraphic correlation difficult. The coal seams deposited under more stable conditions offer the most reliable means of correlation. While marker horizons are difficult to establish, gross general patterns of deposition are recognizable and are discussed below with the aid of the attached generalized columnar section (Figure S-1).

The detailed Kootenay stratigraphy of the deposit area has been established from detailed mapping supplemented by drill hole information.

The basal sandstone - Moose Mountain Member - is a massive, medium gray, fine grained, moderately to well sorted, quartz sandstone containing varying amounts of chert but usually with less than 30%. Locally this sandstone may contain fine grains of white "rotten" feldspar giving a speckled appearance.

Coal Seam 5 - the lowest in the stratigraphic sequence rests on the basal sandstone and has an average thickness of 35 feet. The lower contact of the seam is locally separated from the basal sandstone by varying thicknesses, but usually less than 10 feet, of micaceous shales and siltstones. This relationship was investigated in a cross-cut driven through the contact zone (adit 75-5-N) to examine the stability of the footwall. The relationship is traced laterally through drill hole information and is indicated on the correlation chart of Seam 5 for the North Hill. (Correlation chart of Seam 5 Dwg. G 4474-3). The detailed stratigraphy of Seam 5 is presented later under the discussion on coal.

Coal Seam 4 lies typically 180 to 220 feet above Seam 5. Intervening strata consist of thin to medium bedded fine clastics (shale to fine grained sandstones) with local and intermittent development of massive, medium grained sandstone lenses (Nos. 3 and 4). The intervening strata are divided by a carbonaceous shale and shaley coal zone, the 'D' Horizon, which is typically 20 feet thick, and the base of which occurs approximately mid-way in the section. The horizon is traceable through drill hole intersections but is rarely exposed in outcrop. The 'D' Horizon is persistent and readily identified throughout South Hill; however, identifying and tracing the horizon through North Hill has proven more difficult. Locally this zone may contain coal seams sufficently developed to be economically significant; however, it has not been considered in evaluating the property.

Coal Seam 4 occurs as two distinct benches which on North Hill form separate seams: Seam 4U which has an average thickness of 20 feet. The shale and siltstone parting separating the benches varies in thickness from 3 feet on the south slope of South Hill to a maximum of 40 feet on the northeast slope of North Hill. Locally Seam 4L may split into two benches 4L(1) and 4L(2), upper and lower respectively. The detailed stratigraphy of Seam 4 is presented later under the discussion on coal.

A medium to dark grey shale horizon immediately overlying Seam 4 is characteristic in that it is very friable and breaks down rapidly into rhomb-shaped blocks with approximately 1/4" to 1/2" sides. This characteristic is more prominent in North Hill than South Hill.

The greatest variation in stratigraphy occurs between coal Seam 4 and coal Seam 2; this interval is 240 feet (intersected thickness in hole 74-01) on the north slope of South Hill and 40 feet (intersected thickness in hole 74-28) on the northeast slope of North Hill (Correlation chart Dwg. Misc. 2699-1 ). On South Hill the interval is characterized by two distinctive massive, medium to coarse grained sandstone units (No. 1 and No. 2 - upper and lower respectively) separated by interbeds of shale and siltstone locally with carbonaceous and coaly-shale bands. These sandstone units are recognized in drill holes on the southeast slope of North Hill; however, they are not recognized to the north and west because of rapid facies change. These sandstone units are indiscernible one from the other and both coarsen downwards. Locally they may contain lenses of conglomeratic sandstone. The loss of these sandstone units together with a gradual but substantial thinning of this interval in a northward direction suggest a fairly widespread period of erosion prior to deposition of Seam 2.

Coal Seam 3, encountered sixteen feet below Seam 2 in drill hole SCC 2B and located in outcrop west of adit 72-2-N, could be a remnant of an eroded seam or a local development on the erosion surface. To the north this seam appears to merge with Seam 2 to form a lower bench of Seam 2 (Correlation chart of Seam 2 North Hill Dwg. G 4474-1 ). To the south the seam appears to shale out.

Coal Seam 2 has an average thickness of 12 feet, varying from 5 feet on the south slope of South Hill to a maximum development through the centre of North Hill, depicted in holes SCC 5, 74-41, 74-42 and 74-43A, where the horizon is separated into two benches (the lower probably representing Seam 3) and attains a total thickness of 37 feet (Hole 74-41).

The strata between Seam 2 and the basal Blairmore above are indicative of cyclic deposition. Two massive, medium to coarse grained sandstone units of similar character and thickness ('Box' sandstone and 'Steel' sandstone, upper and lower respectively) are bounded above and below by carbonaceous shale and shaley-coal zones. The lower of these zones encompasses Seam 2. The unit separating the sandstone units encompasses the No. 1 Horizon.

The No. 1 Horizon is generally represented by a 20 foot to 30 foot carbonaceous shale zone encompassing thin coal seams usually less than 2 feet thick and comprising less than 20% of the interval. Locally these seams have merged or developed into seams of up to 6 feet; however, these areas are few and of limited extent precluding the use of this horizon in an economic evaluation.

The interval between Seam 2 and the No. 1 Horizon thins from 80 to 100 feet in the north to 15 to 30 feet in the south (Correlation chart Dwg. Misc. 2699-1 ) and corresponds to a facies change from coarse clastics to fine clastics (shale and siltstone). It is difficult to recognize the interval on South Hill where Seam 2 and the No. 1 Horizon are separated by banded siltstone and shale.

The sandstone unit overlying the No. 1 Horizon is recognized over the length of the property and is marked by a massive black chert granule conglomeratic basal member, the "Kuro-Con" sandstone. Above the basal member the sandstone becomes finer upwards and becomes medium to thinly bedded. The upper part of this sandstone unit is referred to as the "box" sandstone, a term coined after its breaking pattern.

The carbonaceous zone above the "box" sandstone is referred to as the 'A' Horizon. This horizon is typically 50 feet to 70 feet thick and contains several thin coal bands. This horizon is continuous throughout the property area; however, it does not appear to have any economic significance.

Between the 'A' Horizon and the basal Blairmore conglomerate is a grayish brown, thinly bedded, well sorted quartz sandstone. This unit varies in thickness but is generally about 20 to 30 feet thick.

Overlying this sandstone and sometimes separated by 5 to 20 feet of shale and siltstone is the basal Blairmore conglomerate. This conglomerate unit is a massive, hard, vari-coloured, siliceous chert pebble conglomerate with a medium grained sandstone matrix and which usually breaks through the pebbles. Although this unit is massive and hard it weathers readily into a fine pebble gravel.

Plant fossils and remnants of plant fossils were observed at random throughout the Kootenay Formation; however, only two zones are noted for producing reasonably well preserved fossils, the zone immediately overlying Coal Seam 5 and the shaly zone underlying Seam 2.

Outcrop on the property is sparse and mainly confined to access roads; the stratigraphy as discussed above has only evolved through drilling information. The establishment of the stratigraphy is the key to the development of the surface geology maps (Maps Dwg. G 4471-1 and Dwg. G 4471-2 ) attached and the following discussion on the structure of the deposit.

Structure

The geology plans depicting the surface geometry of the deposit was developed from surface mapping, trenching, projected drill hole information and aerial photography (Maps Dwg. G 4471-1 and Dwg. G 4471-2 ). Use of all the above information was necessary because of the sparse outcrop and thick overburden. The lack of outcrop and thick overburden are especially prevalent along the western areas of the property where the lower stratigraphic horizons project to surface.

On North Hill a series of 15 drill holes and 6 trenches together with coal seam exposures along access roads and at adit sites have confirmed the outcrop and/or subcrop traces of the seams at approximately 1,200 foot intervals along strike.

On South Hill 10 drill holes and 4 trenches together with seam exposures along access roads and at adit sites have confirmed the outcrop and/or subcrop traces of coal seams along the north slope, but only of Seam 2 at intervals of 1,200 feet along its strike length. Drilling and trenching for Seams 4 and 5 along the western edge of the proposed South Hill pit were largely unsuccessful because of a heavy mantle of glacial till and broken rock conditions. Because of these conditions determination of reserves were cut off at a line approximating grid line 582,000 E.

The deposit is depicted as an east-dipping monocline striking north to northeast and with dips averaging 30°. The normal continuity of the monocline is interrupted by a number of north to northwest trending normal faults subparallel to and probably associated with the Flathead and Harvey Faults. For the most part these faults dip steeply to the west; however, several east dipping faults have been recognized. More faults are recognized to cut the deposit on South Hill than on North Hill generating a more complex structural situation. This apparent structural discontinuity divides the property into two structural regimes, North Hill and South Hill, which are discussed separately.

North Hill

The structure of the North Hill deposit is portrayed on 19 east-west cross sections at 1" = 100' constructed at 400 foot intervals along its strike length and on structural contour plans at 1" = 400' of the top of Seams 2 and 4 and the base of Seam 5. All of the sections and contour plans are attached to this report. The sections and structural contour plans illustrate and help provide a tight discipline on the location and attitude of faults.

Four major normal faults are recognized to cut through the deposit area on North Hill - numbered 1 through 4 from west to east on the attached geology map (Dwg. G 4471-1 ).

Fault No. 1 was determined from drill hole intersections where apparent stratigraphic displacements in holes 74-42 and 74-50 suggested a normal fault with a displacement of approximately 150 feet in hole 74-50 diminishing northward to an inferred origin between holes 74-30 and SCC 10. An apparent offset of the 'A' Horizon against the No. 1 Horizon was confirmed on the surface in the vicinity of hole 74-37. The fault was also confirmed by subsequent drilling of holes 75D-03A and 75R-12; both holes have been interpreted as having intersected the fault. The attitude of the fault has been calculated at 350°/60° West. An attempt to expose this fault by trenching in the vicinity of hole 74-37 (Trenches 75-F-III-N(a) and (b) ) was unsuccessful because of heavy overburden.

A minor fault with a displacement of 10 to 15 feet cuts Seam 2 in a road cut between holes 74-33 and 74-30 and could be a splay off Fault No. 2 or a northward projection of the fault. A local steepening of dip mapped in a road-cut 400 feet north from hole 74-30 could also be associated with this fault.

Fault No. 2 is recognized in outcrop along the access road to, and approximately 300 feet northwest from drill hole 74-24 and explains the apparent offset in Seam 2 between exposures along the access road to hole 74-24 and the exposure in trench T-75-2-I-N. The fault is used to explain the apparent stratigraphic displacement in drill holes 74-24 and SCC 6 and the discontinuity in structural contours between holes 75D-07 and SCC 6. The fault is also indicated at the collar of hole 74-31 where the 'Kuro-Con' sandstone is in contact with Blairmore Conglomerate. The attitude of this normal fault has been calculated as 330°/70° NE. The stratigraphic displacement against this fault is approximately 130 feet to 150 feet as measured in holes 74-24 and SCC 6.

A disturbed zone in the cut-bank of drill site 75R-05 could be caused by a minor fault associated with or a splay from Fault No. 2. If the disturbed zone represents a fault - the fault would be normal and east dipping and with a stratigraphic displacement of less than 20 feet.

Fault No. 3 is recognized to cut through the drifts of adits 73-2-N and 73-4A-N. The fault has been confirmed along the access road to hole 75R-06 north and west of hole 74-21 where offset of the basal sandstone has been observed. To the southeast the fault merges with Fault No. 4 . The attitude of this normal fault has been calculated at 314°/60° W. Displacement against this fault is approximately 70 feet. An attempt to expose this fault in trench 75-F-II-N was not realized because of heavy drift and broken rock.

Fault No. 4 is subparallel to Fault No. 3 and merges with is to the southeast. The fault is not confirmed on the surface; however, stratigraphic displacements in holes 74-25, 74R-04, 75D-05 and 74-32 are attributed to this fault. The attitude of this normal fault has been calculated at approximately 315°/50° W. An attempt to expose this fault by trenching was made along the access road to hole 74-21 (trench 75-F-I-N) but was unsuccessful. Coal wash was encountered at the south end of the trench which could be Seam 5 on the east side of the fault.

Faulting and/or structural disturbances of a minor nature are observed on North Hill along road-cuts; however, they can not be traced laterally. Displacement, if any, associated with these disturbed zones ranges from a few inches to a few feet.

A small, low-angle normal fault (apparent dip of 30° W) with a dip slip component of 22 feet was exposed along a road-cut 59 feet west of adit 72-4-N.

A zone in a road-cut west of hole SCC 2B where the No. 1 Horizon is exposed shows shale, carbonaceous shale and coal beds to be contorted; however, the overlying sandstone remains undisturbed. This is a zone of soft sediment deformation and sedimentary structures, probably caused by differential compaction.

A normal fault dipping steeply to the east cuts the strata exposed along the access road between adit 72-2-N and hole 74-48. The displacement against this fault appears to be less than 10 feet. A minor west-dipping normal fault is exposed in the cut-bank of drill site 74-48 and has a displacement of 2 feet.

A structural disturbance was encountered in the main drift and cross-cut of adit 72-5-N(a). A steeply-dipping fault of unknown displacement, but less than 10 feet (determined from apparent offset of the basal sandstone), was encountered in the main drift. Associated with this fault, projected to the cross-cut, is an apparent roll in the stratigraphy giving an apparent shift of the basal sandstone. This disturbance is local and can not be traced laterally.

A normal fault was observed along the access road to hole 74-23 and approximately 250 feet south of the hole. The fault strikes approximately east-west, dips to the south, and has a measured displacement of 9 feet.

Along the access road west of adit 73-4-N a roll in Seam 4 is observed. The same roll was encountered in the drift and the cross-cut of the adit and necessitated offsetting the drift to get away from the hanging wall contact of Seam 4.

A disturbed zone along the access road to hole 74-25 is observed at 350 feet south of the hole; however, attitude and offset are not determined although offset appears minor. The disturbed zone may mark the location where Fault No. 3 intersects the surface.

Immediately to the north of adit 73-2-N and along the road for 40 feet, six normal steeply northeast-dipping faults are exposed in the cut-bank. The total stratigraphic displacement against these faults is 15 feet. These faults are interpreted to be splays from, or associated with, Fault No. 4.

The strike of these faults is approximately 315°.

A disturbed zone exposed in the cut-bank of drill sites 75D-07 and 75R-05 could be caused by a splay or associate fault of Fault No. 2 . If the disturbed zone is a fault, the fault would be east dipping and normal with a displacement of less than 20 feet. Stratigraphic offset against this zone has not been determined.

These minor disturbances are in part slump or glacial features and can not be traced laterally. Other disturbed areas may have resulted from differential compaction and will be local by nature. It is the writer's contention that similar such disturbances are to be expected throughout North Hill.

South Hill

The structure of the South Hill deposit is portrayed on 12 east-west cross sections at 1" = 100' constructed at 400 foot intervals along its strike length and on structural contour plans at 1" = 400' on the top of Seams 2 and 4 and the base of Seam 5. All of the sections and contour plans are attached to this report. The sections and structural contour plans illustrate and help provide a tight discipline on the location and attitude of faults.

As noted before, more faults are recognized to cut the deposit on South Hill than North Hill. Ten north to north-west trending normal faults have been mapped or inferred from apparent stratigraphic displacements to cut through the proposed South Hill pit generating a total stratigraphic displacement of approximately 1,500 feet. The faults are numbered

1 through 10 from east to west on the attached geology map (Dwg. G 4471-2 ).

Fault No. 1 is inferred from stratigraphic displacement in hole 75R-13 and discontinuity in Seams 2 and 4 between holes SCC 25 and 75G-05. The normal fault is east dipping and has a displacement of approximately 400 feet. The attitude of the fault is assumed at approximately 320°/70° E. This fault passes to the west of the North Hill deposit when projected across Cabin Creek.

Fault No. 1 marks the east limit of reserve determinations for South Hill.

Fault No. 2 is a west-dipping normal fault and is exposed along the access road approximately 200 feet west from adit 73-2-S where an attitude of 360°/42° W was measured. The fault at this location has an offset of approximately 70 feet. Displacement in holes 74-04 and SCC 29 between Seams 4 and 5 and in hole 75R-08 between Seams 2 and 4 are attributed to this fault. The attitude of the fault is accepted as measured.

Fault No. 3 is an east-dipping normal fault with an apparent displacement of 30 to 40 feet determined from stratigraphic offset along the access road between SCC 29 and 75R-08. A displacement above Seam 2 in hole 75R-08 is attributed to this fault. The attitude is assumed at 345°/70°E.

Fault No. 4 is a west-dipping normal fault and is inferred from displacement in hole SCC 29 below Seam 2 and from discontinuity in Seams 2 and 4 between holes SCC 29 and

and 74-04. This fault is also recognized in the cut-bank along the access road east from hole SCC 30. An apparent offset in the "Kuro-Con" sandstone unit between holes SCC 1 and 74-04 is attributed to this fault. It is conjectured that this fault intersects Fault No. 2 to the south and assumes a greater displacement before intersecting hole SCC 28. An attempt to locate this fault by trenching (T-75-F-V-S) was unsuccessful. The attitude of the fault is assumed at 335°/55° W.

Fault No. 5 represents a fault zone consisting of a number of west and east-dipping normal faults exposed along a 100 foot section of cut-bank west of adit 74-4F-S. These faults are also cut in the cross-cut of the adit. The most easterly of the faults is a steep east-dipping normal fault with a displacement of from 10 to 40 feet. To the west of this fault are several west dipping normal faults (NW/50°W) with total displacement cancelling the displacement against the east-dipping fault and resulting in an overall displacement down to the west of 20 to 30 feet. The faults are clearly defined and are delineated by a 1/2" to 1" thick clay gouge zone. This disturbed area could be related to, or splays from Fault No. 6 .

The projected southward extent of this zone is shown as a single fault with normal displacement to the west. The attitude of the fault is assumed at 325°/70° W.

Fault No. 6 is a prominent west-dipping normal fault and is clearly recognized by stratigraphic offset of Seam 4 exposed along the access road to adits 74-4F-S and 74-4A-S.

The position of the fault has not been definitely established but must pass through a rubble zone extending east along the road for approximately 100 feet from a point 500 feet west from adit 74-4F-S. Evidence for the fault is also seen at a rubble exposure of the "Kuro-Con" sandstone at the north end of an exploration road constructed from the junction into hole SCC 1. This fault is considered to cut holes 74-01 and ST. 5 below Seam 4 displacing approximately 220 feet of stratigraphy including Seam 5. The fault is also attributed to the loss by faulting of Seam 4 in hole SCC 22. A displacement of approximately 70 feet of stratigraphy between Seam 2 and Seam 4 in hole 74-14 is attributed to this fault. Hole 75U-01 drilled into the west face of the rock tunnel in adit 74-4F-S intersected a breccia zone from 37 feet to 43 feet and entered coarse grained sandstones typical of Nos. 1 and 2 sandstone units. The breccia zone is interpreted as Fault No. 6. (Section 17,848,116 N. Dwg. D 3532 ). The attitude of this fault has been calculated at approximately 335°/55° W and has a stratigraphic displacement of 250 feet at the north end diminishing to 70 feet at the south end.

Fault No. 7 and 7' are west-dipping normal faults interpreted to explain the discontinuity of the structural contours between holes SCC 22 and 74-01 and between ST. 6 and SCC 24. Fault 7' on the surface is recognized by apparent offset in the 'A' Horizon east of hole SCC 19 and north of hole ST. 6 . The evidence for Fault No. 7 is scanty and is invoked to explain discontinuity in the subsurface trace of Seam 2 between holes 74-01 and SCC 22. Fault 7 and 7' have been interpreted as the same fault offset by the younger and east-dipping No. 8 Fault. An attempt to locate this fault by trenching (75-F-VI-S) was abandoned because of wet and muddy conditions.

Fault No. 8 is an east-dipping normal fault intersected in adits 73-5-S and 74-4A-S. This fault is also recognized in the cut-bank to the west of adit 74-4A-S and to the east of the Seam 4 exposure approximately 250 feet north from drill hole 74-03. The fault extends to the south and probably cuts the surface along a gully between holes 74-06 and ST. 6 . The loss of Seam 2 in hole 74-06 is attributed to this fault. The displacement against this fault is 70 feet to 100 feet.

Fault No. 9 is a west-dipping normal fault exposed in the cut-bank west of the Seam 4 exposure approximately 250 feet north from hole 74-03 and is also exposed on the road to the north and below the above location at a junction in the access road. The offset, inferred from displacement of Seam 4 exposures on either side of the fault, is approximately 150 feet. Displacements in holes 75D-12, SCC 19 and SCC 24 are attributed to this fault. The displacement appears to decrease to the south. Attempts to locate this fault by trenching were unsuccessful; however, the projected surface trace of the fault was restricted to a narrow area by the exposure of competent rock in trenches 75-F-II-S and 75-F-III-S. Trench 75-F-VII-S was abandoned because of wet and muddy conditions.

Fault No. 10 is an east-dipping normal fault and is inferred from stratigraphic offset of Seam 5 along the access road 400 feet north from hole 75D-27. The fault is also confirmed by discontinuity in Seam 4 and Seam 5 between holes 75D-27 and 75D-28 and between holes 74-05 and SCC 13. The fault is east-dipping and normal with a displacement of approximately 70 feet. The southward projection of this fault beyond hole 74-05 is based on conjecture. A disturbance pertaining to this fault was encountered in trench 75-F-I-S and in hole 75D-28; however, conclusive evidence was not forthcoming.

Minor faulting and structural irregularities between the above-defined faults, similar in nature to those described for North Hill, are in evidence and are to be expected.

West of Fault No. 10 the structure is unresolved, but thrust faulting complicated by younger normal faulting is considered to have fragmented the deposit.

## COAL

Six periods of coal deposition are identified in the Sage Creek Coal deposit and are referred to on the 'Generalized Stratigraphic Columnar Section' (Figure S-1), from oldest to youngest as follows:

i. Seam 5

ii. 'D' Horizon

iii. Seam 4

iv. Seam 3 and Seam 2

v. No. 1 Horizon

vi. 'A' Horizon

Of the six periods of deposition Seam 5, Seam 4, and Seam 2 developed sufficiently to be considered in an economic evaluation and are discussed below.

Coal Seam 5, the lowest in the stratigraphic sequence, rests on the basal sandstone and has an average true thickness of 35 feet. The horizon is generally split into two benches Seams 5U and 5L, by a carbonaceous shale unit of variable thickness, but usually from 3 to 8 feet. The detailed stratigraphy of Seam 5 has been established from good exposures in the cross-cuts of adits and from core recovered from drill holes selectively located throughout the deposit to gain a representative distribution. Correlation through drill holes throughout the deposit has been facilitated from detailed description of the core and with the aid of gamma ray, neutron and density logs (Correlation charts Dwg. G 4474-3 and Dwg. G 4475-3 ).

On North Hill Seam 5 is exposed at the portal of adit 75-5-N where hangingwall and footwall contacts are well exposed; however, the detailed coal seam stratigraphy is indistinct because of weathering and slump structures. The seam is well exposed in the cross-cut of adit 75-5-N and detailed stratigraphy was mapped (Sections and plan of adit 75-5-N Dwg. G 4473 ). Coal wash mixed with overburden material located Seam 5 at the portals of adits 72-5-N(a) and 72-5-N(b) previously named adits 5 (old) and 5 (new). Trenching revealed the seam in part; however, the exposures were insufficient to define seam contacts or detailed stratigraphy. The seam was exposed in the cross-cuts of both adits (Sections and plans of adits Dwg. G 3407 and Dwg. G 2598 ). Seam 5 is exposed at the surface on the west side of the drill site of hole 74-26 and along the access road west of the drill site.

The outcrop and/or subcrop trace of the seam has been derived from projections from seam exposures at adits and from drill hole intersections. Five trenches (73-5-I-N, 75-5-I-N, 75-5-II-N, 75-5-III-N, and 75-5-IV-N) were cut in attempts to confirm the subcrop trace but were abandoned after intersecting greater than 15 feet of overburden. In two trenches 75-5-II-N and 75-5-IV-N coal fragments imbedded in the overburden were observed at a depth of 15 feet. The trace is confirmed by drill holes spaced at intervals of approximately 1,200 feet along the strike length of the seam.

An anomalous zone, approximating grid line 586,000 E, indicates a thickening of Seam 5 and the development of two distinct seams. The thickening is mainly in the parting between the two benches and does not tend to increase or reduce reserves (N-S Section 586,000 E Dwg. D 4478-1). At the north end of North Hill Seam 5 is reduced in thickness because of the shaling out of Seam 5U. (Holes 74-22 and 75R-06). Seam 5 has been cored in 14 holes selectively located throughout the hill to gain a representative distribution.

On South Hill Seam 5 is exposed along access roads at the portals of adits 73-5-S and 73-5A-S; however, the exposures are highly weathered and contaminated with overburden material and detailed seam stratigraphy was undetermined. Attempts were made to improve the exposures by trenching; however, steep topography and unstable overburden conditions cut short the attempts. The seam is well exposed in cross-cuts of the adits where the detailed stratigraphy was mapped (sections and plans of adits Dwg.G3448-5 and Dwg.G3448-6 ).

Seam 5 is exposed on the access road west of hole 75D-30 and along the access roads 500 feet west from drill hole SCC 31 and 700 feet northwest from drill hole SCC 30. The seam has been trenched at these locations; however, exposures were insufficient for detailed stratigraphy. Coal wash, probably derived from Seam 5, was exposed at the west end of trench T-75-F-I-S. No other attempts have been made to expose Seam 5 on South Hill. The seam trace along the west edge of the south pit is inferred from bore hole projections and lies under a heavy mantle of glacial till and broken rock.

in the cross-cuts of adits and from core recovered from drill holes selectively located throughout the deposit to gain a representative distribution. Correlation through drill holes throughout the deposit has been facilitated from detailed description of the core and with the aid of gamma ray, neutron and density logs (Correlation charts Dwg. G4474-2 and Dwg. G4475-2 ).

On North Hill Seam 4 is well exposed in the cut-bank at the portal of adit 72-4-N and detailed stratigraphy is apparent. The detailed stratigraphy also was mapped in the cross-cut of adit 72-4-N (Sections and Plan of Adit Dwg. G3406-A).

Seam 4U only was exposed at the portals of adits 73-4-N and 73-4A-N; however, the exposures were highly weathered and slumped, and no detailed stratigraphy was available. Detailed stratigraphy of Seam 4U was mapped in the cross-cut of adit 73-4-N (Sections and plan of adit Dwg. G3448-2). Coal exposed along the access road to, and approximately 500 feet south from drill hole 74-23, and in trench 75-4-I-N was identified as Seam 4; however, the exposure was inadequate to determine detailed stratigraphy. Seam 4U and Seam 4L were located in trench 75-4-III-N; however, detailed stratigraphy was not determined. Trench 75-4-IV-N exposed Seam 4 and defined all contacts; however, exposure was not suitable for detailed stratigraphy.

On North Hill holes 74-40, 75D-23, 75D-17, 75D-11, 75D-13 and 75G-09A together with exposures at adit sites and

An anomalous zone approximating grid line 586,000 E indicates a thickening of the shale parting separating Seam 5U and Seam 5L. This appears to be a continuation of the same trend described above for North Hill (Section 586,000 E Dwg. D 4478-2 ).

The upper part of Seam 5U shales out to the southwest resulting in a thinning of the seam in that direction. Corresponding to this trend the upper part of Seam 5L becomes markedly shalier; this is caused by intermittent shale deposition interrupting the normal development of the seam (Correlation chart Dwg. Misc.2699-2 ). This interval of Seam 5L usually contains less than 50% raw ash by weight and has been included in determining seam thickness for reserve purposes. The increased shale content has been considered in determining the yield of the deposit. This trend in Seam 5 has been monitored in 6 core holes drilled in the south and southwest areas of the deposit.

Seam 5 has been cored in 10 holes selectively located throughout the South Hill deposit to gain a representative distribution.

Coal Seam 4 occurs as two benches and on North Hill these benches form separate and distinct seams; Seam 4U and Seam 4L. The average thickness of Seam 4U is 27 feet and of Seam 4L is 20 feet. The parting varies in thickness from a minimum of 3 feet in the south slope of South Hill to a maximum of 40 feet in the northeast slope of North Hill. The detailed stratigraphy of Seam 4 has been established from good exposures in trenches confirm the outcrop and/or subcrop trace of the seam at approximately 1,200 foot intervals along strike. The one break in confirming the surface trace of the seam is the area of hole 74-30; the depth of overburden at this location prevented exposing the seam (Trench 75-4-II-N).

In hole 74-43A on the east slope of North Hill Seam 4 has 3 benches. The lower bench is 10 feet thick and is interpreted to be a local development within a predominantly carbonaceous shale sequence underlying Seam 4L (Section 17,853,460 N). Another anomalous zone is through hole 74-24 and adit 73-4-N. In hole 74-24 Seam 4L has thinned to two feet and at adit 73-4-N is unrecognized. The loss in Seam 4L along this trend is interpreted to be a shaling-out of the seam.

On South Hill coal Seam 4 is exposed in cut-banks at the portals of adits 74-4F-S, 74-4A-S and along the main access road 250 feet north from hole 74-03. Detailed stratigraphy at these exposures and in the cross-cuts of adits 74-4F-S and 74-4A-S has been mapped (Sections and plans of adits Dwg. G 3504-1, Dwg. G 3504-2 and Dwg. G3505).

Exposures of Seam 4 are located at the portal of adit 73-4-S, along the access road 250 feet northwest from hole SCC 30, in the cut-bank of the drill site for hole 75R-14, along the access road approximately 300 feet west-southwest from hole 75R-14, and 350 feet northwest from hole 75D-24. These exposures have all been exposed sufficiently to identify the seam; however, detailed stratigraphy is unavailable. The detailed stratigraphy was mapped in the cross-cut of adit 73-4-S (Sections and plan of adit Dwg.G3448-4 ). The seam was also exposed in trench 75-4-I-S; however, the coal was contaminated with overburden and disturbed and seam stratigraphy was not available. Coal wash encountered in trench 75-4-X-S was probably derived from Seam 4. Seam 4 was intersected near the surface in hole 75D-14 a few feet to the east of the trench.

The subcrop trace of Seam 4 along the west edge of the proposed South Hill pit lies under a heavy mantle of glacial till and broken rock and has been projected from drill hole intersections.

Towards the southwest of the South Hill deposit a split in Seam 4L occurs and is shown on the 'Generalized Stratigraphic Columnar Section' (Figure S-1) as Seam 4L(1) and 4L(2). The development of this split is illustrated on the correlation chart of Seam 4 South Hill (Correlation chart Dwg. G4475-3 ).

Coal Seam 2, the youngest economic coal horizon in the deposit, has an average thickness of 12 feet. The seam varies from a minimum of 5 Feet underlying the south slope of South Hill to a maximum development through the centre of North Hill where a thickness of 37 feet is measured (hole 74-41). The maximum development passes through holes SCC 5, 74-41, 74-42 and 74-43A (Section 17,853,460 N) where the seam is separated into two benches, the lower probably representing Seam 3.

The detailed stratigraphy of Seam 2 has been established from good exposure in the cross-cuts of adits and from core recovered from drill holes selectively located throughout the deposit to gain a representative distribution. Correlation through drill holes throughout the deposit has been facilitated from detailed description of the core and with the aid of gamma ray, neutron and density logs (Correlation charts of Seam 2 Dwg. G4474-1 and Dwg. G4475-1 ).

On North Hill Seam 2 is exposed in the cut-bank at the portal of adit 72-2-N and the detailed stratigraphy of the seam can be discerned. The seam is well exposed in the cross-cut of the adit and the detailed stratigraphy was mapped (Sections and plan of adit Dwg. G2597-A). Seam 2 is exposed at the portal of adit 73-S-N, in the cut-bank of the access road 100 feet north from hole SCC 32, and in the cut-bank 150 feet northwest from holes 74-24. In the above locations the seam is identifiable; however, it is contorted and highly weathered and the detailed stratigraphy is indiscern ble. The detailed stratigraphy is well exposed in the cross-cut of adit 73-2-N and has been mapped (Sections and plan of adit Dwg. G3448-1).

The outcrop and/or subcrop trace of Seam 2 on North Hill has been derived from seam exposures and projections from drill hole intersections at approximately 1,200 foot intervals along its strike length. The surface trace of Seam 2 was confirmed in trenches 75-2-I-N, 75-2-IV-N, 75-2-V-N and 75-2-VI-N. Exposures in the trenches were insufficient to determine detailed stratigraphy. Trenches 75-2-II-N and 75-2-IV-N were abandoned in overburden at a depth of 15 feet. The seam is cored in 10 drill holes distributed throughout

North Hill to give a representative distribution.

On South Hill Seam 2 is exposed at the portal of adit 73-2-S and in a cut-bank west of hole SCC 27. Detailed stratigraphy of these exposures is indiscernible; however, Seam 2 was exposed in the cross-cut of adit 73-2-S and the detailed stratigraphy was mapped (Sections and plan of adit Dwg. G3448-3A). The only other exposure of Seam 2 was in trench 75-F-II-S. This exposure was sufficient to identify Seam 2; however, detailed stratigraphy was indiscernible. Coal wash along the access road to, and approximately 450 feet north from SCC 26 and coal wash in the cut-bank along the access road 400 feet east from hole SCC 30 are probably derived from Seam 2.

The outcrop and/or subcrop trace of Seam 2 on South Hill has been derived from the above seam exposures together with projections from drill hole intersections at approximately 1,200 foot intervals along the strike length.

Coal Quality

The coal quality of the Sage Creek deposit has been determined from bulk samples from adits and core recovered from drilling. In all, 492 tons of samples have been extracted from 13 adits. All of the adits are confined to the north slope of North Hill, the south slope of North Hill, and the north slope of South Hill. Core recovered from 36 drill holes, which were selectively drilled to develop a representative distribution, supplemented the adit data and provided quality control throughout the deposit.

Details of the testing and analytical work and the results thereof are dealt with in other reports and only those parameters which are used to determine coal reserves are discussed in this report.

<u>Coal Seam Thickness</u>

Coal seam thickness has been determined from direct measurement of the seams in cross-cuts of adits and of core recovered from drilling. Other determinations of seam thickness in drill holes are defined by gamma ray, neutron and density logs and are accepted as absolute. Only discernible benches of coal three feet or greater in thickness and comprising part or all of Seam 2, Seam 4U, Seam 4L, Seam 5U and Seam 5L are used in considering total seam thickness. Where a bench of coal contains numerous shale partings, only those benches containing less than 50% raw ash by weight are included in seam thickness. Shale partings, when separating benches of a defined seam, are included in seam thickness if they are five feet or less and excluded if greater than five feet. Partings separating Seam 4U and Seam 4L and Seam 5U and Seam 5L are excluded from seam thickness. Where partings separating these seams are five feet or less in thickness they were accommodated in reserves by treating them as dilution assuming a specific gravity of 2.6 .

The thickness of each seam throughout the deposit is illustrated by 10 seam isopach plans at 1" to 200' and are as follows:

One each for North Hill and South Hill of:

1) Seam 2

2) Seam 4U

3) Seam 4L

4) Seam 5U

5) Seam 5L

All thicknesses are vertical intersected thicknesses or have been calculated to a vertical intersection assuming a dip of 30°. It should be noted that the vertical thickness does not represent true seam thickness, but is compensated for in the polygonal method used for calculating reserves.

Raw Ash

The raw ash content of the coal seams was determined for the given seam thickness at each sample point from:

a) Direct analysis of bulk samples.

b) Direct analysis of core when core recovery was greater than 80%.

c) Indirectly from density log readings.

Where information was unavailable for raw ash determination from one of the above three methods the raw ash for that sample point was interpolated from surrounding sample points considering seam correlation, seam thickness, the sample recovered and interpretation from geophysical logs.

It should be mentioned at this point that raw ash determined from rotary chip samples is considered unreliable due to the following reasons:

a) Contamination caused by downhole caving.

b) The drilling method of returning samples to the surface in a fluid medium between the pipe and hole wall. This method probably induces plucking from the hole wall causing contamination of the sample. Some of the fine coal may go into suspension in the fluid system.

c) The probable recovery of drilling mud constituents with the sample.

d) Unrepresentative sampling due to differential sloughing within the coal seam.

To overcome the problem of raw ash content of coal seams intersected in rotary holes a method utilizing the density log was developed. The method demonstrated that the density log readings could be used to determine the raw ash content of coal intercepts from which poor sample recovery precluded a direct analysis.(Appendix C attached).

The raw ash content of each seam has been contoured producing 10 contour plans at 1" to 200' as follows:

One each for North Hill and South Hill of:

1) Seam 2

2) Seam 4U

3) Seam 4L

4) Seam 5U

5) Seam 5L

## Moisture Content and In Situ Specific Gravity

During the 1975 drilling programme the surface moisture content was determined for 52 core samples taken from various intervals in 4 drill holes. The samples were weighed immediately upon recovery and at regular intervals every one or two hours, while being air dried. The drying process continued until the weights of the samples were stabilized. The surface moisture was determined from the weight lost during the drying period. The average moisture of the 52 samples used was 9.7% by weight on an air dried basis. Based on this result, and the experience of others in the Western Canadian coalfields, it seems reasonable to assume that the in situ moisture content throughout the deposit is approximately 10% by weight.

In calculating the in situ coal reserves, the moisture content of the seams must be taken into account. The specific gravity of the raw coal was determined in the laboratory on an air dried basis and does not take surface moisture into consideration. Therefore, it was necessary to adjust the specific gravity (dry basis) to in situ specific gravity. The formula developed for this is illustrated below:

$$\text{In Situ Specific Gravity} = \frac{100 \text{ s.g.}}{(\text{s.g.})\ (A) - A + 100}$$

Where s.g. = specific gravity of dried coal as determined in laboratory.

A = percent of moisture by weight in the coal seam (ie. surface moisture)

For example:

s.g. = 1.5

A = 10%

then, In Situ Specific Gravity = $\frac{100 \times 1.5}{1.5 \times 10 - 10 - 100}$ = 1.428

The in situ specific gravity was determined for all sample points, where specific gravity (dry basis) was measured, using the above formula. For the sample points where no such information was available a graph was constructed relating specific gravity (dry basis) to raw ash. The specific gravity (dry basis) was thus determined from raw ash and converted to in situ specific gravity using the above formula (Appendix C).

The in situ specific gravity for each seam is illustrated on 10 contour plans at 1" to 200' as follows:

One for each of North Hill and South Hill of:

1) Seam 2
2) Seam 4U
3) Seam 4L
4) Seam 5U
5) Seam 5L

## Oxidation

Three areas of possible oxidation of coal have been investigated and are as follows:

I. Oxidation in the weathered zone (ie. in from the outcrop or subcrop trace of the seam).

II. Oxidation associated with faults.

III. Local pockets of oxidized coal at depth.

## I. Oxidation in the Weathered Zone

The extent of the oxidized coal zone in from the outcrop and/or subcrop of the seams has been investigated by drilling and in the main drifts of the adits.

Twenty holes were drilled along the projected outcrop and/or subcrop traces of the seams, one of the purposes being to determine the downdip extent of the oxidized zone (Overlay highlighting the points of information Dwgs. G4479-2 and G4480-2). The core recovered from the holes was tested for oxidation. Results of the testing showed that 10 of the holes intersected the oxidized/unoxidized interface within a coal seam, five intersected only unoxidized coal and five intersected only oxidized coal. The vertical depth of oxidation ranged from 20 to 75 feet and rarely exceeded 50 feet (Appendix D).

The extent of oxidation in from the outcrop of coal seams was also monitored in the main drifts of the 14 adits. The average depth of oxidation was found to be 80 feet (Appendix E).

The points of intersection of the oxidized/unoxidized contact have been plotted on plans of each seam, at 1" to 200', and joined up. Where data is insufficient to complete the contour the average of 50 feet has been used.

## II. Oxidation Associated with Faults

From the experience of coal operators in Western Canada oxidation associated with faults has been found. To test for this, two adits (74-4F-S and 74-4A-S) were driven to intersect faults and were bulk sampled along the fault contact. Tests carried out on the coal showed no oxidation (Appendix F ). A third adit(75-5-S ) also intersected a fault and test results showed no oxidation.

Testing of coal samples recovered from drill holes in which faults have been interpreted to cut close to the sample point have shown no oxidation.

## III. Local Pockets of Oxidized Coal at Depth

Experience at operating coal mines in Western Canada shows local pockets or trends of oxidized coal at depth. To test for any such zones or pockets at Sage Creek, composites of all coal seams recovered were subjected fo float/sink and froth flotation and the float portion tested for F.S.I. In the case of cored holes, samples were analyzed in two foot, or less, increments for raw ash, specific gravity (dry basis) and F.S.I. Those samples with an F.S.I. lower than 1 1/2 to 2 with a corresponding low raw ash content were subjected to float/sink and froth flotation analysis. If tests showed a high float in the flotation fraction but still showed a low F.S.I. the sample was sent to Ottawa for petrographic examination. The petrographic test results invariably showed that the depressed F.S.I.'s result from abnormal concentrations of inert maceral components. While some of the samples do show depressed F.S.I.'s to be caused by high inerts, the composite sample of the seam showed normal F.S.I.'s .

No oxidation was found in any of the samples. It has been concluded that in the absence of any indication of oxidation at depth, no allowance will be made in determining the clean coal yield.

## GEOLOGICAL COAL RESERVES

The in situ coal reserves underlying the Sage Creek coal deposit were determined using the polygonal method. Polygons were constructed around each sample point on separate plans on North Hill for Seam 2, Seam 4U, Seam 4L and a combined plan for Seam 5U and Seam 5L and on South Hill for Seam 2, a combined plan of Seam 4U and Seam 4L and a combined plan of Seam 5U and Seam 5L. The polygons are plotted at a scale of 1" = 200' and are attached. The parameters used in calculating the reserves have been discussed in the above discussion on coal and are further discussed in Appendix G attached. The detailed reserve calculations are also tabulated in the attached appendix.

The total in situ reserves within the proposed pit limits are 133 million long tons of raw coal.

A second method of calculating coal reserves underlying the Sage Creek deposit has been employed as a check on the polygonal method. The second method is a computer check using the unit grid method whereby the coal seam thickness isopachs and raw ash and in situ specific gravity contours are utilized. The method and detailed calculations are incorporated in Appendix H.

In addition to the defined reserves there are additional potential reserves in the following areas:

a) Southwest of South Hill

The area immediately southwest of South Hill has been partially tested by 11 drill holes. Varying thicknesses of coal were intersected in 9 of the holes but because of structural disturbances seam identification is difficult.

The area has a potential for some 30 million tons of raw coal which might be amenable to open pit mining methods. Structural disturbances could, however, preclude economic recovery.

b) East of North Hill

All of the defined coal seams continue eastward down dip from the eastern limit of the proposed North Hill pit. Assuming that the seams continue to the Harvey Fault, about 50 million tons of raw coal could be available for underground mining.

c) East and Southeast of South Hill

There is evidence that the coal seams persist down dip from South Hill by the presence of coal in an oil borehole about 5 miles to the southeast. Immediately adjacent to South Hill on the east, however, pre-Tertiary erosion has removed the coal to an unknown extent, and it could well be impractical to mine whatever coal has been preserved.

Owen Cullingham

Toronto, Ontario, Canada
July, 1976

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|---|---|---|
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| | -1972 | "Report on Exploration, June to September, 1972". Private Report of November, 1972. |
| | -1973 | "Report on Exploration, January to April, 1973". Private Report of May, 1973. |
| | -1973 | "Report of Exploration and Geology, June to September, 1973". Private Report of December, 1973. |
| | -1975 | "Report on Exploration and Geology June to December, 1974". Private Report of May, 1975. |
| HENNESSEY, W. J. | -1974 | "Report on Visit to Sage Creek Property, August 1 & 2, 1974". Private Report of August, 1974. |
| | -1975 | "Geology of Sage Creek Coal Property, Southeastern British Columbia". Private Report of April, 1975. |
| | - | Correspondence and verbal communications, September 1974 to February 1976. |
| RIO ALGOM LIMITED | -1976 | "Sage Creek Coal Limited Technical Presentation to the Japanese Steel Industry". Private Report of May, 1976. |

## 3.4. DETERMINATION OF RAW ASH AND TONNAGE FACTORS

### 3.4.1. Introduction

A computer-assisted study of available data for specific gravity, raw ash, density tool readings and the moisture content of the raw coal in place was undertaken to develop a method whereby the specific gravity and raw ash of the in situ coal could be determined from density tool readings taken in the drill holes.

The study demonstrated that the density tool readings could be used with reasonable confidence to determine the in situ specific gravity for each drilled coal seam intercept. This specific gravity could then be used as a tonnage factor to apply to the ore reserve polygon influenced by that intercept. Furthermore, it was demonstrated that density tool readings could be used to determine the raw ash content of the rotary drill coal seam intercepts from which poor sample recovery precluded a direct laboratory raw coal analysis.

The procedure followed to determine in situ specific gravity and raw ash from the density tool readings is outlined below.

### 3.4.2. Relationship of Density Tool Reading to Laboratory Determined Specific Gravity

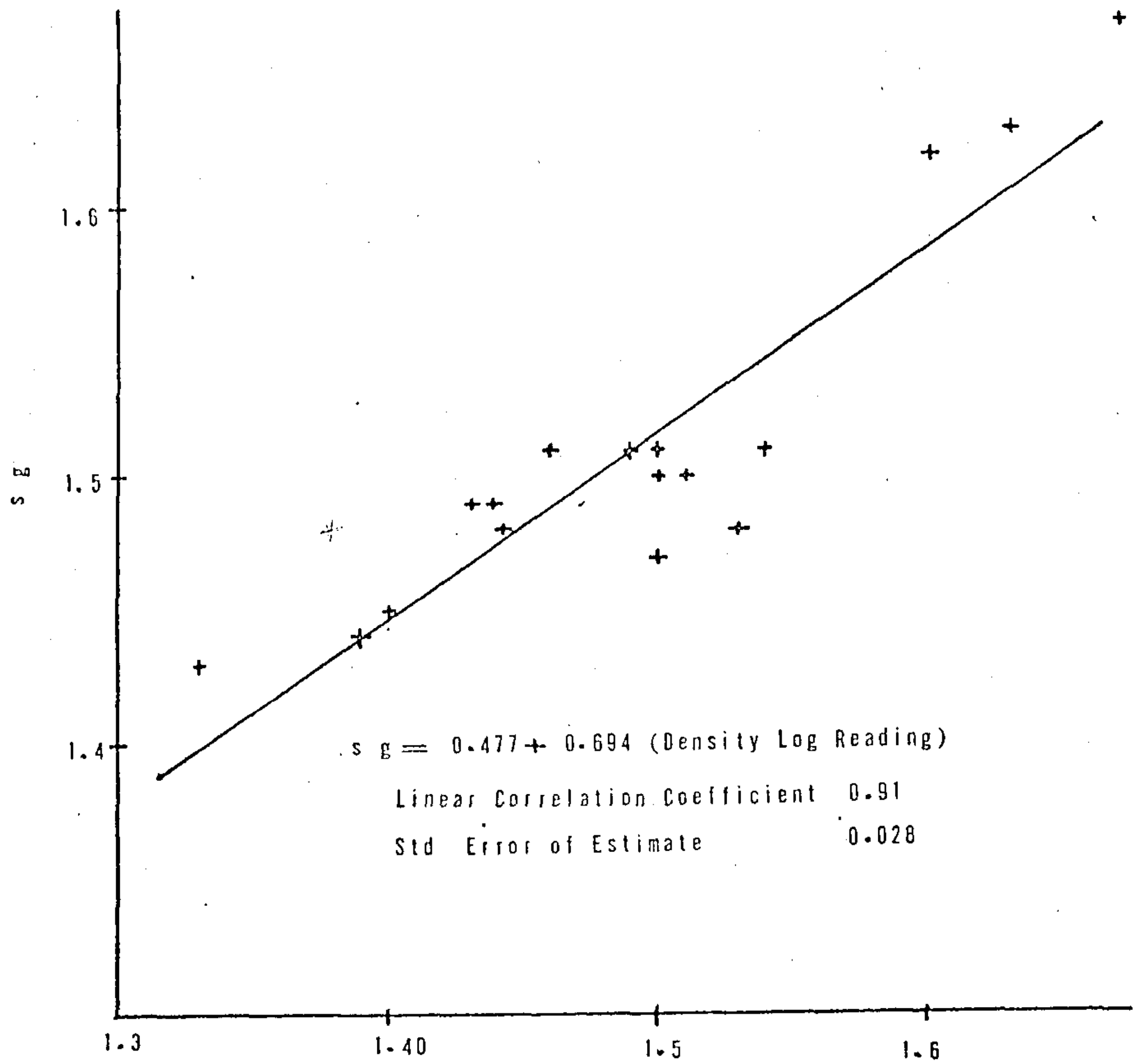
The relationship of the average density tool reading to the weighted average specific gravity is illustrated in Figure 3 - 6. Each point represents one diamond drill hole seam intercept; data used are listed in Table 3 - 2. Data for a seam intercept were used in establishing the relationship displayed in Figure 3 - 6 only if the following criteria were met:

- core recovery exceeded 85 per cent
- core interval exceeded 10 feet
- density logging was performed in an open hole (i.e., not through the casing)
- the density log readings were averaged over a length which closely corresponded with the core length analyzed in the laboratory
- the entire core recovered was analyzed
- the caliper log did not indicate excessive hole caving in the seam

The line fitted to the points of Figure 3 - 6 using the conventional least squares criterion is accepted as the best estimate of the relationship. The equation of the line is:

Laboratory Determined Specific Gravity = 0.477 + 0.694 X Density Tool Reading

CORRELATION
BETWEEN
s g AND DENSITY LOG READING




DENSITY LOG READING

## Tabulation of Data For Seam Intercepts *

| Hole | Seam | Avg. Weight (s.g. Lab.) | Density Log Reading | Ash (%) | Core Recovery (%) | Core Length (ft.) | Core Length - Log Length |
|---|---|---|---|---|---|---|---|
| 75-D-02 | 2 | 1.48 | 1.44 | 23.60 | 100.0 | 22.0 | 0.0 |
| 75-D-02 | 4L | 1.50 | 1.51 | 25.90 | 100.0 | 12.5 | -0.5 |
| 75-D-03A | 4U | 1.45 | 1.40 | 18.70 | 90.5 | 22.3 | 0.2 |
| 75-D-03A | 4L | 1.49 | 1.43 | 24.90 | 100.0 | 29.0 | -1.0 |
| 75-D-04 | 5L | 1.51 | 1.50 | 28.60 | 100.0 | 19.0 | 1.0 |
| 75-D-06 | 2 | 1.51 | 1.46 | 27.78 | 90.2 | 20.5 | 0.0 |
| 75-D-06 | 4U | 1.44 | 1.39 | 19.02 | 89.5 | 33.5 | -0.4 |
| 75-D-06 | 5L | 1.49 | 1.44 | 23.70 | 86.4 | 22.2 | 0.0 |
| 75-D-07 | 2 | 1.43 | 1.33 | 19.06 | 95.0 | 11.0 | 0.0 |
| 75-D-07 | 5L | 1.52 | 1.49 | 27.60 | 95.6 | 11.0 | 0.5 |
| 75-D-10 | 4U | 1.51 | 1.49 | 23.50 | 88.0 | 27.0 | 1.0 |
| 75-D-10 | 4L | 1.62 | 1.60 | 35.90 | 93.6 | 14.8 | 0.0 |
| 75-D-10 | 5U | 1.51. | 1.54 | 25.80 | 93.8 | 13.0 | -1.0 |
| 75-D-12 | 4U | 1.48 | 1.53 | 21.90 | 100.0 | 30.3 | -1.0 |
| 75-D-16 | 4U | 1.50 | 1.50 | 24.30 | 94.0 | 31.8 | -1.5 |
| 75-D-24 | 4U | 1.47 | 1.50 | 21.90 | 93.0 | 34.0 | 0.5 |
| 75-D-32 | 5L | 1.63 | 1.63 | 35.50 | 100.0 | 21.1 | -1.1 |
| 75-D-16 | 5L | 1.67 | 1.67 | 38.28 | 86.5 | 20.0 | 0.0 |

* These figures can be used to carry out valid comparison of density log readings with laboratory ash and s.g. data.

This relationship was used to estimate a specific gravity value for each seam intercept for which sufficient laboratory data were not available to determine a value directly. The values were then adjusted, as explained below, for in situ moisture content to estimate in situ specific gravity.

### 3.4.3. Determination of In Situ Specific Gravity from Laboratory Determined Specific Gravity

The specific gravity of coal as determined in the laboratory does not take in situ moisture into consideration. An estimate of in situ moisture was therefore determined and laboratory specific gravity values were adjusted to arrive at in situ specific gravity values.

During the 1975 drilling programme the moisture contents of 52 drill core samples, listed in Table 3 - 3, were determined. Core samples were weighted immediately on recovery from the drill hole and again after being air dried. No simple relationship exists between moisture content and ash content or the laboratory determined specific gravity. It is not possible therefore to apply a moisture factor which varies with coal ash content. Average moisture content of the 52 samples tested is 9.7 per cent by weight on an air dried basis. Based on this result, and the experience of others in the western Canadian coalfields, it seems reasonable to assume that the in situ moisture content throughout the

# SAGE CREEK COAL

## MOISTURE DETERMINATIONS

## AIR DRIED

| HOLE # | SEAM | CORE INTERVALS | % ASH | DRYING HOURS TO STABILIZATION | % MOISTURE LOST |
|---|---|---|---|---|---|
| 75D-08 | 5U | 594-596 | 27.9 | 31 | 7.8 |
| 75D-08 | 5U | 596-598 | 41.5 | 24 | 6.2 |
| 75D-08 | 5U | 598-600.5 | 17.4 | 31 | 8.5 |
| 75D-08 | 5U | 600.5-603 | 27.5 | 32 | 8.5 |
| 75D-08 | 5U | 603-605.7 | 30.2 | 29 | 8.7 |
| 75D-08 | 5L | 611-615 | 43.5 | 29 | 8.0 |
| 75D-08 | 5L | 615-620 | 38.9 | 26 | 12.6 |
| 75D-08 | 5L | 620-626 | 56.1 | 27 | 11.8 |
| 75D-08 | 5L | 626-628 | 15.3 | 18 | 11.7 |
| 75D-08 | 5L | 628 634 | 26.4 | 29 | 14.2 |
| 75D-08 | 5L | 634-639 | 25.9 | 30 | 13.4 |
| 75D-10 | 5U | 33.5-35.6 | 14.8 | 20 | 9.8 |
| 75D-10 | 2 | 57-58 | 72.7 | 15 | 7.5 |
| 78D-10 | 2 | 58-59 | 52.7 | 16 | 8.5 |
| 75D-10 | 2 | 59-60 | 78.1 | 17 | 6.4 |
| 75D-10 | 2 | 60-61 | 36.1 | 22 | 14.0 |
| 75D-10 | 4U | 267-269 | 40.7 | 14 | 9.7 |
| 75D-10 | 4U | 269-271 | 12.6 | 19 | 9.3 |
| 75D-10 | 4U | 271-273 | 25.9 | 20 | 12.0 |
| 75D-10 | 4U | 273-275 | 17.3 | 16 | 7.5 |

TABLE [illegible]-[illegible]
cont'd

| HOLE # | SEAM | CORE INTERVALS | % ASH | DRYING HOURS TO STABILIZATION | % MOISTURE LOST |
|---|---|---|---|---|---|
| 75D-10 | 4U | 275-277 | 17.3 | 15 | 8.8 |
| 75D-10 | 4U | 278-280 | 15.1 | 16 | 10.0 |
| 75D-10 | 4U | 280-282 | 20.1 | 10 | 6.0 |
| 75D-10 | 4U | 282-284 | 23.7 | 19 | 10.8 |
| 75D-10 | 4U | 284-285.4 | 20.0 | 18 | 10.5 |
| 75D-10 | 4U | 285.4-286.8 | 27.6 | 24 | 12.8 |
| 75D-10 | 4U | 288-290 | 36.5 | 20 | 9.6 |
| 75D-10 | 4U | 290-292 | 27.0 | 18 | 8.6 |
| 75D-10 | 4L | 293-294.7 | 22.4 | 14 | 9.9 |
| 75D-10 | 4L | 294.7-296.7 | 70.7 | 14 | 5.6 |
| 75D-10 | 4L | 302-304.2 | 31.2 | 18 | 12.4 |
| 75D-10 | 4L | 304.2-306 | 27.4 | 19 | 14.3 |
| 75D-10 | 4L | 306-308.2 | 27.1 | 24 | 15.4 |
| 75D-10 | 4L | 308.2-310.5 | 29.5 | 20 | 14.5 |
| 75D-10 | 4L | 311-312.6 | 49.1 | 19 | 12.6 |
| 75D-10 | 4L | 314-316.8 | 24.5 | 19 | 8.7 |
| 75D-10 | 5U | 524-526.2 | 28.3 | 14 | 7.2 |
| 75D-10 | 5U | 526.2-526.9 | 24.5 | 7 | 6.0 |
| 75D-10 | 5U | 526.9-528 | 28.0 | 10 | 9.5 |
| 75D-10 | 5U | 528-530 | 45.6 | 12 | 10.4 |
| 75D-10 | 5U | 530-532 | 20.3 | 14 | 11.8 |
| 75D-10 | 5U | 533.7-535.4 | 24.6 | 14 | 8.4 |
| 75D-10 | 5U | 535.4-537 | 17.2 | 15 | 9.1 |
| 75D-10 | 5U | 537-538.6 | 49.1 | 11 | 8.0 |
| 75D-10 | 5L | 538.6-540 | 71.3 | 11 | 5.2 |

TABLE 3-3
cont'd

| HOLE | SEAM | CORE INTERVALS | % ASH | DRYING HOURS TO STABILIZATION | % MOISTURE LOST |
|---|---|---|---|---|---|
| 75D-10 | 5L | 542-543 | 27.7 | 11 | 8.4 |
| 75D-10 | 5L | 544-546 | 56.6 | 14 | 7.1 |
| 75D-10 | 5L | 546-548.3 | 34.1 | 20 | 11.4 |
| 75D-10 | 5L | 550-552 | 27.8 | 11 | 9.7 |
| 75D-11 | 4L | 32.7-34.9 | 23.4 | 22 | 15.8 |
| 75D-12 | 4U | 294.4-297.1 | 16.5 | 14 | 6.7 |
| 75D-12 | 4L | 313.9-316.4 | 14.1 | 12 | 5.0 |
| | | | | AVERAGE | 9.7 |

Sage Creek coal deposit is 10 per cent by weight.

The formula used for conversion of laboratory determined specific gravity to in situ specific gravity is illustrated below:

$$\text{In Situ Specific Gravity} = \frac{100\ \text{s.g.}}{(\text{s.g.})\ (A) - A + 100}$$

Where s.g. = Specific gravity of dried coal as determined in laboratories.

A = per cent of water by weight in the coal seam (i.e., in situ moisture in the coal seam)

For example:

s.g. = 1.5

A = 10 per cent

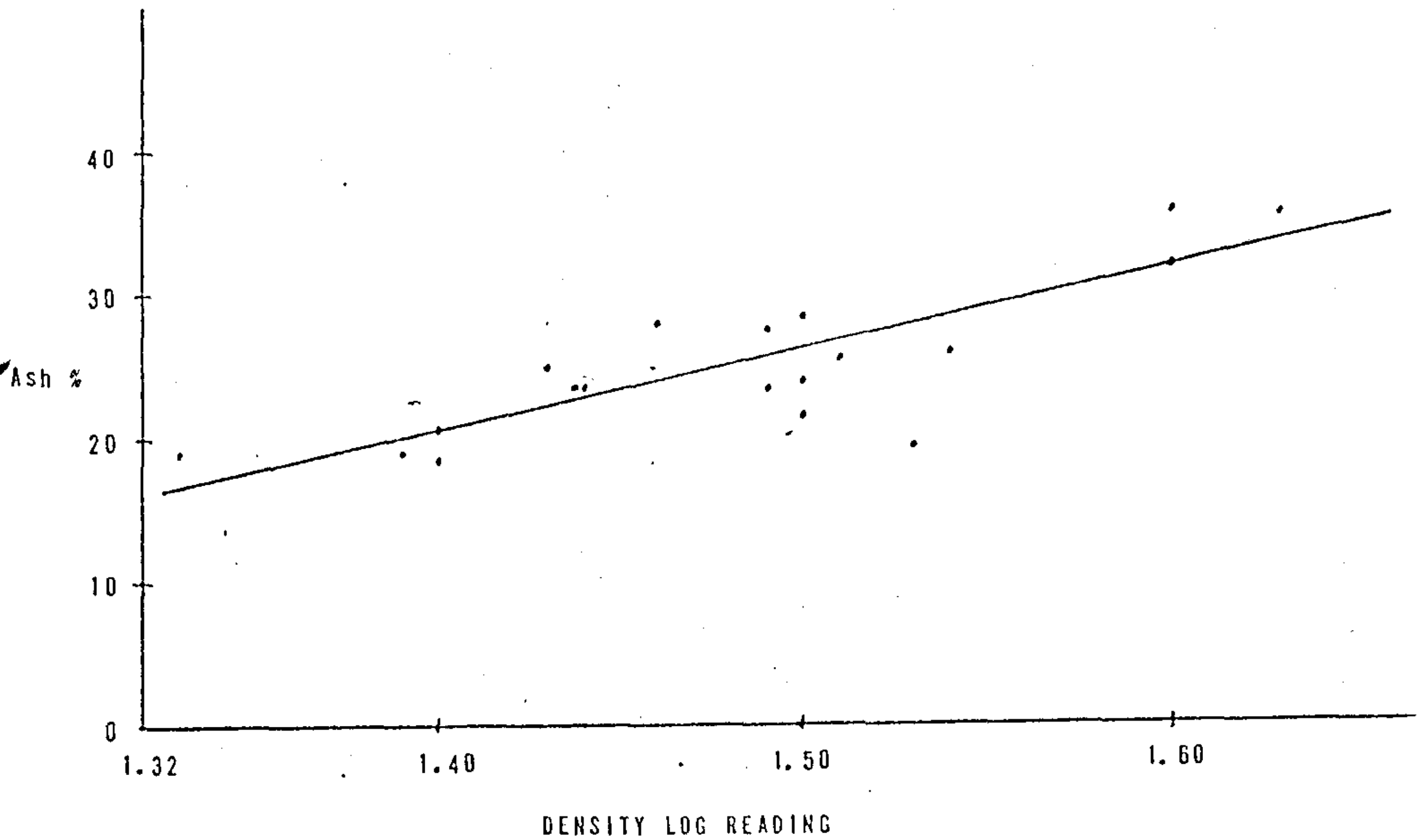
then, in situ specific gravity = $\frac{100 \times 1.5}{1.5 \times 10 - 10 + 100} = 1.428$

3.4.4. Relationship of the Density Log Reading to Laboratory Determined Ash Content

The diamond drill hole seam intercept data listed in Table 3 - 2 establishes the relationship illustrated in Figure 3 - 7. The line fitted to the points in Figure 3 - 7 using the conventional least squares criterion is accepted as the best estimate of the density log reading - ash content relationship. The equation of the line is:

$$\text{Ash content \%} = -61.35 + 58.48 \times \text{Density Log Reading}$$

CORRELATION
BETWEEN
ASH CONTENTS AND DENSITY LOG READING




Ash % = -61.35 + 58.48 (Density Log Reading)

Linear Coefficient Correlation 0.866

Standard Error of Estimate 2.95

SAGE CREEK COAL LTD

APRIL 1976

3.4.5. Relationship of Specific Gravity and Ash Content

The relationship of laboratory determined specific gravity and ash content is illustrated in Figure 3 - 8. Each plotted symbol represents one or more of 802 diamond drill core samples. The equation of the fitted line is:

Laboratory Determined Specific Gravity = 1.2262 + 0.0116 X Ash Content

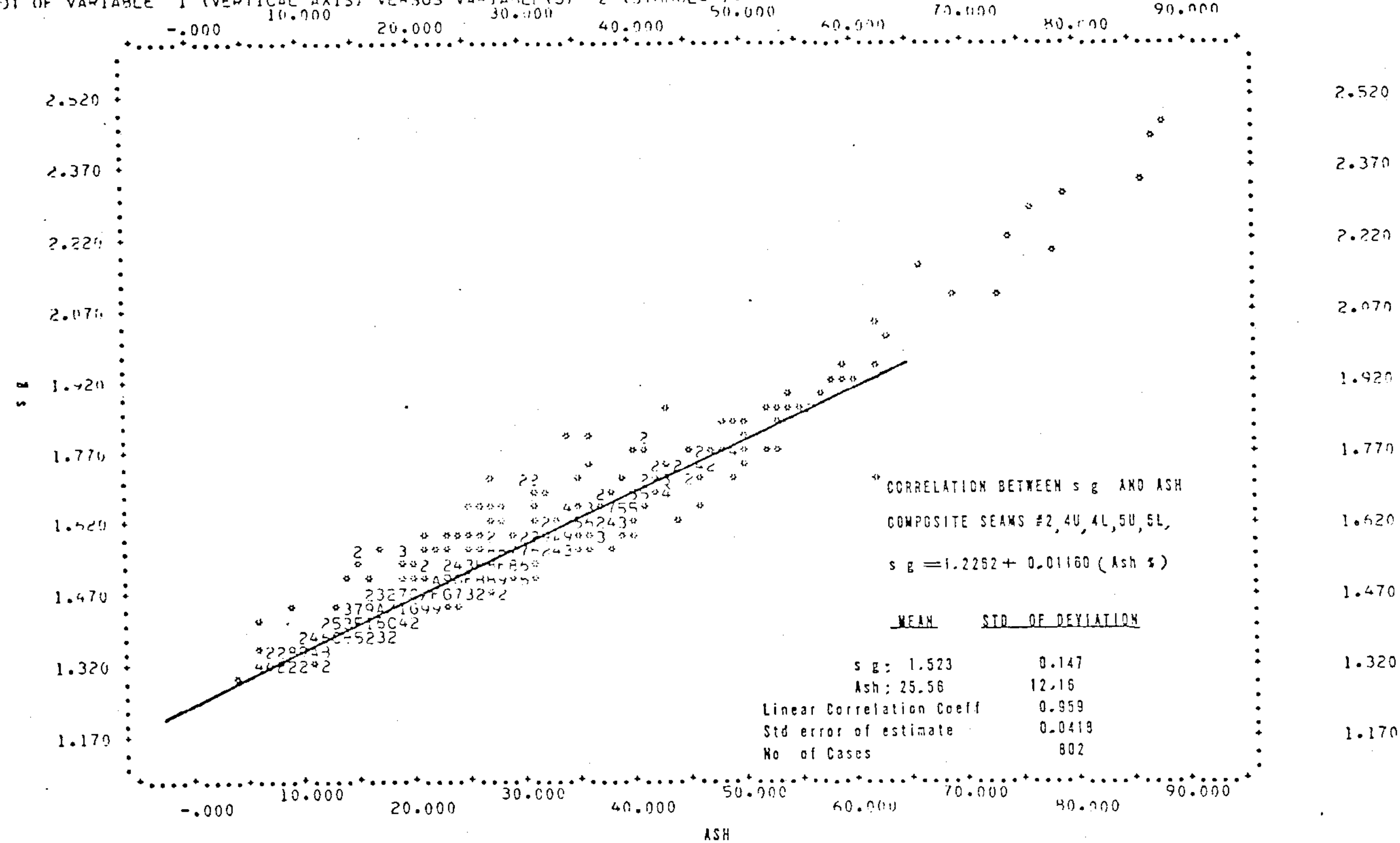
Regression lines were also determined for the specific gravity-ash content relationship on an individual seam basis. No statistically significant differences exist between the lines for the individual seams and the composite line, the equation of which is shown above.

3.4.6. Use of the Relationships in Ore Reserve Estimation

If the density log information is to be of use in estimating the ash and in situ specific gravity values for ore reserve calculation purposes, it is critical that good estimates be made of the density log reading - laboratory specific gravity relationship, and the density log reading - ash relationship. These relationships, illustrated in Figures 3 - 6 and 3 - 7, have been satisfactorily determined. The correlation coefficients and standard errors of the estimates indicate that both fitted lines are satisfactory for prediction purposes. Further work would add

PLOT OF S.G. VERSUS ASH SAGE CREEK PROJECT

OT OF VARIABLE 1 (VERTICAL AXIS) VERSUS VARIABLE(S) 2 (SYMBOL=*).



additional points to each plot but would not significantly change the accepted equations.

The determined relationships were therefore applied to the rotary holes and any diamond drill holes which had poor recovery, to estimate ash contents and in situ specific gravity for ore reserve calculation. In some adits, ash values were known from laboratory work but specific gravities were unavailable. In such cases, Figure 3 - 8 was used to estimate a dry basis specific gravity which could be converted to an in situ specific gravity value.

SECTION 6. RESERVES

## 6.1 INTRODUCTION

All reserves discussed in this section are considered to be proven reserves and have been divided into two categories:

(1) In situ reserves within pit limits

(2) Mineable raw metallurgical coal reserves

The in situ reserves total 132, 720, 000 long tons and are defined as coal contained within the proposed pit limits in seams that have adhered to seam-thickness criteria. The raw coal reserves total 116, 645, 000 long tons and are defined as that portion of the in situ reserves which will be recovered in the mining operation and delivered to the preparation plant.

An area of Seam 5 at the extreme west side of South Hill is not included in the reserves due to structural complexities. The South Hill geological section in Figure 3 - 3 illustrates where the coal seam is terminated.

Reserve calculations, including data on ash and S. G., are tabulated in Appendix E and are summarized in Table 6 - 1.

## 6.2. IN SITU COAL WITHIN PIT LIMITS

### 6.2.1. Reserve Determination Criteria

(a) Seam Thickness

Only discrete coal seams of 3 feet or more in thickness were included in reserves. In cases where a seam contains numerous narrow shale partings, such a seam was included in reserves only if it contained at least 50 per cent coal by weight.

(b) Tonnage Factor

The density of coal in place was determined for each data point used in reserve calculations. The density so determined was then applied to the volume of influence of that data point.

### 6.2.2. Method of Calculating Reserves

Within the limits of the pits, in situ coal reserves were calculated using the polygonal method on separate base plans for each of the following coal seams:

North Hill - Seam 2, Seam 4 Upper, Seam 4 Lower, and a combination of Seam 5 Upper and Seam 5 Lower.

South Hill - Seam 2, a combination of Seam 4 Upper and Seam 4 Lower, and a combination of Seam 5 Upper and Seam 5 Lower.

It was decided to combine the base plans for those seams above because they are commonly separated by less than 5 feet of rock partings. The coal seam sub-crops* and the intersections of these seams with the pit limits were plotted onto the base plans to delineate the in situ coal within the limits of the pits.

Vertical thicknesses of coal were plotted at their respective drill-hole intercept locations and polygons were drawn around these points. If available, ash and bulk density data of raw coal were noted on the polygons. At holes where this information was not available, the ash and bulk density characteristics of all nearby holes were used together with all other available information in order to obtain representative data. Coal tonnages were calculated using the planimetered area of each polygon and the bulk density of the coal in the hole, or the adit, whose zone of influence that polygon represented.

---

* Sub-crop means a "subsurface outcrop" that describes the areal limits of a truncated rock unit at a buried surface of unconformity.

## 6.3. MINEABLE RAW METALLURGICAL COAL RESERVES

These reserves were determined by applying the following criteria to the in situ reserves:

### 6.3.1 Coal Loss at Contacts

One foot (vertical thickness) of coal loss was deducted at all rock-coal contacts, that is one foot at the hanging wall of each seam, one foot at the footwall of each seam, one foot at the hanging wall of a sorted parting and one foot at the footwall of a sorted parting.

### 6.3.2. Coal Loss at Faults

An exercise was performed to determine coal losses at faults where displacement was sufficient to result in rock-coal contacts. It was estimated that there will be a reserve loss of 4 feet (measured horizontally) in such fault zones.

### 6.3.3. Coal Loss Due to Oxidation

All coal within 50 feet of surface was considered to be oxidized. The resultant coal loss was determined to be comparable to using a measurement of 80 feet down dip from the sub-crop.

Although such oxidized coal may be of economic value at some future date, it is treated as waste metallurgical coal in this report.

### 6.3.4. Thickness of Partings

Shale partings, when separating seams, are included in reserves if they are 5 feet or less in thickness. Partings of more than 5 feet would be sorted in the mining operation and thus handled as waste.

If the shale partings that are included in the reserves occur within Seams 2, 4 Upper, 4 Lower, 5 Upper and 5 Lower, the shale parting tonnages are accounted for by the bulk densities of the seams. If these shale partings occur between Seams 4 Upper and 4 Lower or 5 Upper and 5 Lower, the tonnages were calculated separately using a specific gravity of 2.6.

### 6.3.5. Dilution at Contacts

One foot (vertical thickness) of rock dilution was added per mineable member, that is 6 inches at the hanging wall and 6 inches at the footwall. No rock dilution was attributed to separated partings.

6.3.6. Dilution at Faults

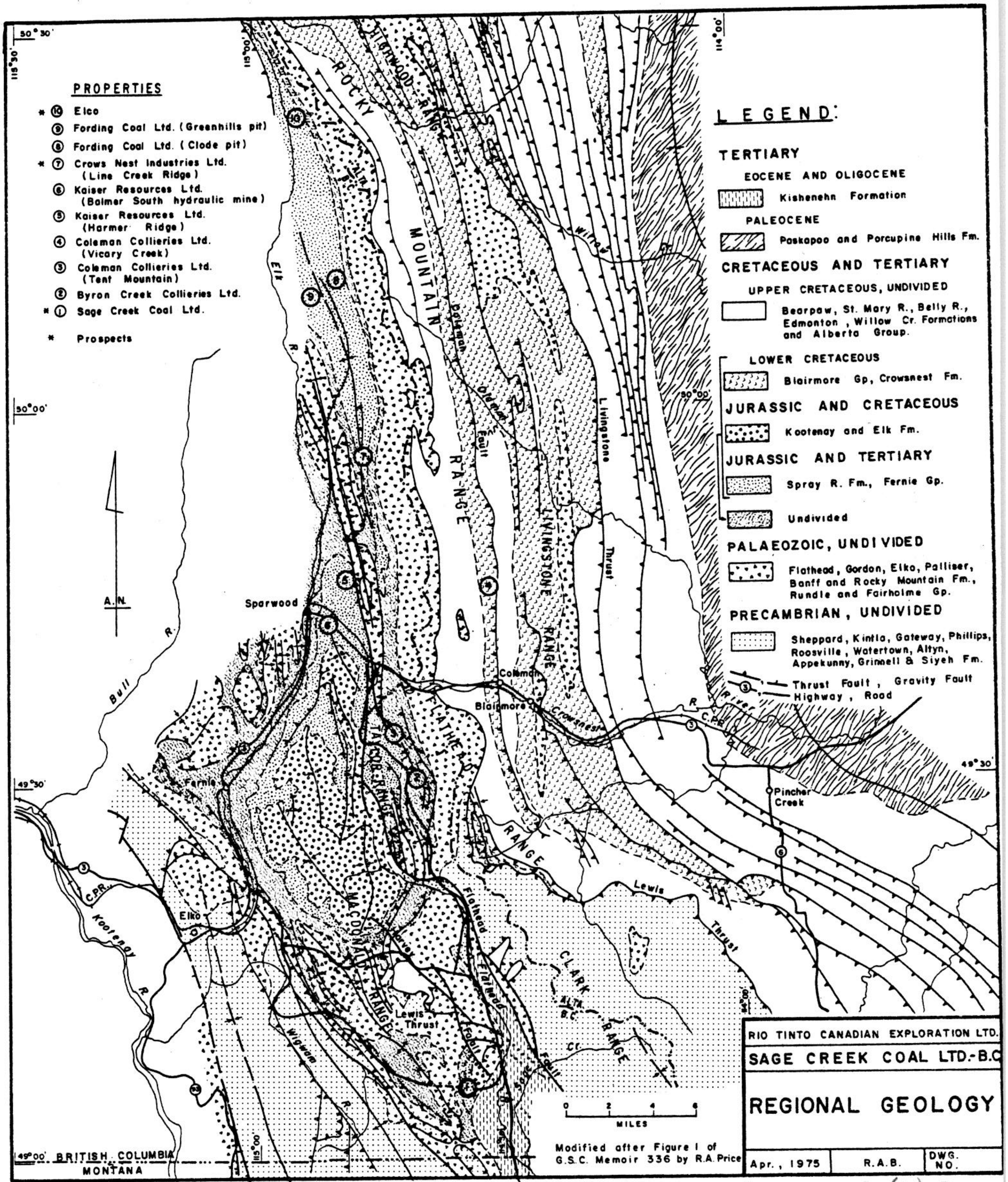
Four feet of rock dilution was added at faults where displacement was sufficient to result in rock-coal contacts. All rock dilution, as well as partings between Seams 4 Upper and Lower and partings between Seams 5 Upper and Lower, were given a specific gravity of 2.6 for purposes of tonnage calculations.

6.3.7. General

The deductions from the quantity of coal available for delivery to the washing plant amount to 12.1 per cent of gross in situ coal for North Hill and 12.2 per cent for South Hill. Therefore, the mining recovery is 87.9 per cent for North Hill and 87.8 per cent for South Hill.

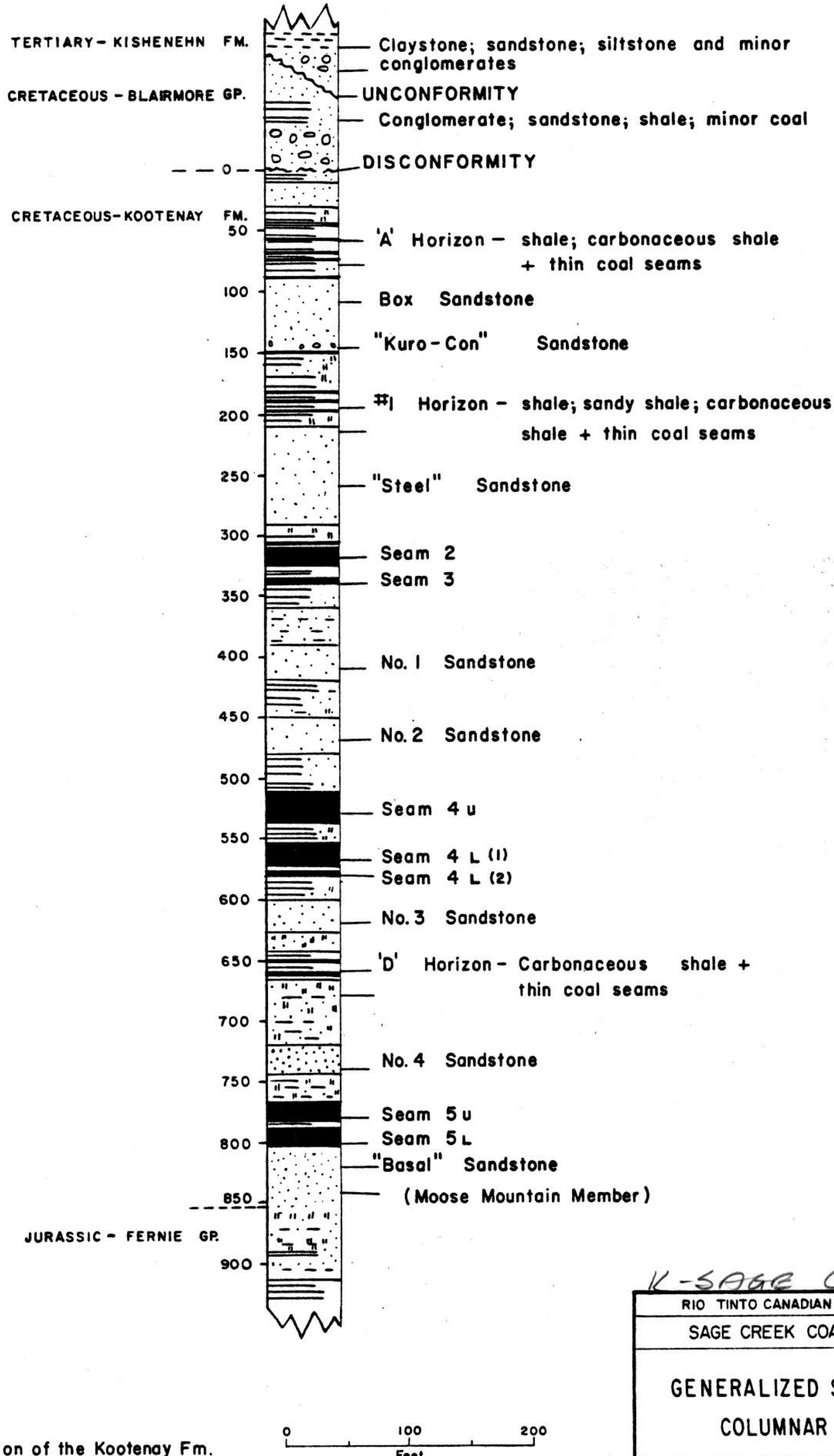
As the 116,645,000 long tons of mineable raw metallurgical coal are mined, they will be diluted with 13,818,000 long tons of waste rock. Therefore, a total of 130,463,000 long tons of diluted coal will be delivered to the preparation plant.

Figure 3-1




K- SAGE CREEK 75(1)E

# Figure 3-5




K-SAGE CREEK 75(1)E

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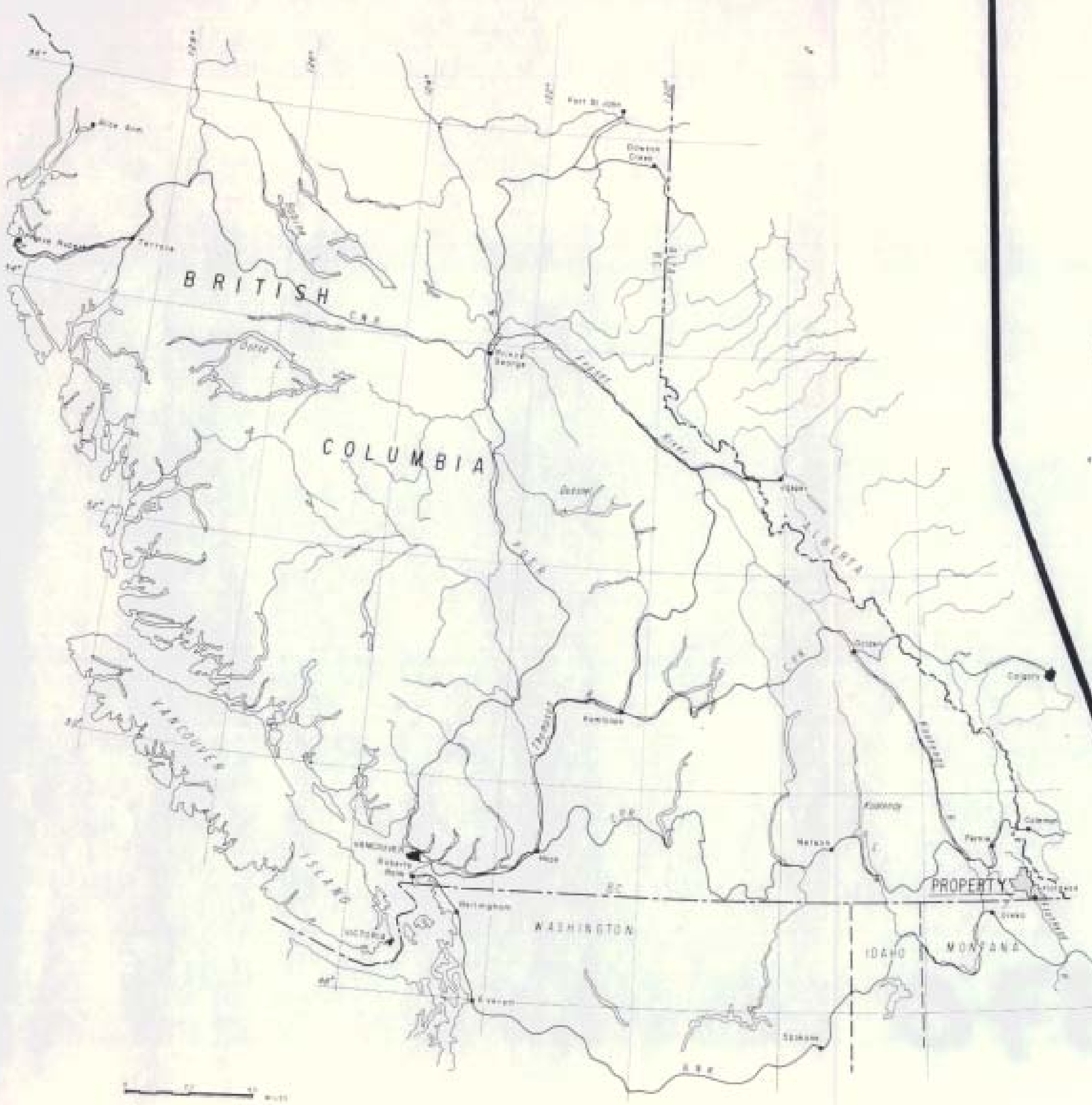
SAGE CREEK COAL LTD. — B.C.

GENERALIZED STRATIGRAPHIC COLUMNAR SECTION

April 1976 | O.C. / L. Nagy | Fig:

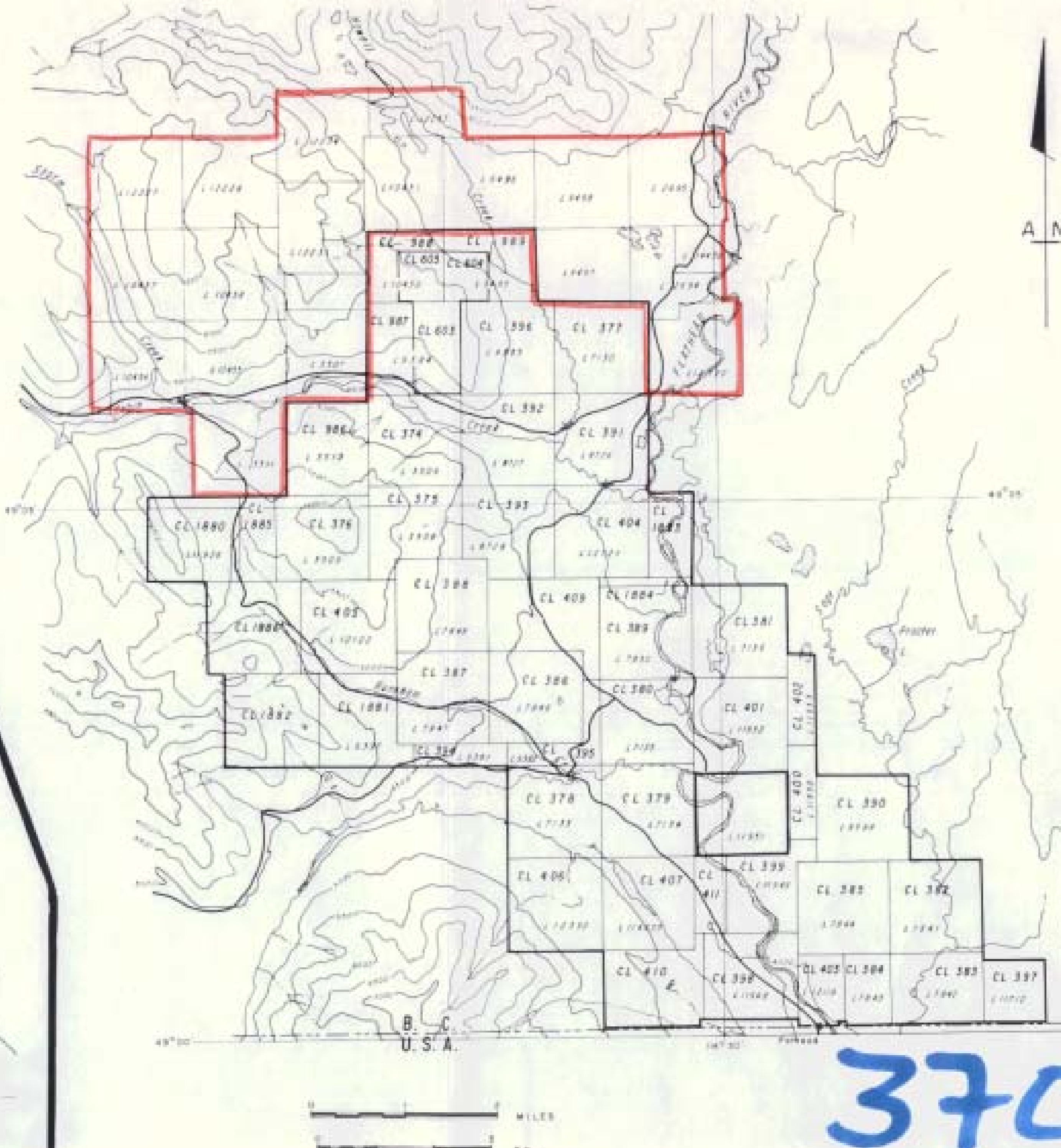
NOTE:

Section of the Kootenay Fm. in the Sage Creek Coal Deposit




PROPERTY LOCATION MAP

SHOWING RAILWAYS TO VANCOUVER




L E G E N D

| | |
|---|---|
| ——— | Outline of property |
| L. 11712 | Lot number |
| CL. 397 | Coal Licence |

NOTE: 603, 604 & 605 purchased from C.N.I. Nov. 1973

370

K-SAGE CREEK 75(1)E

| RIO TINTO CANADIAN EXPLORATION LTD. | | |
|---|---|---|
| SAGE CREEK COAL LIMITED - B.C. | | |
| PROPERTY PLAN | | |
| FEB. 1975 | O.C. / E.S. | DWG. L 2692 |

K-SAGE CREEK 75(2) E-2

SAGE CREEK COAL
EXPLORATION + GEOLOGY
(MAPS)



O. CULLINGHAM (BOOK - C-3) JULY 1976

00370 (1)


LEGEND
Jf Jurassic - Fernie Fm.
Kk Cretaceous - Kootenay Fm.
Kbl Cretaceous - Blairmore Gp
Tk Tertiary - Kishenehn Fm.
Coal Seam, Defined
Coal Seam, Inferred
Coal Seam, Possible
Overburden
Sandstone
Siltstone
Interbedded Sandstone & Siltstone
Shale or Mudstone
Carbonaceous Shale
Interbedded Shale & Siltstone
Conglomerate
Gravel
Claystone
Interbedded Gravels & Claystone
No Recovery
Fault, Direction of movement indicated
Contact, Defined, Inferred
Drill Hole
Gamma Ray Profile - Left
Neutron Profile - Right
FAULT No. 1
FAULT No. 2
FAULT No. 3
FAULT No. 4
Elev 5,000'
Elev 4,000'
Elev 3,000'
FEET
METERS
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD.
K - SAGE CREEK 75(2)E
NORTH HILL
370 (1)
SECTION: 17.586.000E
(M1)
(See DWG. No. D4478-2 for SOUTH HILL)
DATE: June, 1976
DRAWN BY: L. Nagy
CK'D. BY: O.C.
Approved: O.C.
DWG. NO. D4478-1

LEGEND
Jf Jurassic - Fernie Fm.
Kk Cretaceous - Kootenay Fm.
Kbl Cretaceous - Blairmore Gp.
Tk Tertiary - Kishenehn Fm.
Coal Seam, Defined
Coal Seam, Inferred
Coal Seam, Possible
Overburden
Sandstone
Siltstone
Interbedded Sandstone & Siltstone
Shale or Mudstone
Carbonaceous Shale
Interbedded Shale & Siltstone
Conglomerate
Gravel
Claystone
Interbedded Gravels & Claystone
No Recovery
Fault, Direction of movement indicated
Contact, Defined, Inferred
Drill Hole
Gamma Ray Profile - Left
Neutron Profile - Right
843,000N
844,000N
845,000N
846,000N
847,000N
848,000N
849,000N
850,000N
5,000'
Elev. 5,000'
4,000
Elev. 4,000'
3,000'
Elev. 3,000'
74-15
74-12
SCC-26
(Projected 304' at 30°, Azim 095°)
FAULT No. 1
75n-13
75g-06
Tk
Kbl
Kk
Jf
'A' HORIZON
Box Sandstone
Steel Sandstone
2
No. 1 Sandstone
No. 2 Sandstone
4U
4L
'D' HORIZON
5U
5L
12.5'
39.5'
5'
12'
2.5'
14.25'
5.25'
8.5'
23.75'
29'
18'
45'
5.5'
21.5
6.5'
14'
12.25'
49.5'
26'
14.5
39'
FEET
METERS
0 100 200 300 400 500 600
0 50 100 150 200
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD.
K- SAGE CREEK 75 (2) E
SOUTH HILL
370
SECTION: 17.586.000E
M2
(See DWG. No. D4478-1 for NORTH HILL)
DATE: June, 1976
DRAWN BY: L. Nagy
CK'D. BY: O.C
Approved: O.C.
DWG. NO. D4478-2

LEGEND
Jf Jurassic - Fernie Fm.
Kk Cretaceous - Kootenay Fm.
Kbl Cretaceous - Blairmore Gp.
Tk Tertiary - Kishenehn Fm.
Coal Seam, Defined
Coal Seam, Inferred
Coal Seam, Possible
Overburden
Sandstone
Siltstone
Interbedded Sandstone & Siltstone
Shale or Mudstone
Carbonaceous Shale
Interbedded Shale & Siltstone
Conglomerate
Gravel
Claystone
Interbedded Gravels & Claystone
No Recovery
Fault, Direction of movement indicated
Contact, Defined, Inferred
Drill Hole
Gamma Ray Profile - Left
Neutron Profile - Right
581,000E
582,000E
583,000E
584,000E
585,000E
586,000E
587,000E
588,000E
5,000'
4,000
3,000'
Elev. 5,000'
Elev. 4,000'
Elev. 3,000'
75D-09
74-09
(PROJECTED 36' at 004°)
75D-21
75D-12
75R-07
O.B.
FAULT No. 9
FAULT No. 7
FAULT No. 6
FAULT No. 8
FAULT No. 5
FAULT No. 4
FAULT No. 2
FAULT No. 1
'A' HORIZON
'D' HORIZON
Box Sandstone
No. 1 Sandstone
No. 2 Sandstone
4U
4L
5U
5L
2
Kk
Kbl
Jf
Tk
FEET
METERS
0 100 200 300 400 500 600
0 50 100 150 200
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD.
SOUTH HILL 370
SECTION 17.846.660
M3
K-SAGE CREEK 75 (2)E
DATE: June, 1976
DRAWN BY: L. Nagy
CK'D. BY: O.C.
Approved: O.C.
DWG. NO. D4477-6

LEGEND
Jf Jurassic - Fernie Fm.
Kk Cretaceous - Kootenay Fm.
Kbl Cretaceous - Blairmore Gp.
Tk Tertiary - Kishenehn Fm.
Coal Seam, Defined
Coal Seam, Inferred
Coal Seam, Possible
Overburden
Sandstone
Siltstone
Interbedded Sandstone & Siltstone
Shale or Mudstone
Carbonaceous Shale
Interbedded Shale & Siltstone
Conglomerate
Gravel
Claystone
Interbedded Gravels & Claystone
No Recovery
Fault, Direction of movement indicated
Contact, Defined, Inferred
Drill Hole
Gamma Ray Profile - Left
Neutron Profile - Right
581,000E
582,000E
583,000E
584,000E
585,000E
586,000E
587,000E
588,000E
5,000'
4,000'
3,000'
Elev. 5,000'
Elev. 4,000'
Elev. 3,000'
74-05
SCC-13
(Projected 48' at 180°)
74-06
SCC-29
(Projected 84' at 185°)
74-07
SCC-25
(Projected 79' at 185°)
FAULT No. 9
FAULT No. 7
FAULT No. 8
FAULT No. 6
FAULT No. 5
FAULT No. 4
FAULT No. 3
FAULT No. 2
FAULT No. 1
'B' HORIZON
'D' HORIZON
No. 1 Sandstone
No. 2 Sandstone
Bar Sandstone
2
4U
4L
5U
5L
Kk
Kbl
Jf
Tk
FEET
0 100 200 300 400 500 600
METERS
0 50 100 150 200
M4
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD.
SOUTH HILL 370 (1)
SECTION 17,847,060
K-SAGE CREEK 75(2)E
DATE: June, 1976
DRAWN BY: L. Nagy
CK'D. BY: O.C.
Approved: O.C.
DWG. NO. D4477-7


L E G E N D
Jf Jurassic - Fernie Fm.
Kk Cretaceous - Kootenay Fm.
Kbl Cretaceous - Blairmore Gp.
Tk Tertiary - Kishenehn Fm.
Coal Seam, Defined
Coal Seam, Inferred
Coal Seam, Possible
Overburden
Sandstone
Siltstone
Interbedded Sandstone & Siltstone
Shale or Mudstone
Carbonaceous Shale
Interbedded Shale & Siltstone
Conglomerate
Gravel
Claystone
Interbedded Gravels & Claystone
No Recovery
Fault, Direction of movement indicated
Contact, Defined, Inferred
Drill Hole
Gamma Ray Profile - Left
Neutron Profile - Right
581,000E
582,000E
583,000E
584,000E
585,000E
586,000E
587,000E
588,000E
5,000'
4,000
3,000'
Elev. 5,000'
Elev. 4,000'
Elev. 3,000'
75D-30 75D-30A
( Projected 129' at 355° )
FAULT No. 8
FAULT No. 6
FAULT No. 4
FAULT No. 2
FAULT No. 1
SCC-31
( Projected 61' at 002° )
X-Cut Adit 73-5a-5
75R-14
( Projected 91' of 010° )
75R-13
( Projected 32' at 002° )
75G-01
O.B. Glacial Till
'D' HORIZON
No. 4 Sandstone
'A' HORIZON
No. 1 Sandstone
No. 2 Sandstone
5U
5L
4U
4L
2
Jf
Kk
Kbl
Tk
FEET
METERS
0 100 200 300 400 500 600
0 50 100 150 200
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD.
SOUTH HILL 370
SECTION 17. 848. 660 M5
K-SAGE CREEK 75(2)E
DATE: June, 1976
DRAWN BY: L. Nagy
CK'D. BY: O.C.
Approved: O.C.
DWG. NO. D4477-11


RIO TINTO CANADIAN EXPLORATION LTD.

SAGE CREEK COAL LTD.

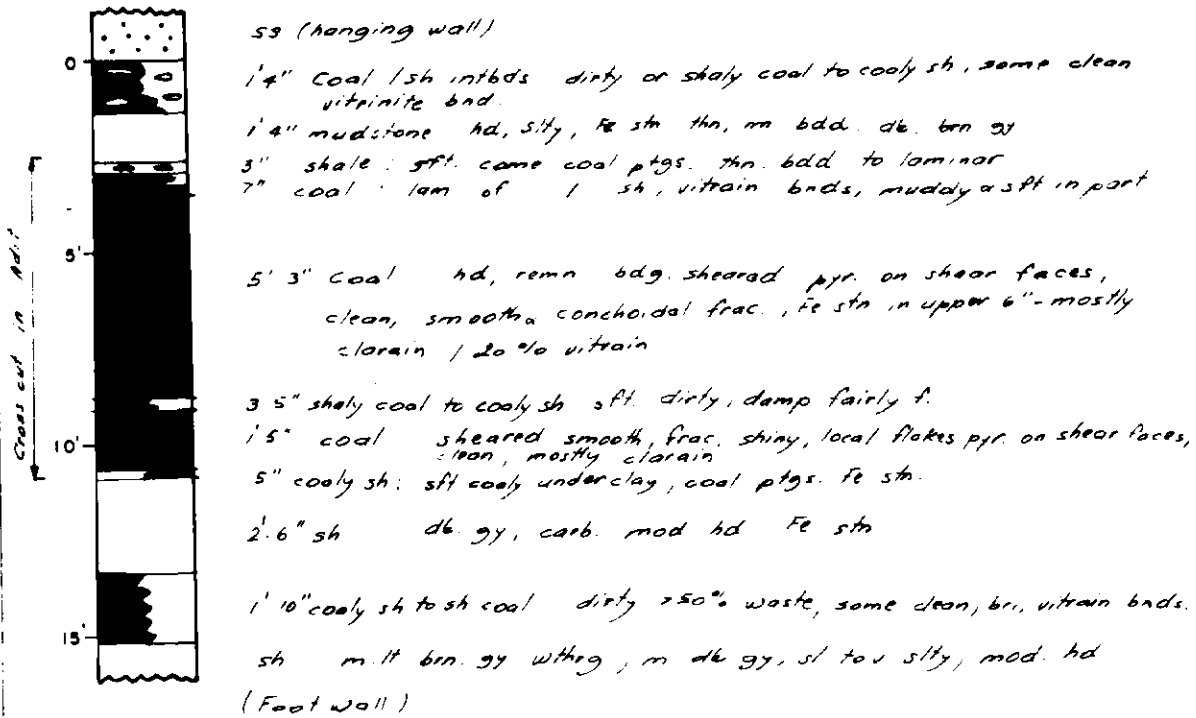
SOUTH HILL 370(1)

SECTION 17.849.060

M6

K- SAGE CREEK 75(2)E.

DATE: June, 1976 | DRAWN BY: L. Nagy | CK'D. BY: O.C. | Approved: O.C. | DWG. NO. D4477-12

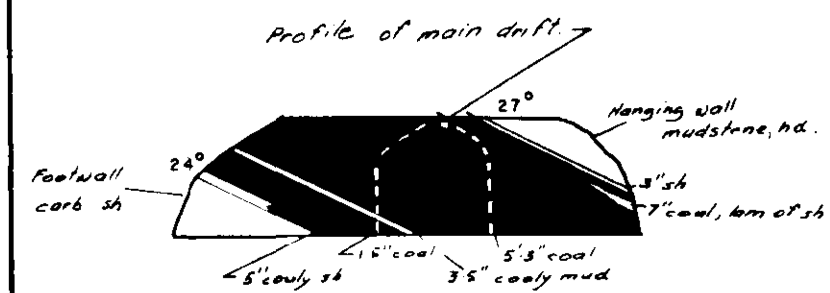



## SECTION

NORTH FACE

(measured at waist height by O.C. and R.W. Aug, 1972)

SCALE: 1" = 5'



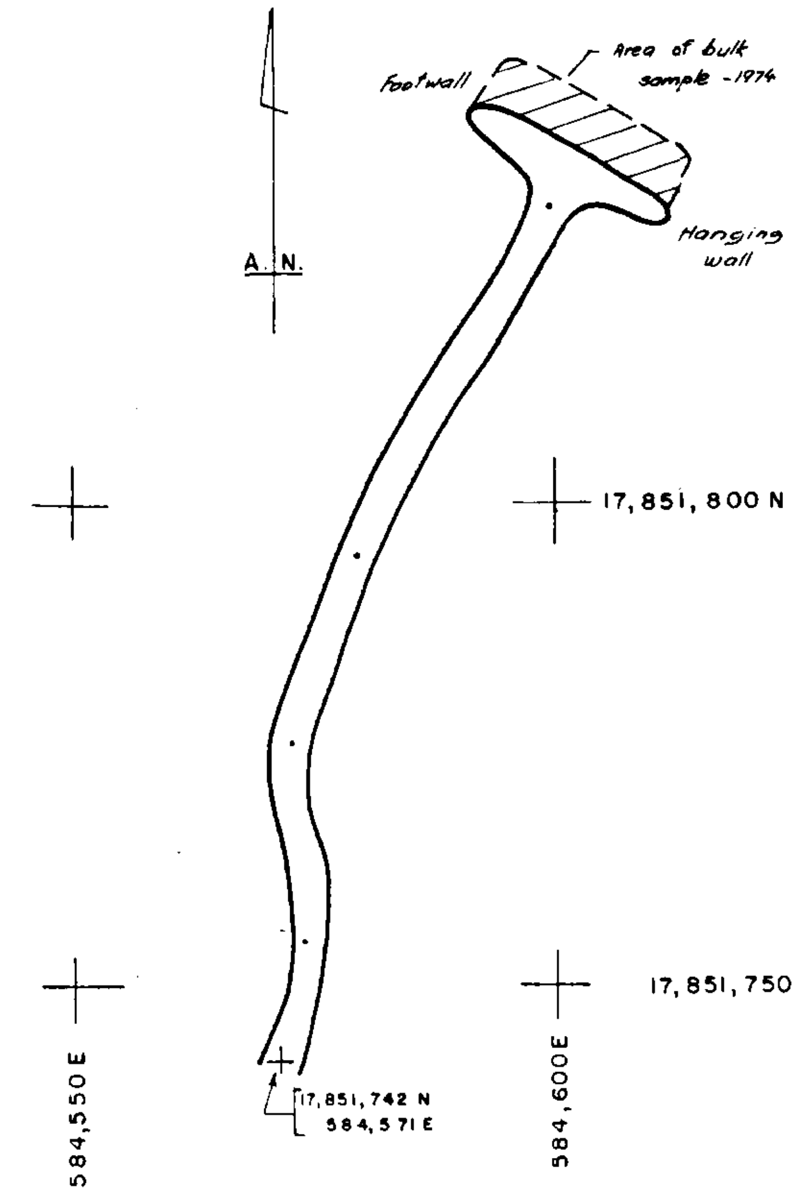

## CROSS - CUT

NORTH FACE OF CROSS CUT

(measured by O. Cullingham & R. Maxwell)

August, 1972

SCALE: 1" = 5'




## PLAN

Survey Plot after Dabbs (1972)

SCALE: 1" = 20'

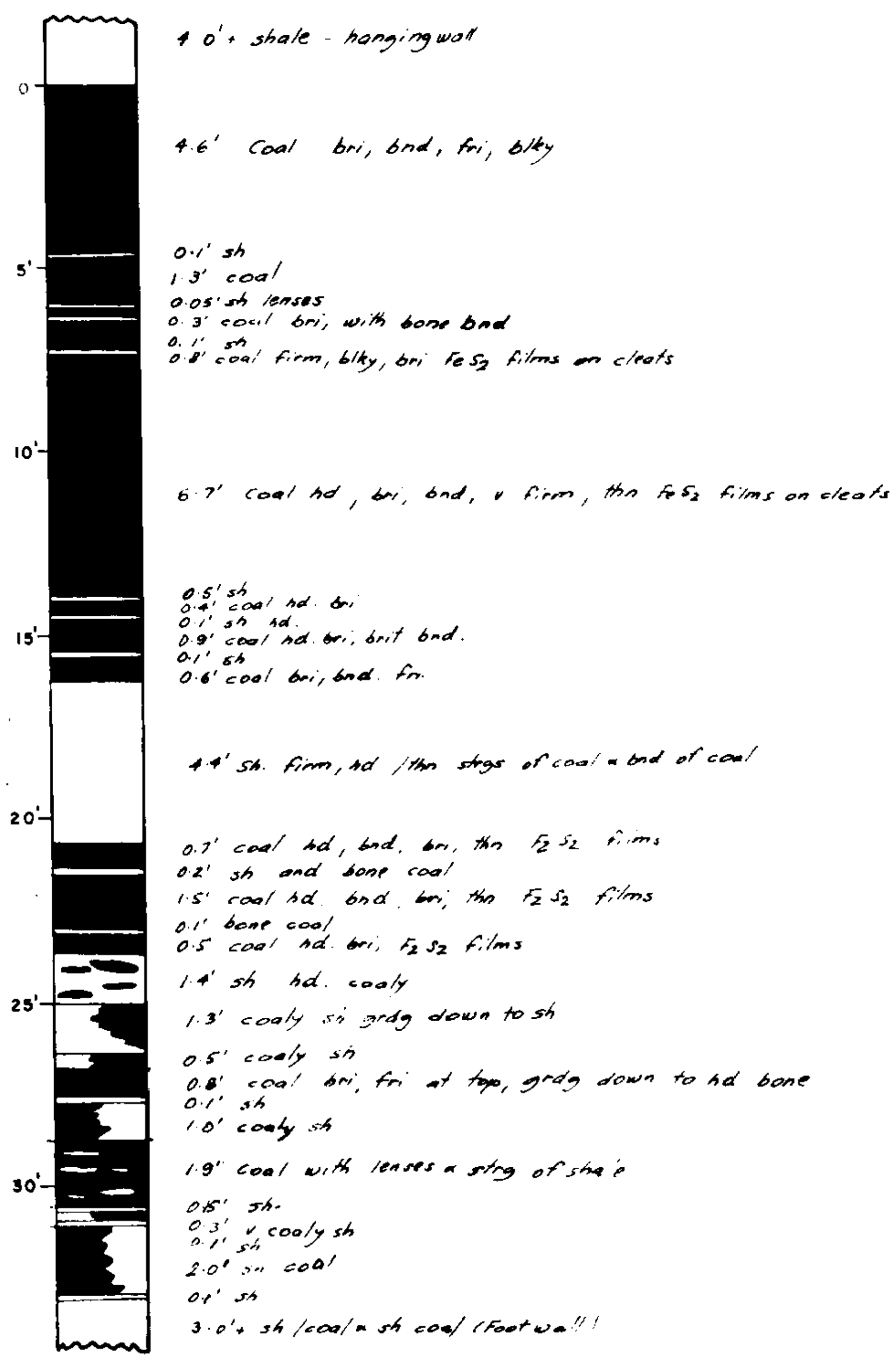
N.T.S. 82-G-1,2

370 (2)

(M1)

K-SAGE CREEK 75(2)E

| |
|---|
| RIO TINTO CANADIAN EXPLORATION LTD. |
| SAGE CREEK COAL LTD. - B.C. |
| ADIT No. 72-2N - SEAM 2<br>22-N |
| Nov, 1972 — O.C / e.k. — DWG. G-2597-A |



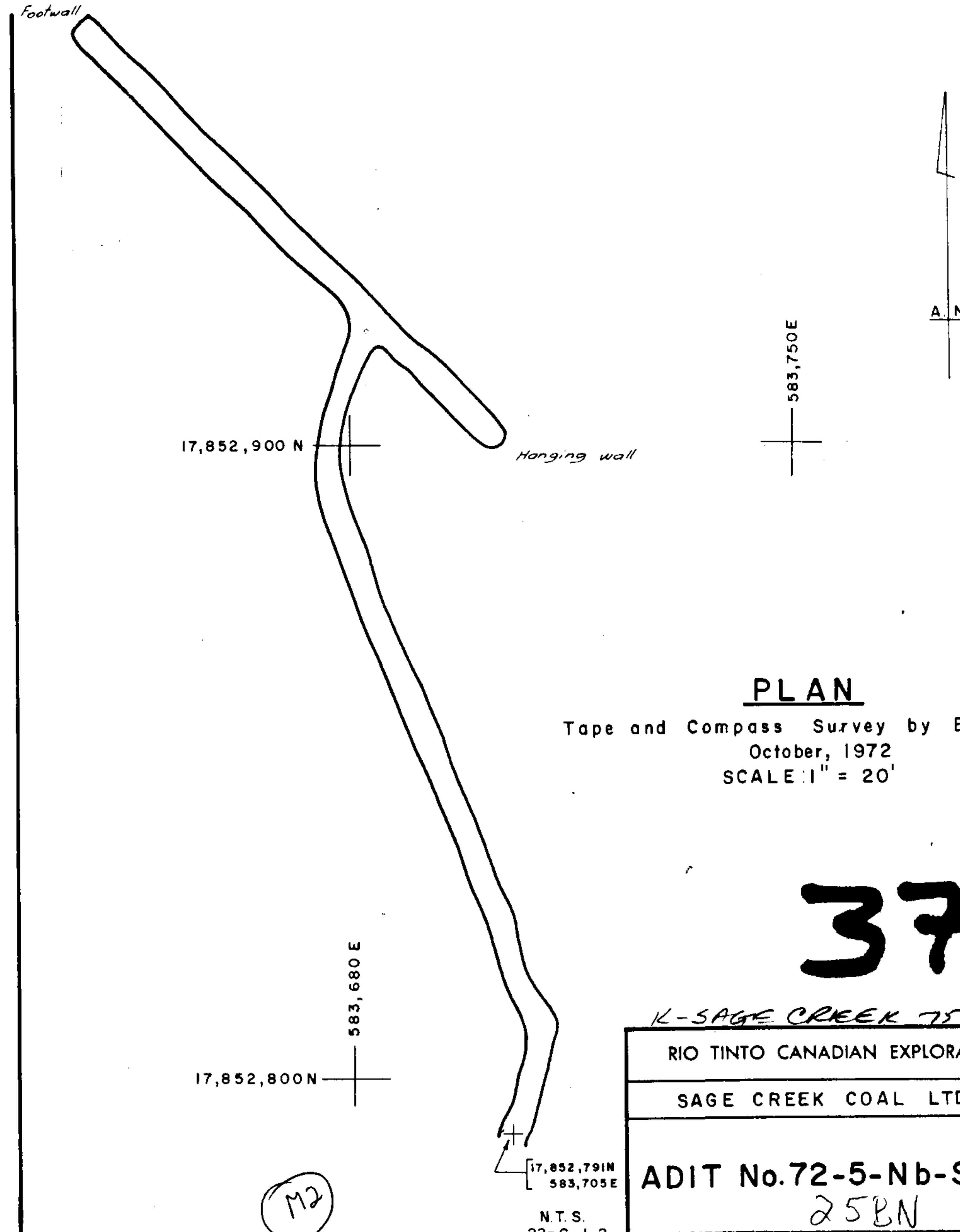

## SECTION

NORTH FACE

(measured at mid-rib height by R.A. Benkis & W.J. Hennessey)

October, 1972

SCALE: 1" = 5'




## PLAN

Tape and Compass Survey by B. Pewsey

October, 1972

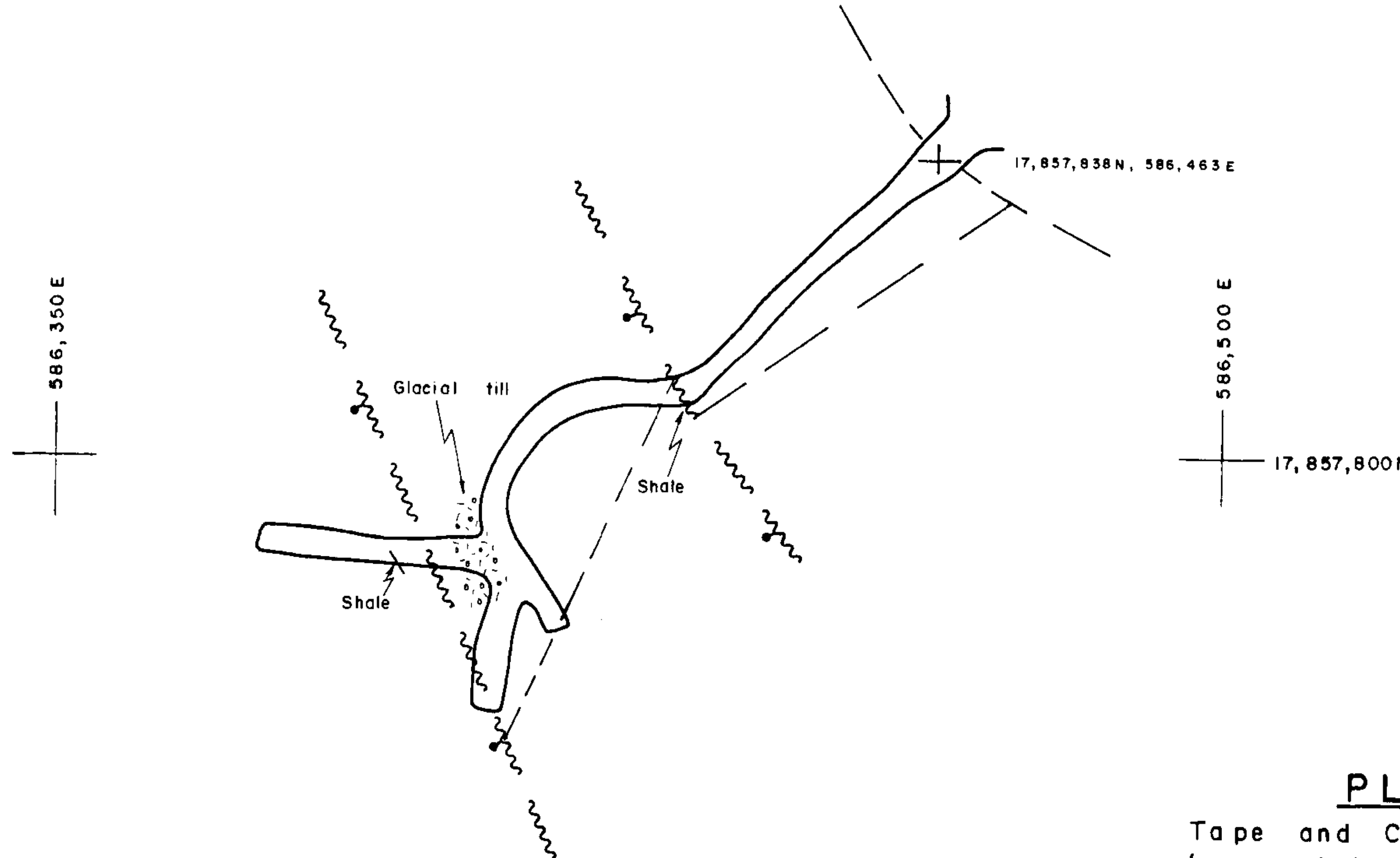
SCALE: 1" = 20'

370(2)

K-SAGE CREEK 75(2)E

M2

| RIO TINTO CANADIAN EXPLORATION LTD. | | |
|---|---|---|
| SAGE CREEK COAL LTD. - B.C. | | |
| ADIT No. 72-5-Nb-SEAM 5 25BN | | |
| Nov, 1972 | R.A.B., B.P./ e.k. W.J.H. | DWG. G-2598 |

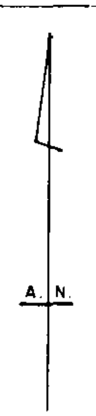



# PLAN

Tape and Compass Survey
(measured by B. Pewsey ; Sept., 1973)

370 K-SAGE CREEK 75(2)E
(2)

NORTH HILL




M3

SCALE
0 20 40 60 80
One Inch = 20 Feet

| | | |
|---|---|---|
| RIO TINTO CANADIAN EXPLORATION LTD. | | |
| SAGE CREEK COAL LTD. — B.C. | | |
| ADIT No. 73-4a-N | | |
| Dec., 1973 | O.C. / L. Nagy | DWG. G-2645 |


370 (2)

(M4)

44 FS

# SAGE CREEK, B.C.

MEASUREMENT OF SEAM IN CROSSCUT 74-4F-S
150' IN FROM PORTAL

SCALE: 1" = 5'

MEASURED BY: A. BEDFORD AND W. HENNESSEY, AUG. 1, 1974

PREPARED FOR

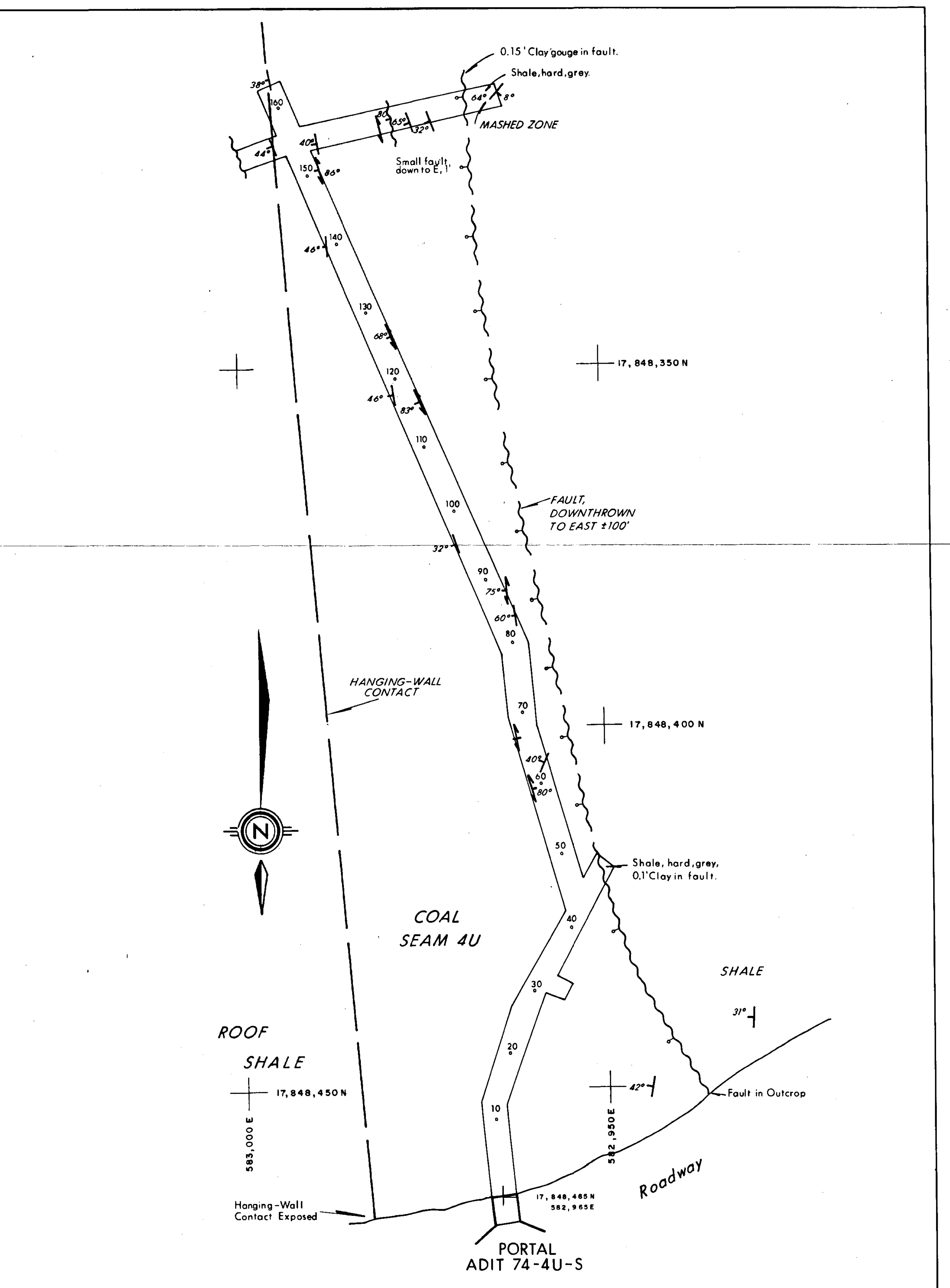
SAGE CREEK COAL LTD.

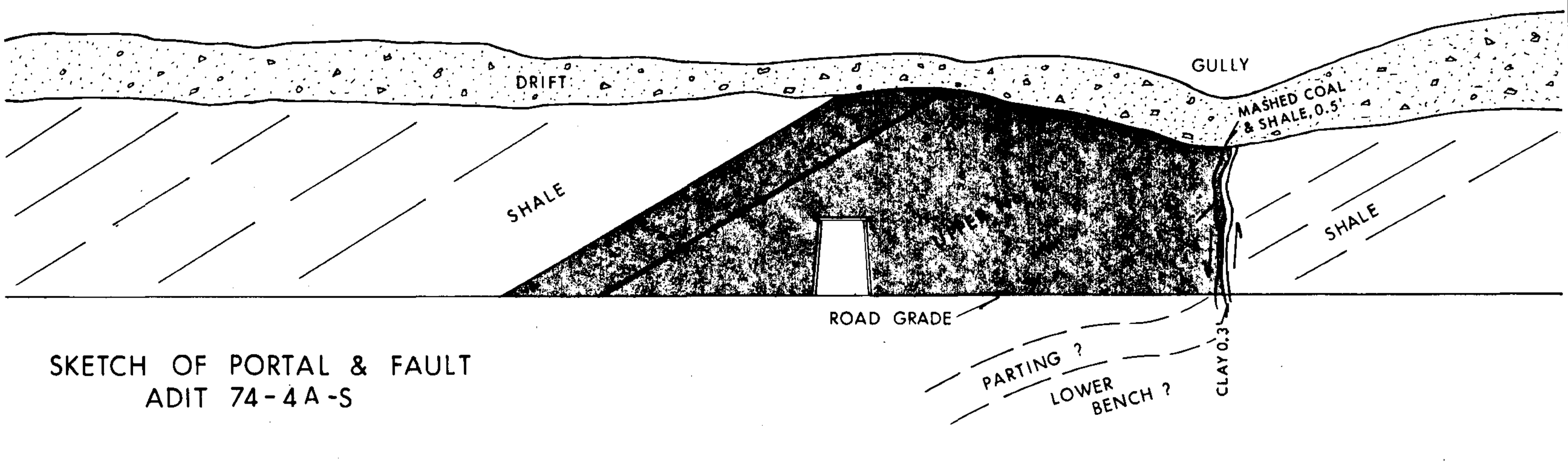
BY

W.J. HENNESSEY CONSULTING LTD.

K-SAGE CREEK 75(2)E

DWG. G-3504-2




SKETCH OF PORTAL & FAULT
ADIT 74-4A-S

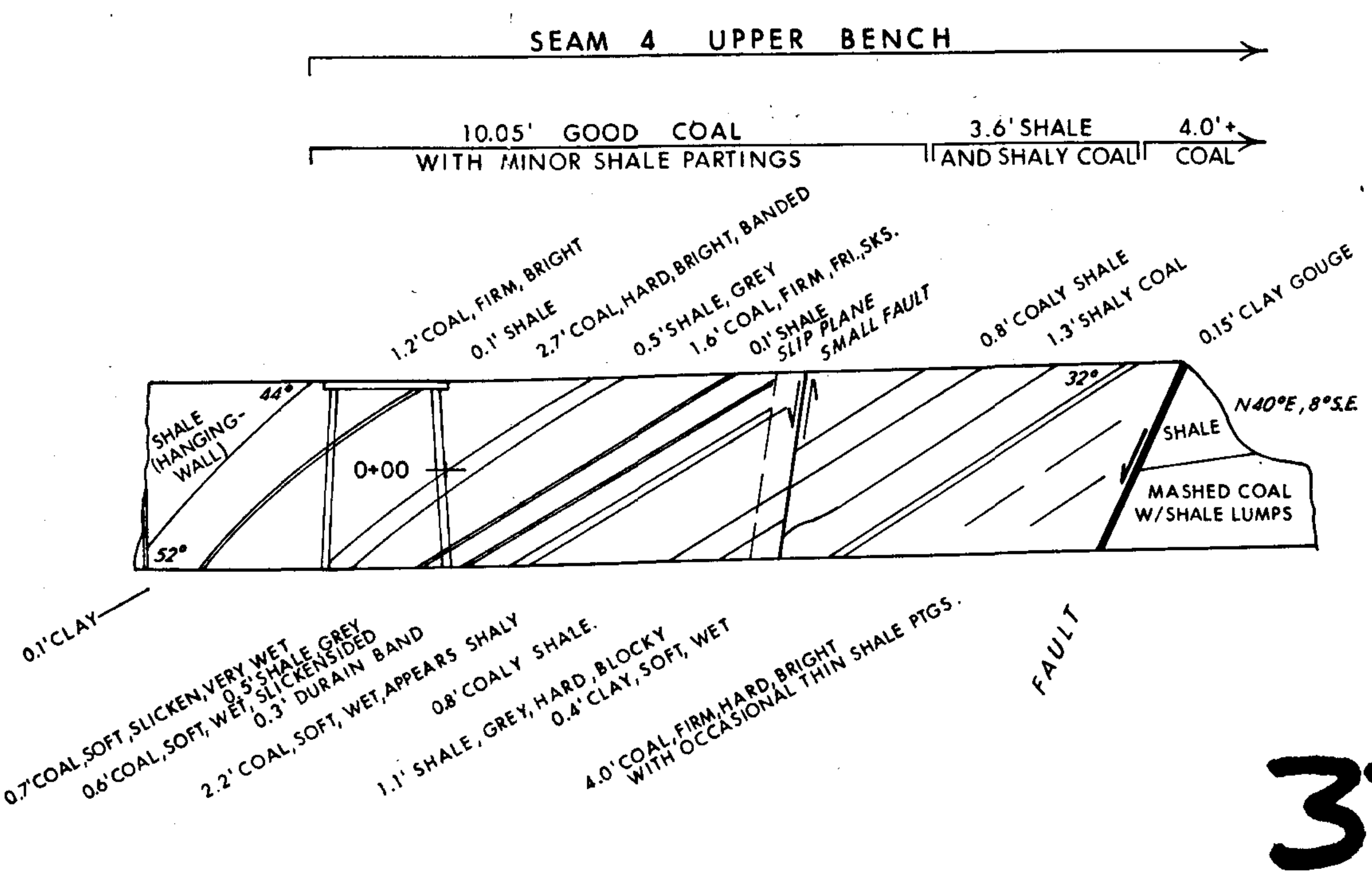
# ADIT 74-4A-S

## GEOLOGY

FEET 0 10 20 30 40
0 3 6 9 12 METERS

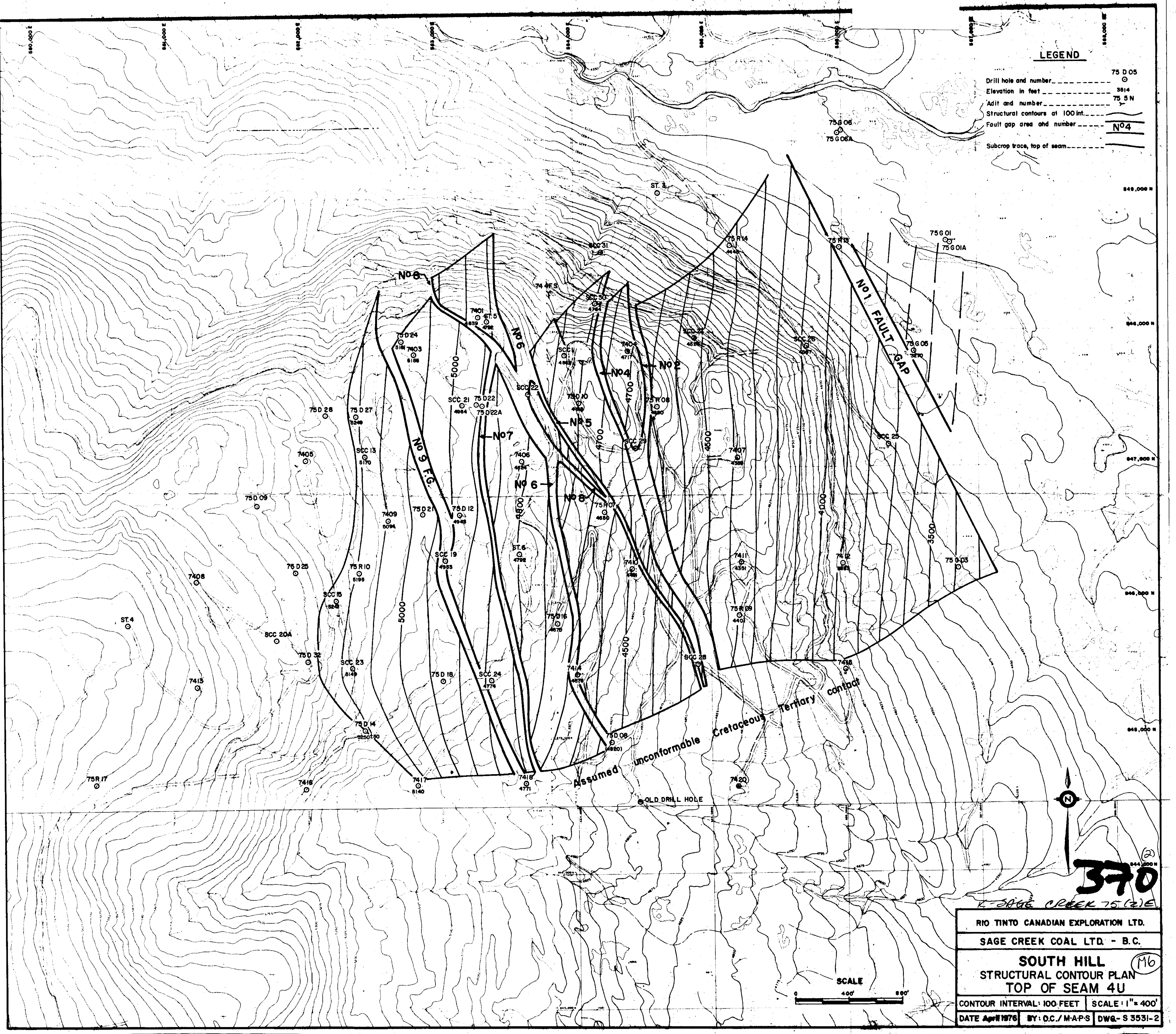
AUGUST 1, 1974. W.HENNESSEY
A.BEDFORD
AUGUST 13,1974 W.HENNESSEY
SURVEYED BY: B. PEWSEY

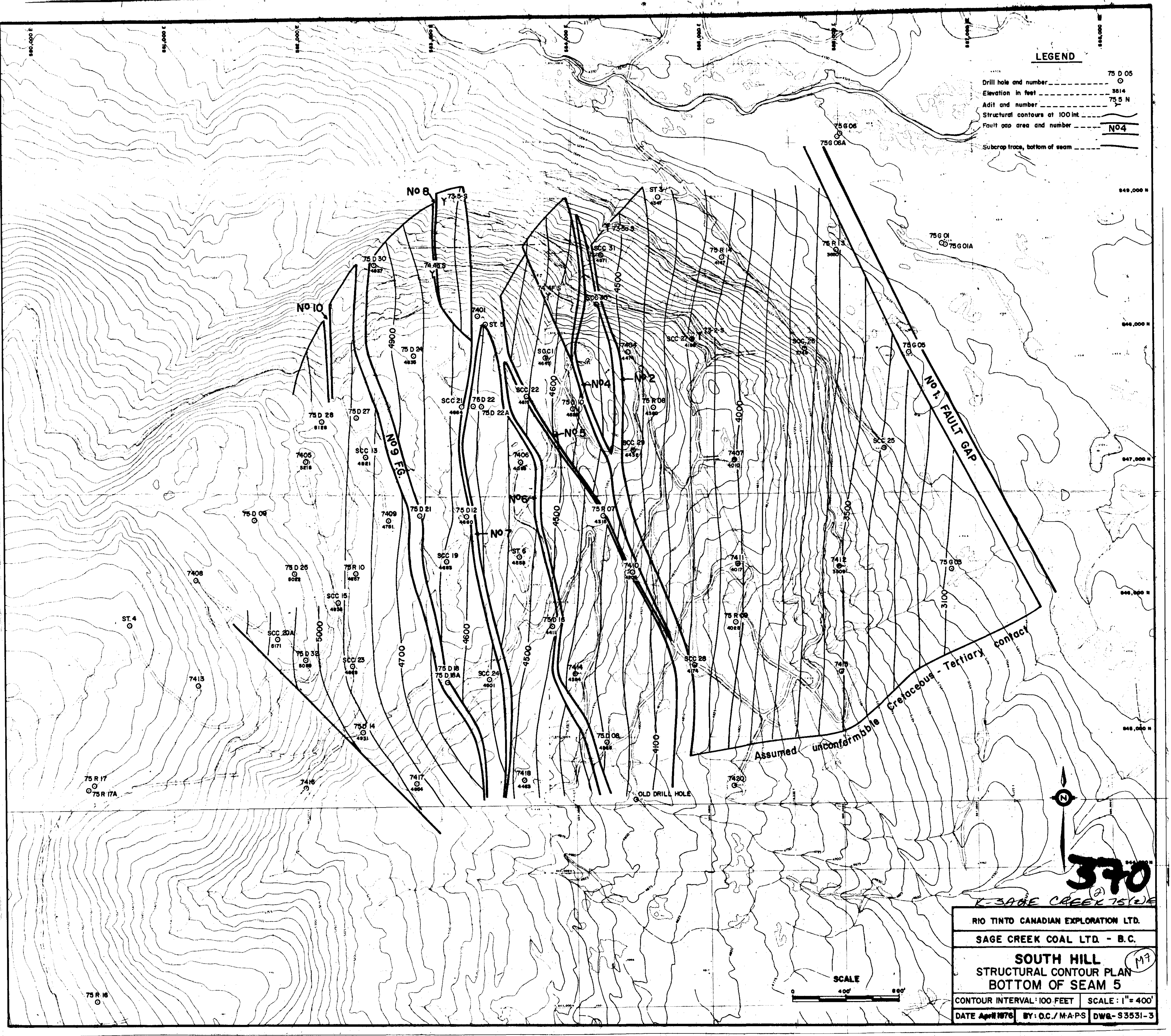
PREPARED FOR
SAGE CREEK COAL LTD.
BY
W.J.HENNESSEY CONSULTING LTD.
AUGUST 14, 1974

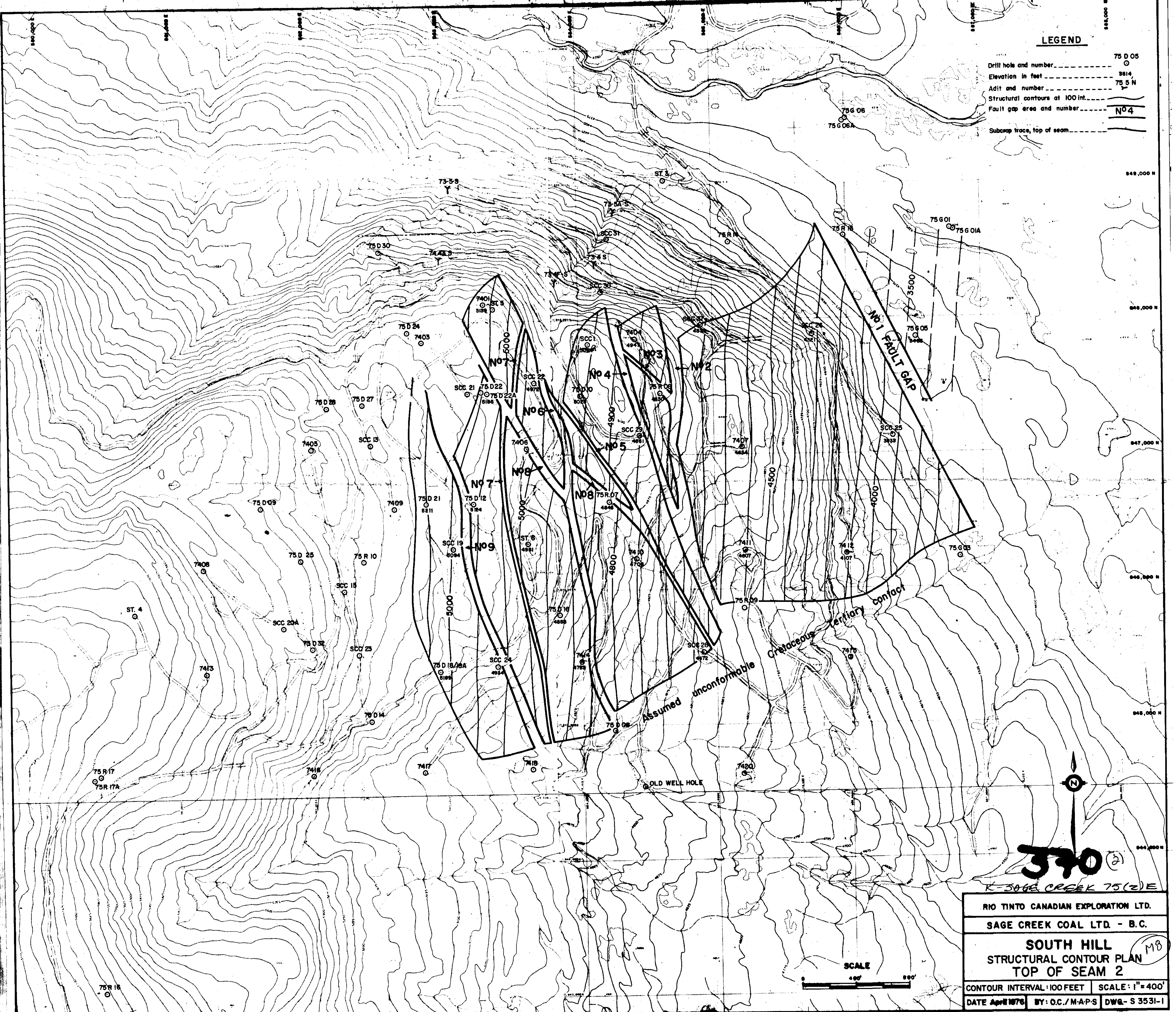


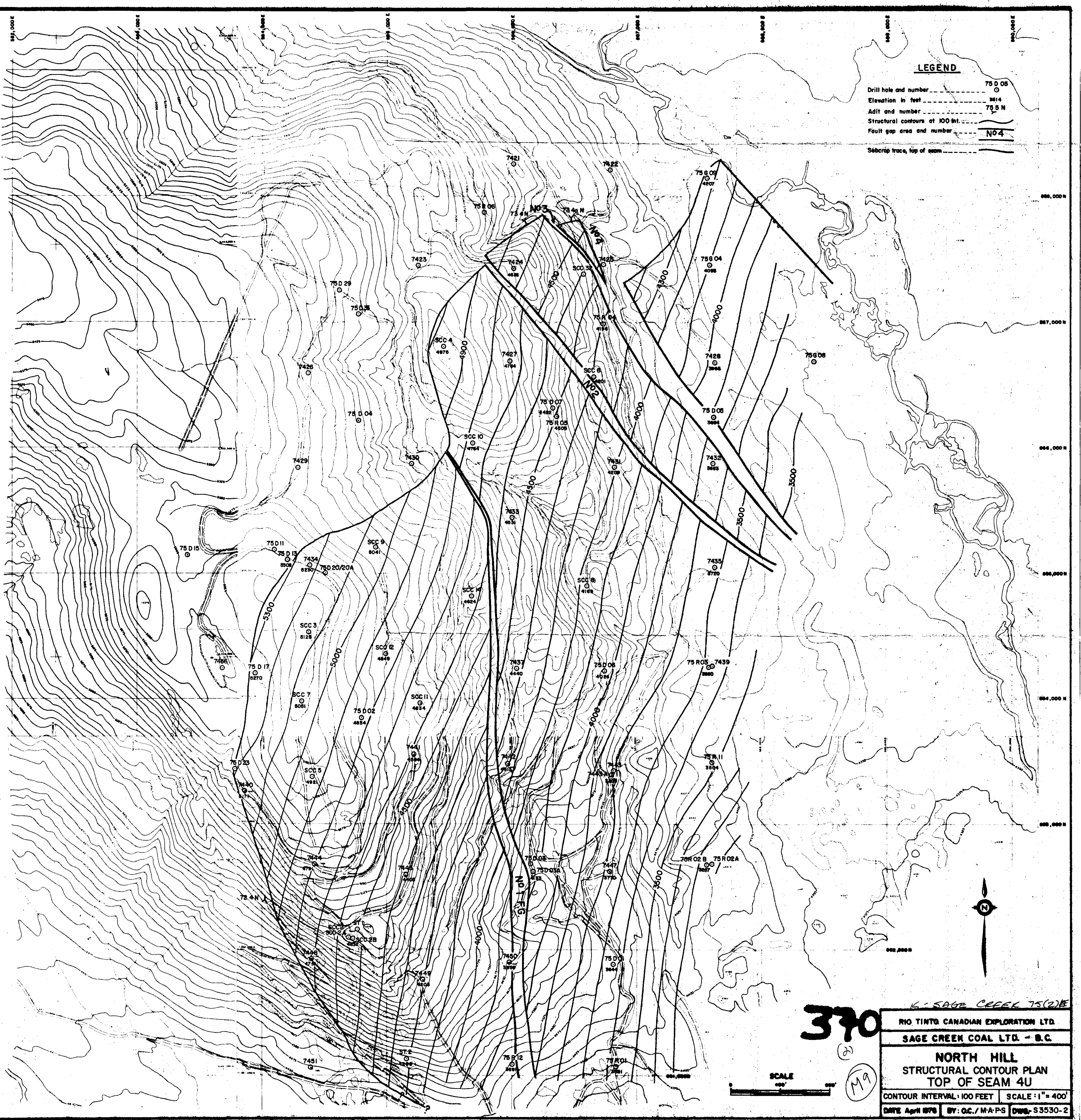

370 (2)
1115

SAGE CREEK, B.C.
MEASUREMENT OF SEAM IN CROSSCUT 74-4A-S
155' IN FROM PORTAL
SCALE: 1" = 5'
M5
MEASURED BY: W. HENNESSEY, AUG. 13, 1974
PREPARED FOR
SAGE CREEK COAL LTD.
BY
W.J. HENNESSEY CONSULTING LTD.
0 5 10 FEET
0 1 3 METERS
DWG. G-3505
X-SAGE CREEK 75(2)K


LEGEND
Drill hole and number 75 D 05
Elevation in feet 3514
Adit and number 75 5 N
Structural contours at 100 int.
Fault gap area and number Nº4
Subcrop trace, top of seam
No1 FAULT GAP
Nº9 F.G.
Nº6
Nº7
Nº5
Nº8
Nº4
Nº2
Assumed unconformable Cretaceous Tertiary contact
OLD DRILL HOLE
SCALE
0 400' 800'
370
(2)
K-SAGE CREEK 75 (2) E
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
SOUTH HILL
M6
STRUCTURAL CONTOUR PLAN
TOP OF SEAM 4U
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./M.A.P.S
DWG.- S 3531-2


LEGEND
Drill hole and number 75 D 05
Elevation in feet 3814
Adit and number 75 5 N
Structural contours at 100 int
Fault gap area and number No4
Subcrop trace, bottom of seam
No 1 FAULT GAP
No 9 F.G.
No 10
No 8
No 2
No 4
No 5
No 6
No 7
Assumed unconformable Cretaceous - Tertiary contact
OLD DRILL HOLE
SCALE
0 400' 800'
370
K-SAGE CREEK 75(2)E
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
SOUTH HILL
STRUCTURAL CONTOUR PLAN
BOTTOM OF SEAM 5
M7
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./M.A.P.S
DWG.-S3531-3


LEGEND
Drill hole and number
75 D 05
Elevation in feet
3514
Adit and number
75 S N
Structural contours at 100 int.
Fault gap area and number
No 4
Subcrop trace, top of seam
No 1 FAULT GAP
No 2
No 3
No 4
No 5
No 6
No 7
No 8
No 9
Assumed unconformable Cretaceous Tertiary contact
OLD WELL HOLE
3500
4000
4500
4800
4900
5000
370 (2)
K-SAGE CREEK 75(2)E
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
SOUTH HILL
STRUCTURAL CONTOUR PLAN
TOP OF SEAM 2
M8
SCALE
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./M.A.P.S
DWG.- S 3531-1



LEGEND
Drill hole and number 75 D 05
Elevation in feet 3614
Adit and number 75 5 N
Structural contours at 100 int.
Fault gap area and number Nº4
Subcrop trace, top of seam
SCALE
400'
800'
K-SAGE CREEK 75(2)E
370
(2)
M9
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
NORTH HILL
STRUCTURAL CONTOUR PLAN
TOP OF SEAM 4U
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./ M·A·P·S
DWG. S3530-2

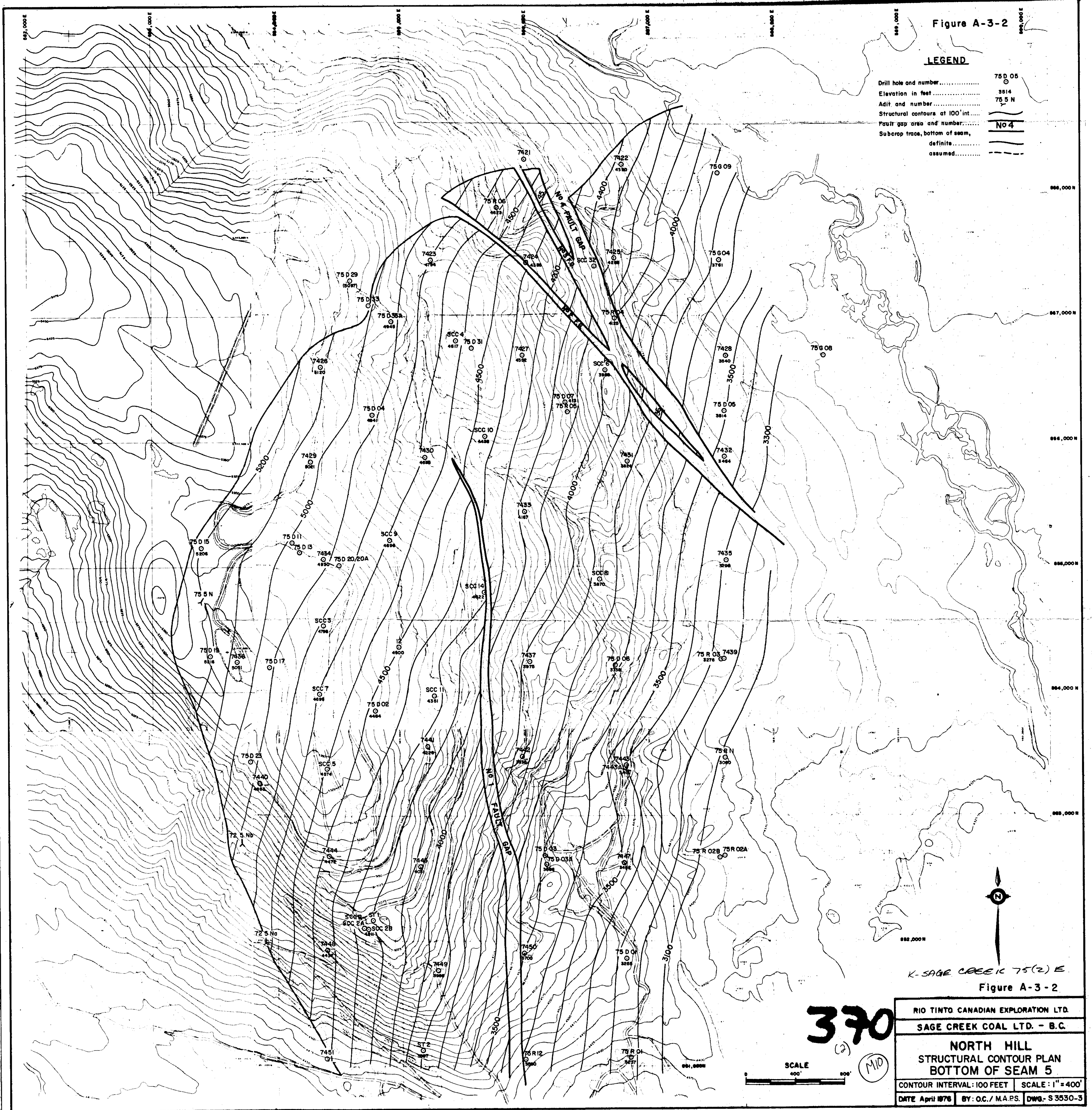
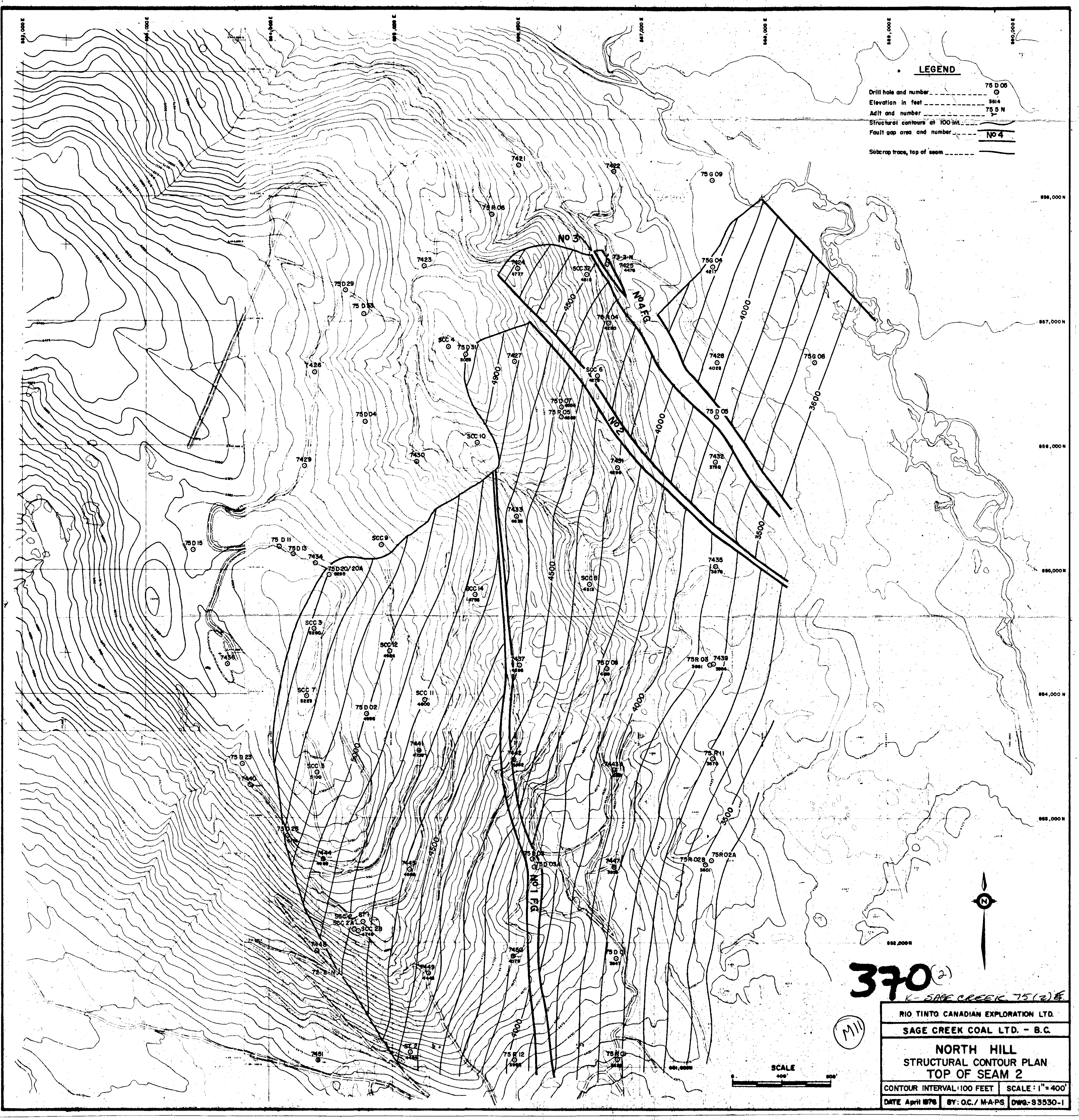
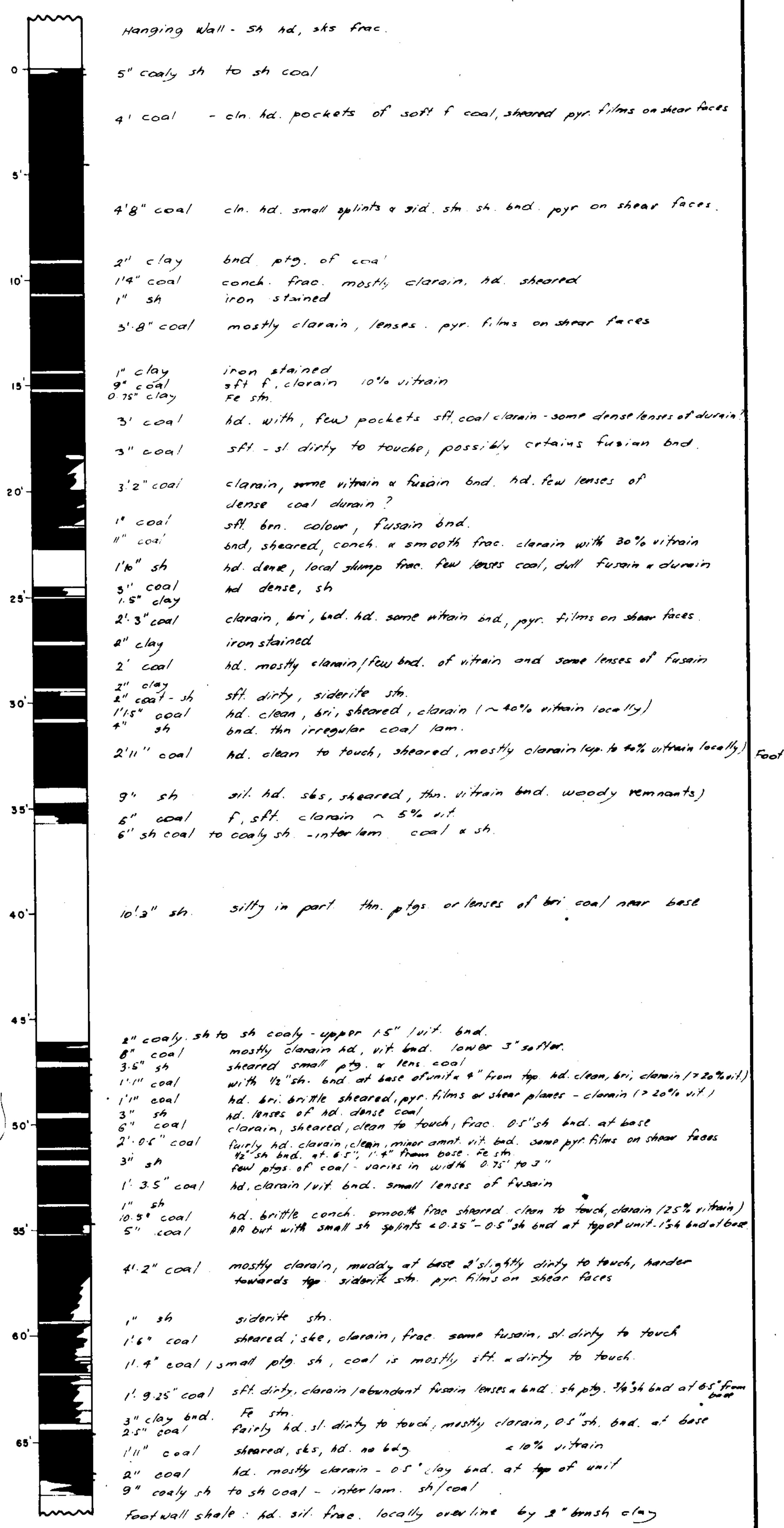


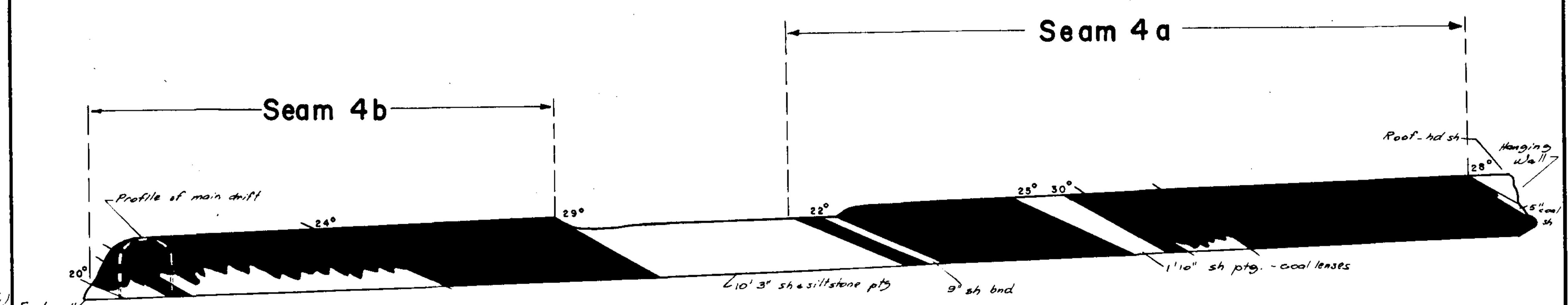
Figure A-3-2
LEGEND
Drill hole and number ........ 75D 05
Elevation in feet ........ 3514
Adit and number ........ 75 5 N
Structural contours at 100' int. ........
Fault gap area and number ........ No 4
Subcrop trace, bottom of seam,
definite ........
assumed ........
No 4 FAULT GAP
No 3 F.G.
No 2 F.G.
No 1 FAULT GAP
K-SAGE CREEK 75(2) E
Figure A-3-2
370
(2)
M10
SCALE
0
400'
800'
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
NORTH HILL
STRUCTURAL CONTOUR PLAN
BOTTOM OF SEAM 5
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./ M.A.P.S.
DWG.- S 3530-3


LEGEND
Drill hole and number 75 D 06
Elevation in feet 3514
Adit and number 75 5 N
Structural contours at 100 int.
Fault gap area and number No 4
Subcrop trace, top of seam
No 3
No 4 F.G.
No 2
No 1 F.G.
4900
4500
4000
3600
3500
5000
SCALE
370(2)
K-SAGE CREEK 75(2)
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
NORTH HILL
STRUCTURAL CONTOUR PLAN
TOP OF SEAM 2
CONTOUR INTERVAL: 100 FEET
SCALE: 1" = 400'
DATE April 1976
BY: O.C./ M·A·PS
DWG.-S3530-1



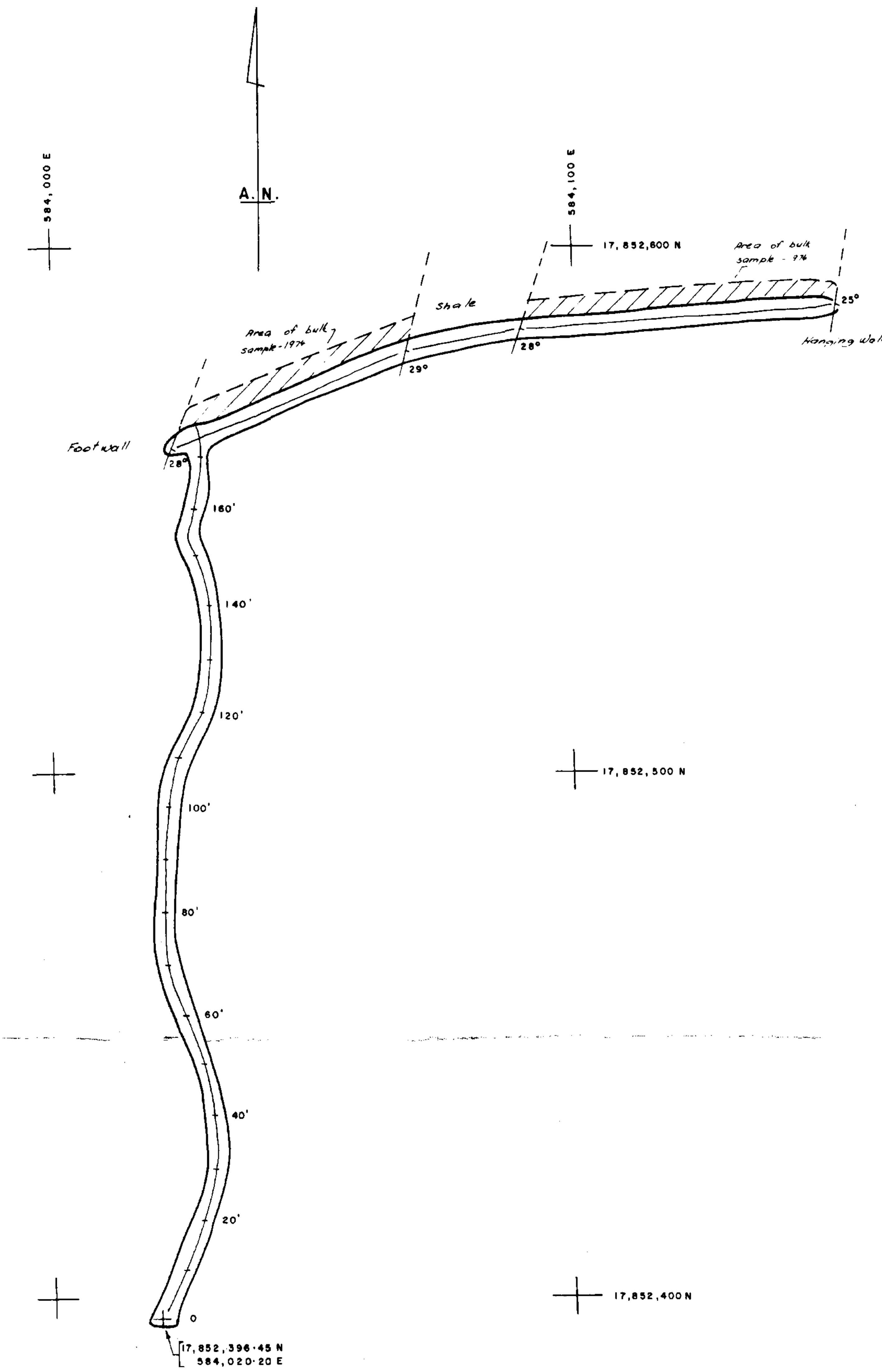

## SECTION

NORTH FACE
(measured at waist height by O.C. and R.M. ; July, 1972)
SCALE: 1" = 5'




## CROSS - CUT

NORTH FACE OF CROSS - CUT
(measured by O.C. and R.M. ; July, 1972)
SCALE. 1" = 10'




## PLAN

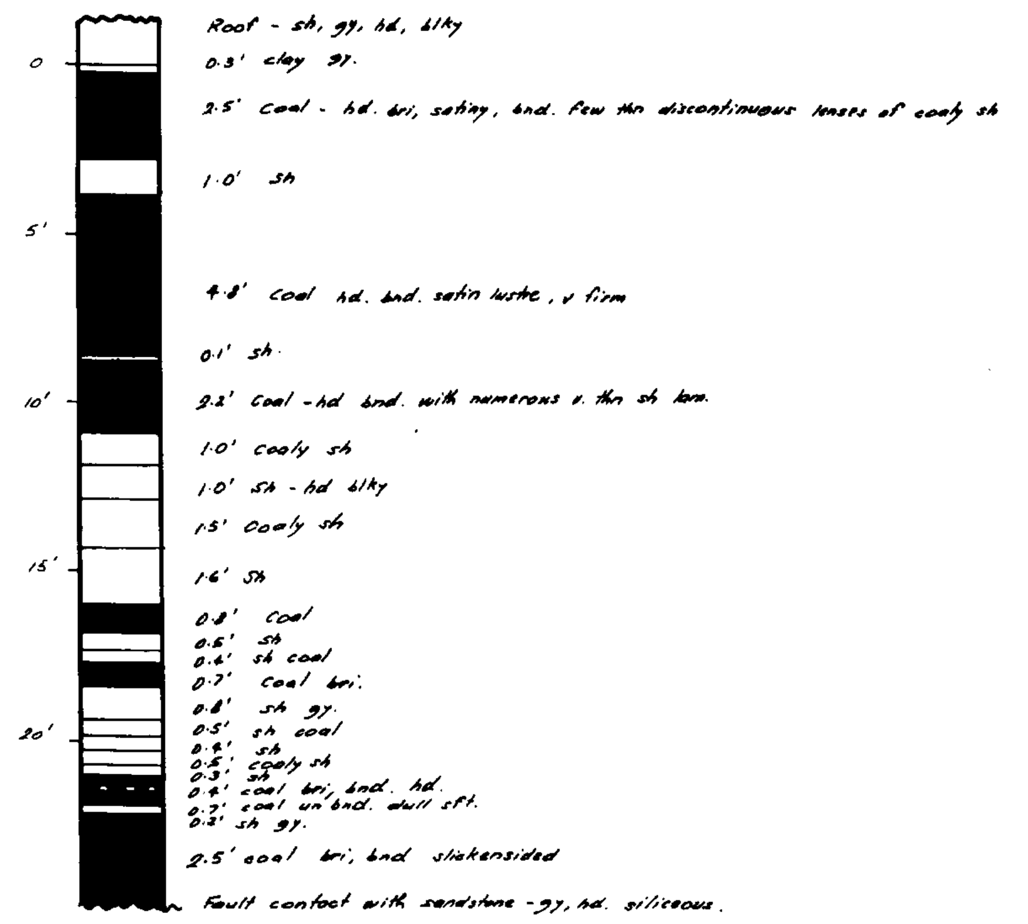
Tape and Compass Survey
(measured by O. Cullingham &
R. Maxwell ; July, 1972)
SCALE: 1" ≈ 20'

M12 370 (2)

K-SAGE CREEK 75 (2) E.

N.T.S
82-G-1,2

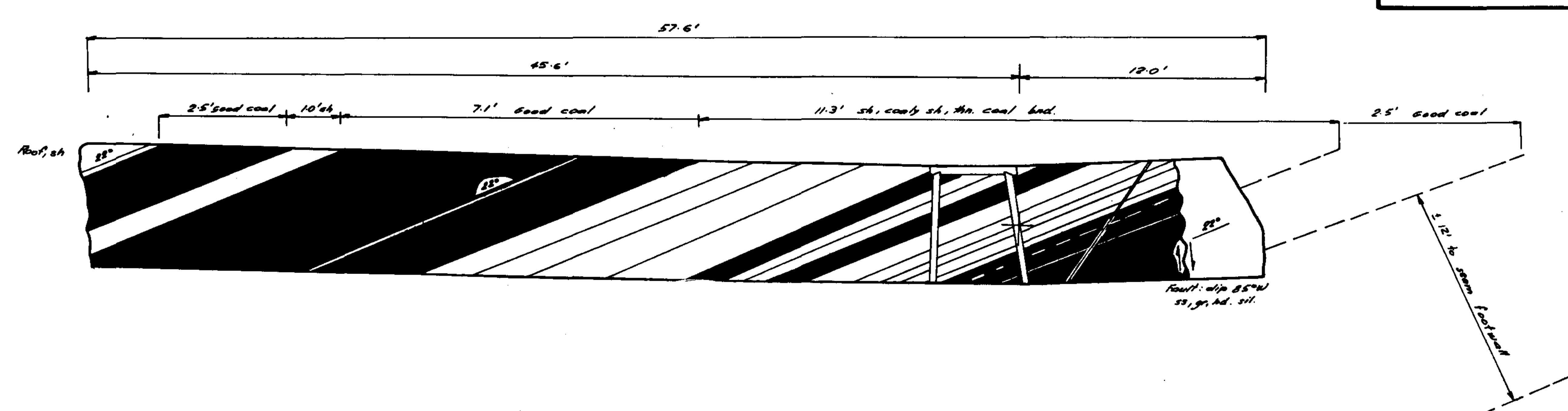
| |
|---|
| RIO TINTO CANADIAN EXPLORATION LIMITED |
| SAGE CREEK COAL LTD. - B.C. |
| ADIT No. 72-4N - SEAMS 4a & 4b<br>24-N |
| Nov, 1972 \| O. C. / e. k. \| DWG. G-3406-A |




## SECTION

SOUTH FACE
(Measured at waist height by B. Pewsey and W. Hennessey July, 1973)
SCALE: 1" = 5'

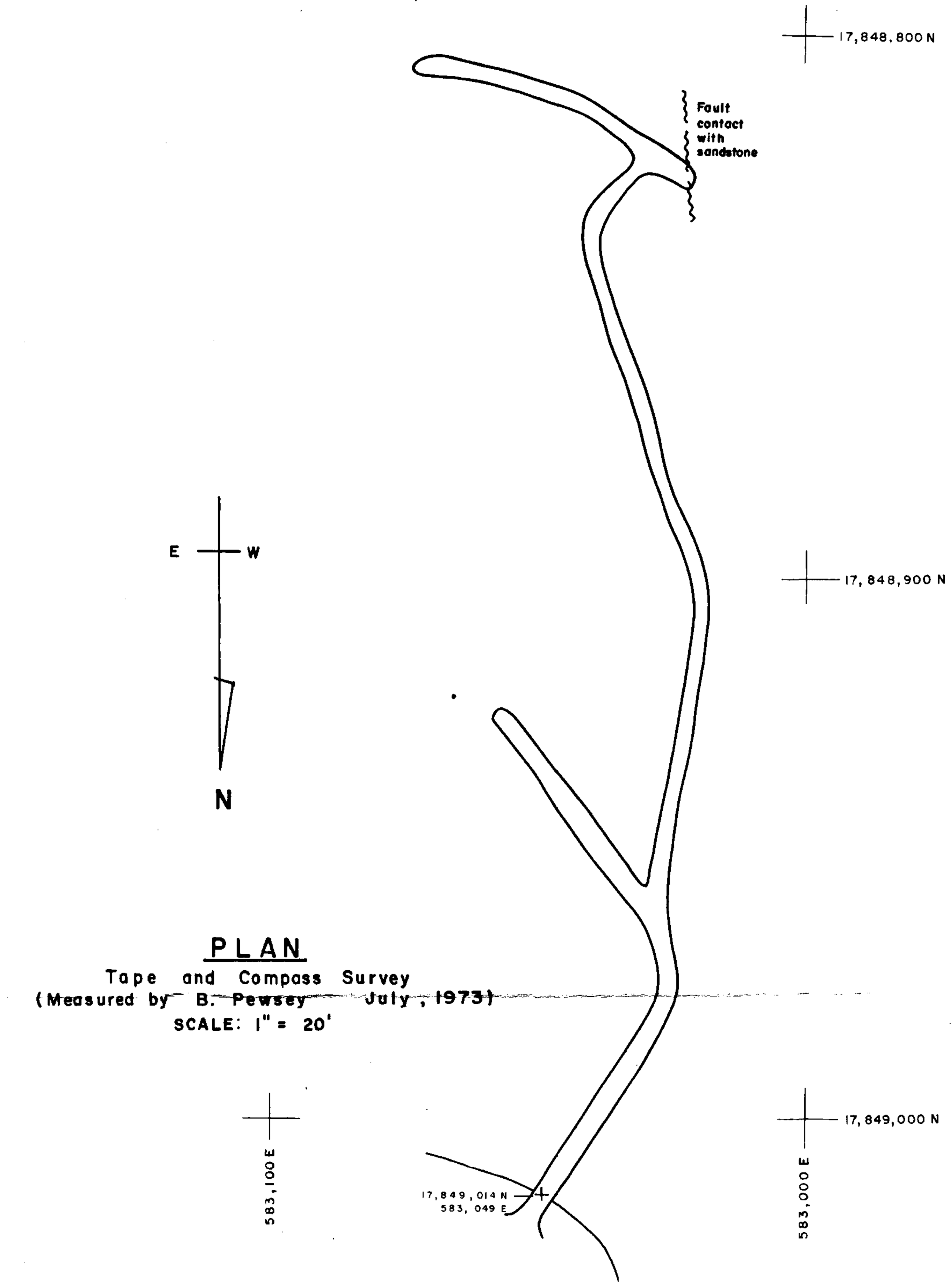
E. W.




## CROSS - CUT

SOUTH FACE OF CROSS-CUT
(Measured by B. Pewsey and W. Hennessey, July, 1973)
SCALE: 1" = 5'

N.T.S.
82-G-1,2




## PLAN

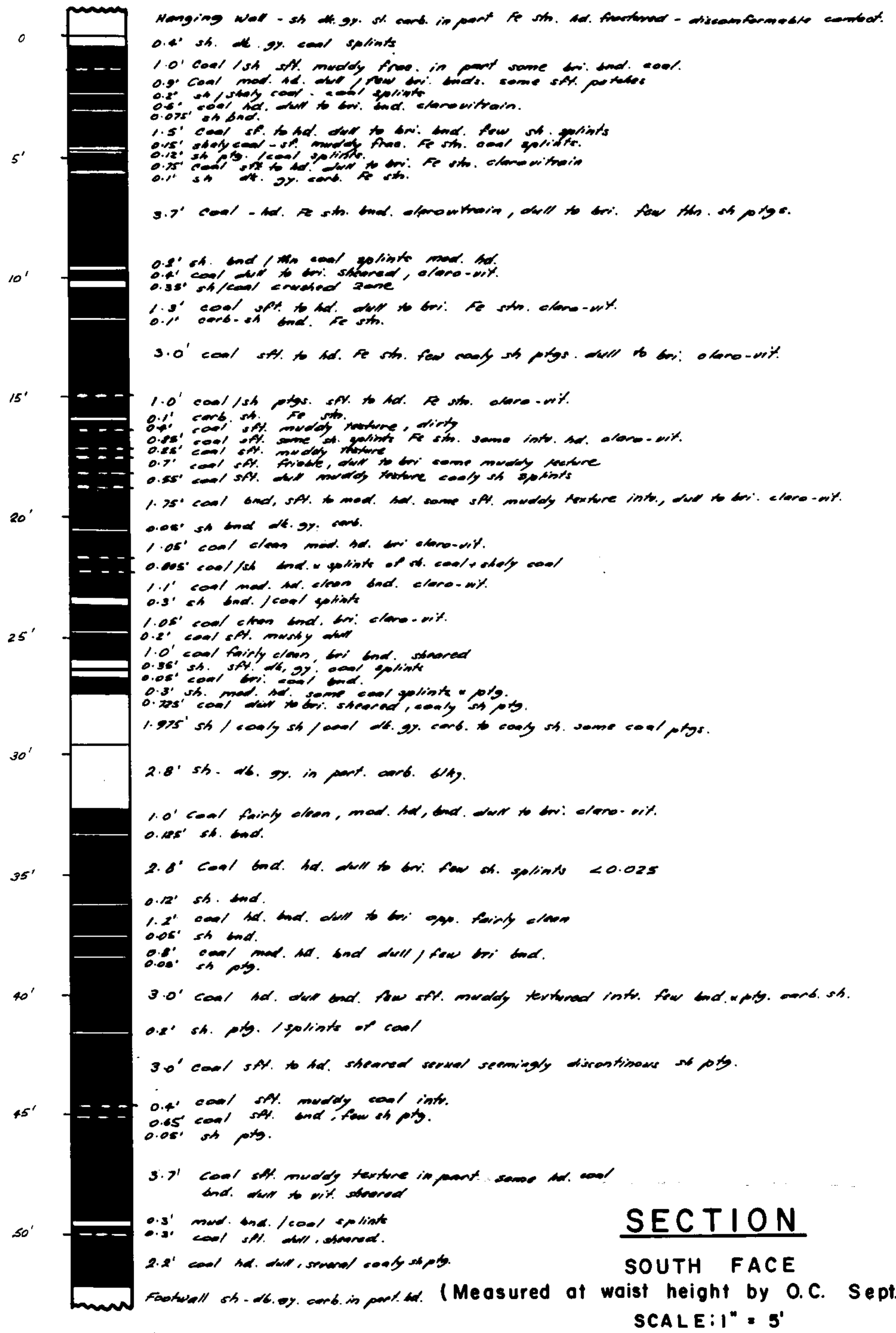
Tape and Compass Survey
(Measured by B. Pewsey July, 1973)
SCALE: 1" = 20'

M13 370

K-SAGE CREEK 75(2)E (2)

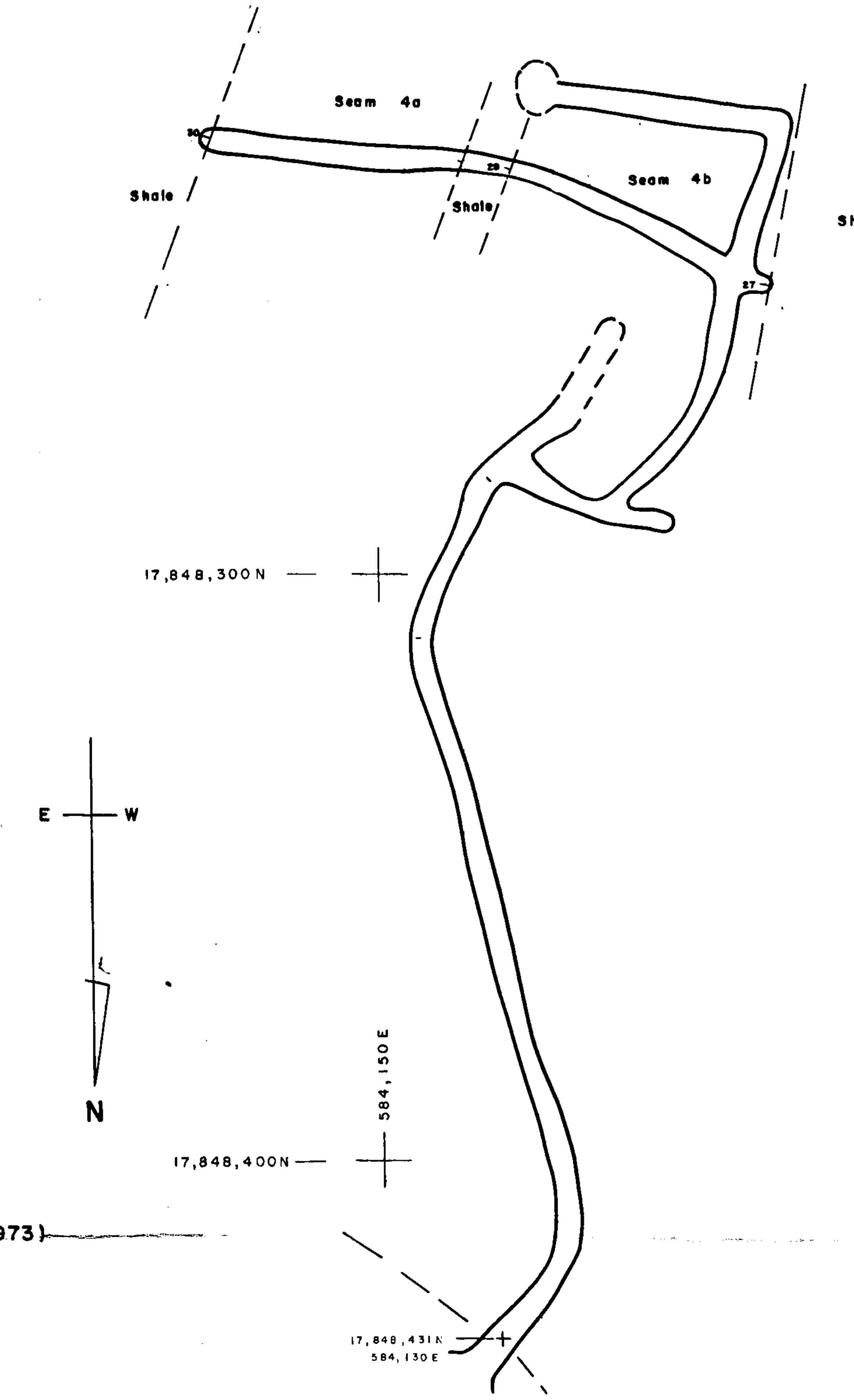
SOUTH HILL

| | | |
|---|---|---|
| RIO TINTO CANADIAN EXPLORATION LIMITED | | |
| SAGE CREEK COAL LTD. - B.C. | | |
| ADIT No.73-5-S, SEAM 5 (35-5) | | |
| Dec, 1973 | O.C. / L. Nagy | DWG. G-3448-5 |



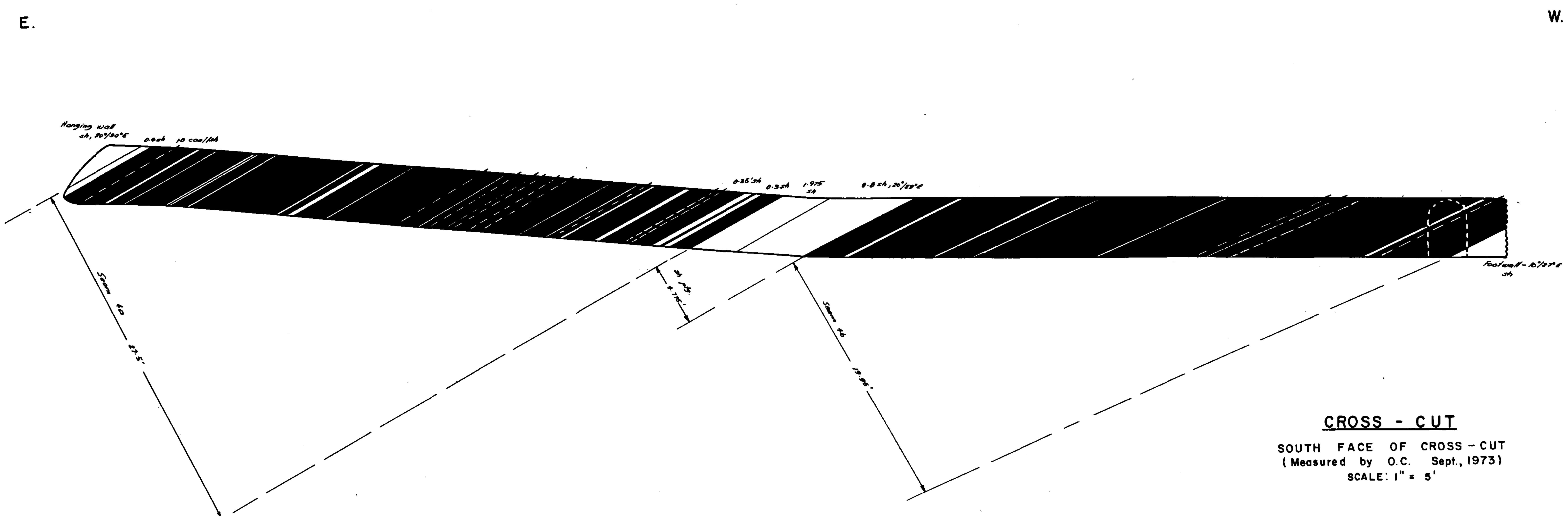

## SECTION

SOUTH FACE
(Measured at waist height by O.C. Sept., 1973)
SCALE: 1" = 5'




## PLAN

Tape and Compass Survey
Measured by O.C. and B.P. Sept., 1973
SCALE: 1" = 20'




## CROSS - CUT

SOUTH FACE OF CROSS - CUT
(Measured by O.C. Sept., 1973)
SCALE: 1" = 5'

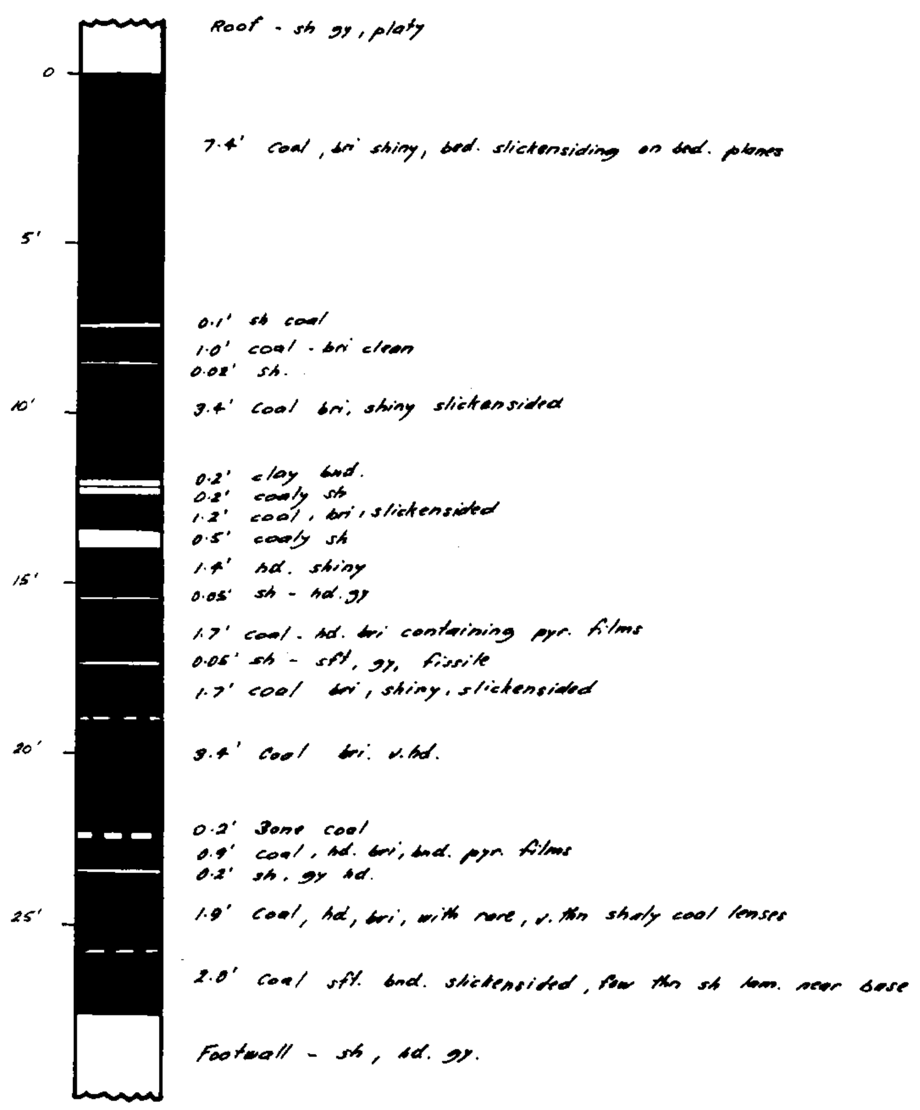
N.T.S.
82-G-1,2

M14 370

K-SAGE CREEK 75(2)E (2)

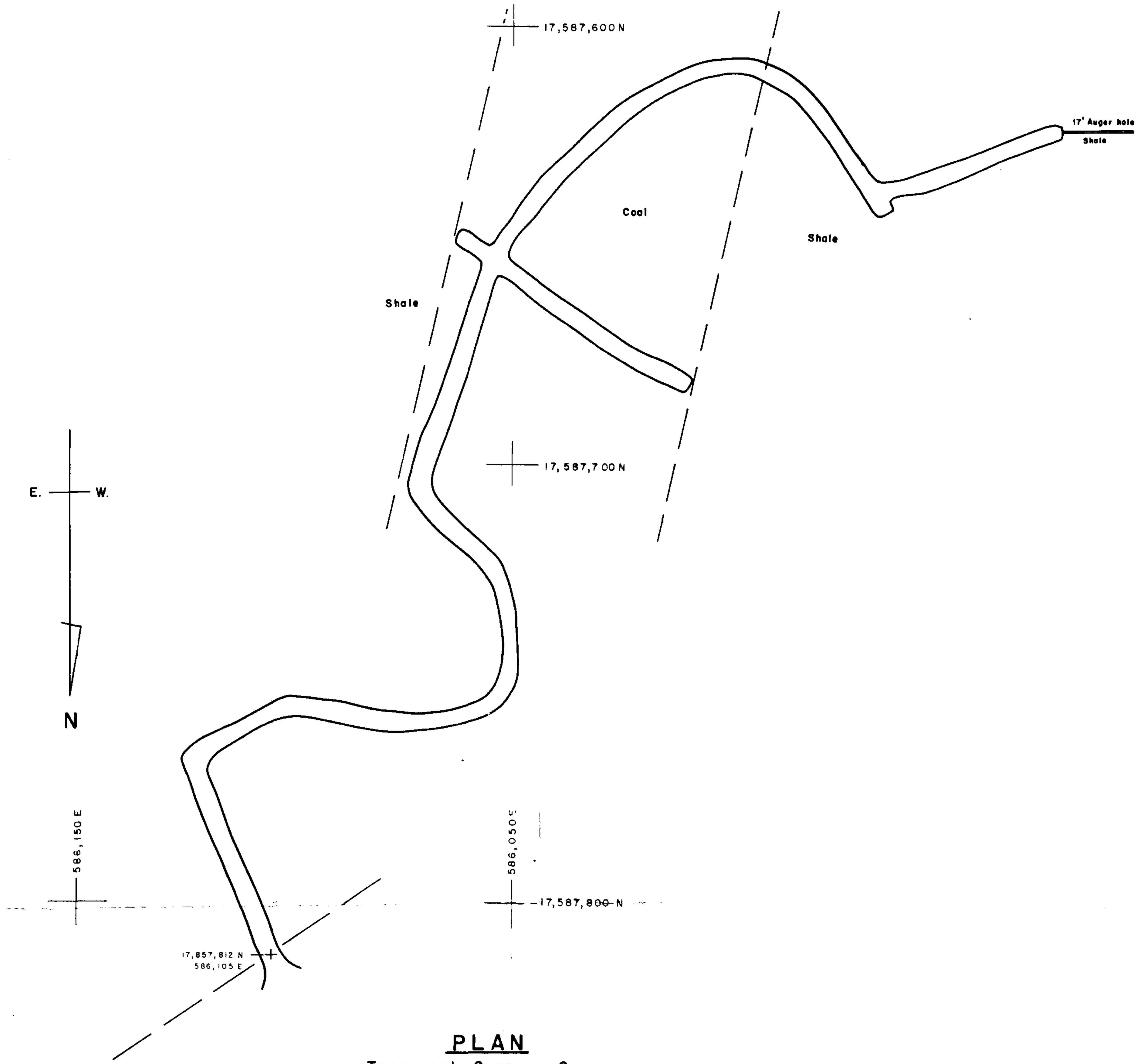
SOUTH HILL

| |
|---|
| RIO TINTO CANADIAN EXPLORATION LIMITED |
| SAGE CREEK COAL LTD. - B.C. |
| ADIT No. 73-4-S, SEAMS 4a, 4b 34-5 |
| Dec, 1973 — O.C. / L. Nagy — DWG. G-3448-4 |



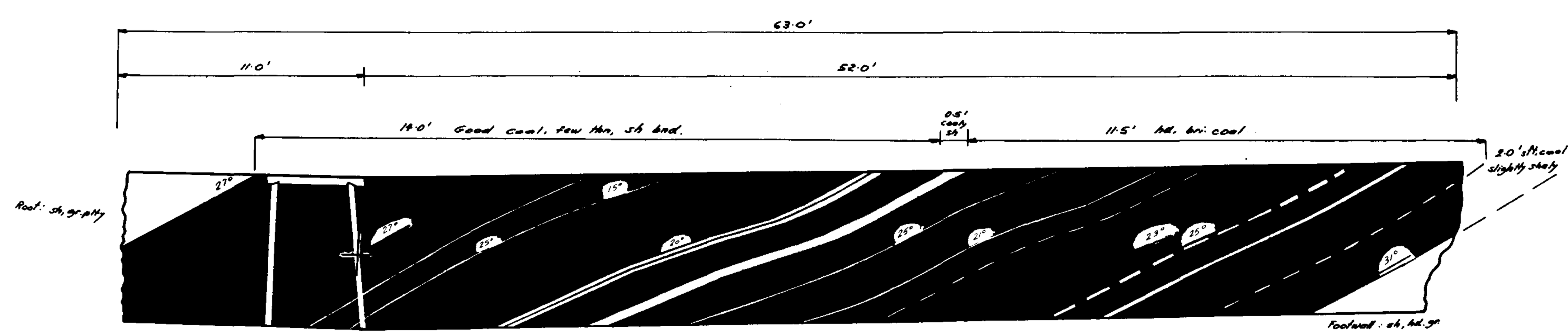

## SECTION

SOUTH FACE
(Measured at waist height by W. J. Hennessey July, 1973)
SCALE: 1" = 5'




## PLAN

Tape and Compass Survey
(Measured by B. Pewsey July, August, 1973)
SCALE: 1" = 20'




## CROSS - CUT

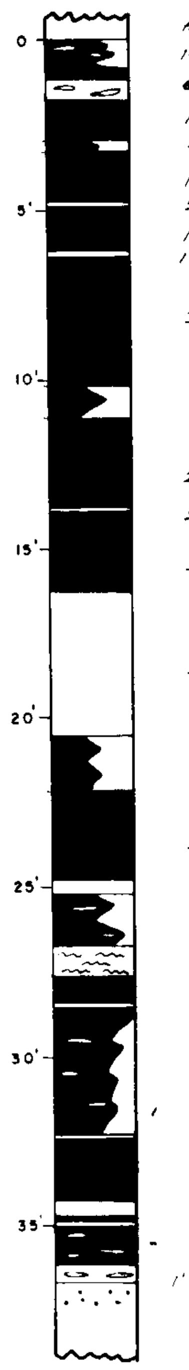
SOUTH FACE OF CROSS-CUT
(Measured by B. Pewsey and W. Hennessey, July, 1973)
SCALE: 1" = 5'

N.T.S.
82-G-1,2

(M15)

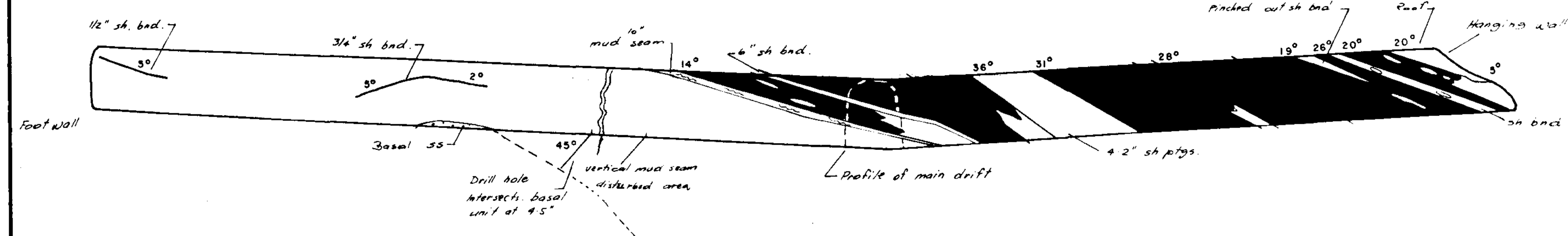
370 K-SAGE CREEK 75 (2)E
(2)

| | |
|---|---|
| NORTH HILL | |
| RIO TINTO CANADIAN EXPLORATION LIMITED | |
| SAGE CREEK COAL LTD. - B.C. | |
| ADIT No. 73-4-N, SEAM 4a (34-N) | |
| Dec, 1973 | O.C. / L. Nagy | DWG. G-3448-2 |



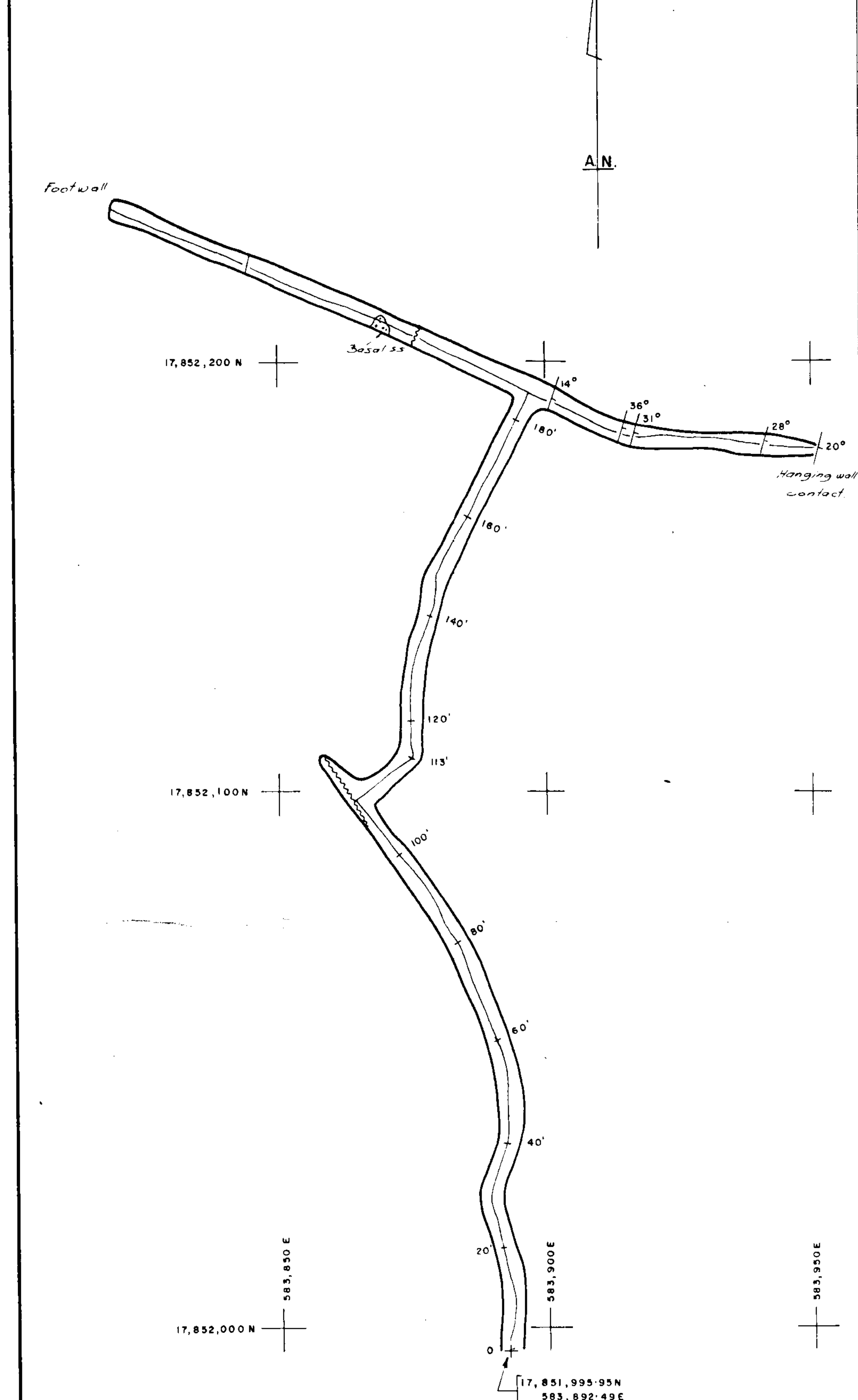

## SECTION

NORTH FACE
(measured at waist height by O.C. and R.M. ; Aug, 1972)
SCALE: 1" = 5'




## CROSS - CUT

NORTH FACE OF CROSS - CUT
( measured by O.C. and R.M. ; Aug, 1972)
SCALE: 1" = 10'




## PLAN

Tape and Compass Survey
(measured by O. Cullingham &
R. Maxwell ; August, 1972 )
SCALE: 1" = 20'

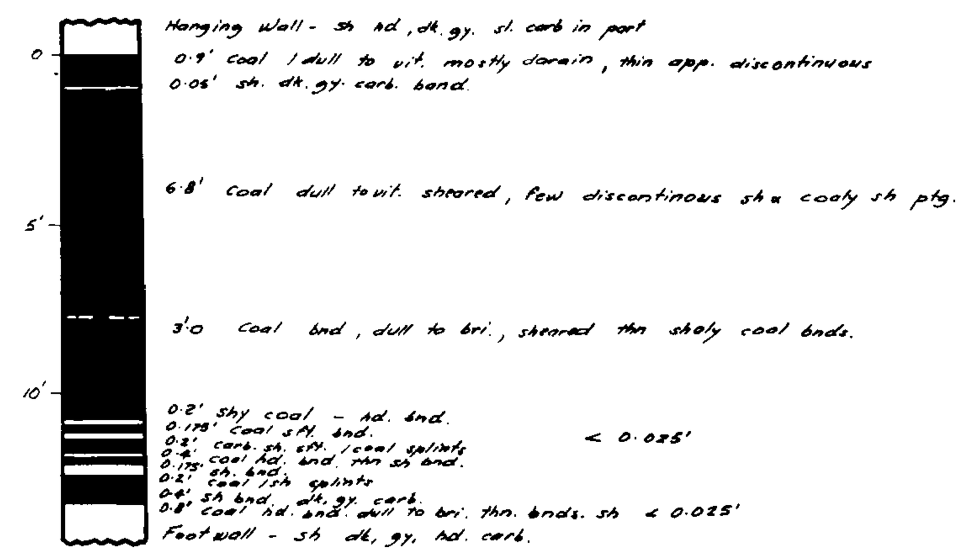
N.T.S
82-G-1,2

K-SAGE CREEK 75(2)E

370 (2)

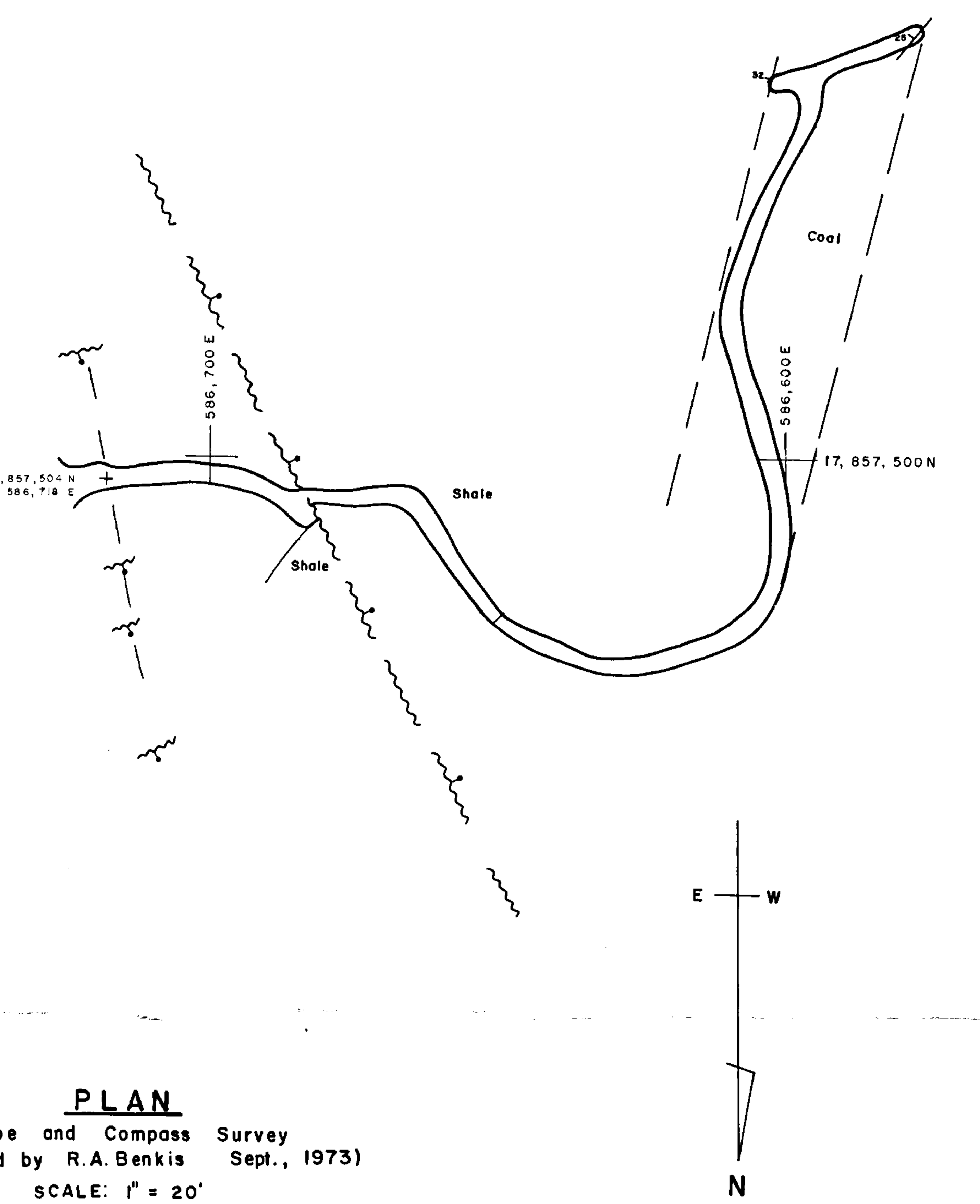
(M16)

| |
|---|
| RIO TINTO CANADIAN EXPLORATION LIMITED |
| SAGE CREEK COAL LTD. - B.C. |
| ADIT No. 72-5-Na- SEAM 5 (23AN) |
| Nov, 1972   O.C. / e.k.   DWG. G - 3407 |




## SECTION

SOUTH FACE
(Measured at waist height by O.C. Sept., 1973)
SCALE: 1" = 5'

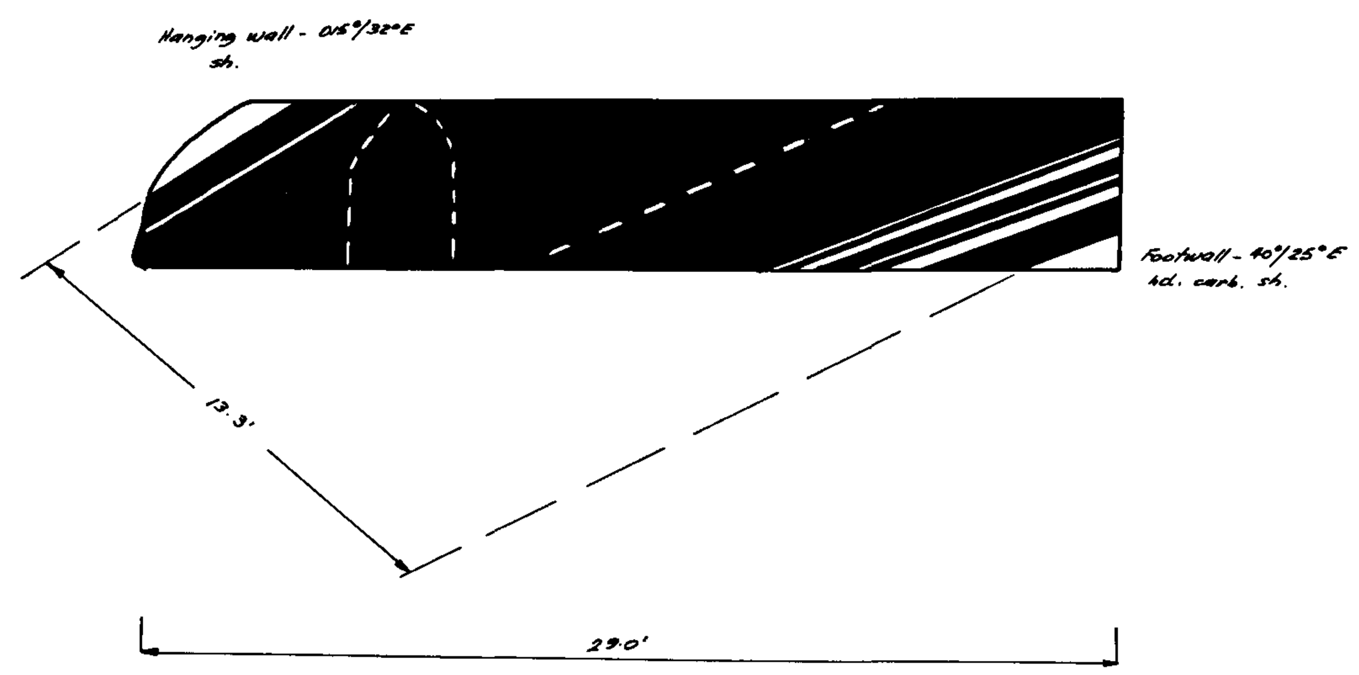



## PLAN

Tape and Compass Survey
(Measured by R.A. Benkis Sept., 1973)
SCALE: 1" = 20'

E.

W.




## CROSS - CUT

SOUTH FACE OF CROSS-CUT
(Measured by O.C. Sept., 1973)
SCALE: 1" = 5'

N.T.S.
82-G-1,2

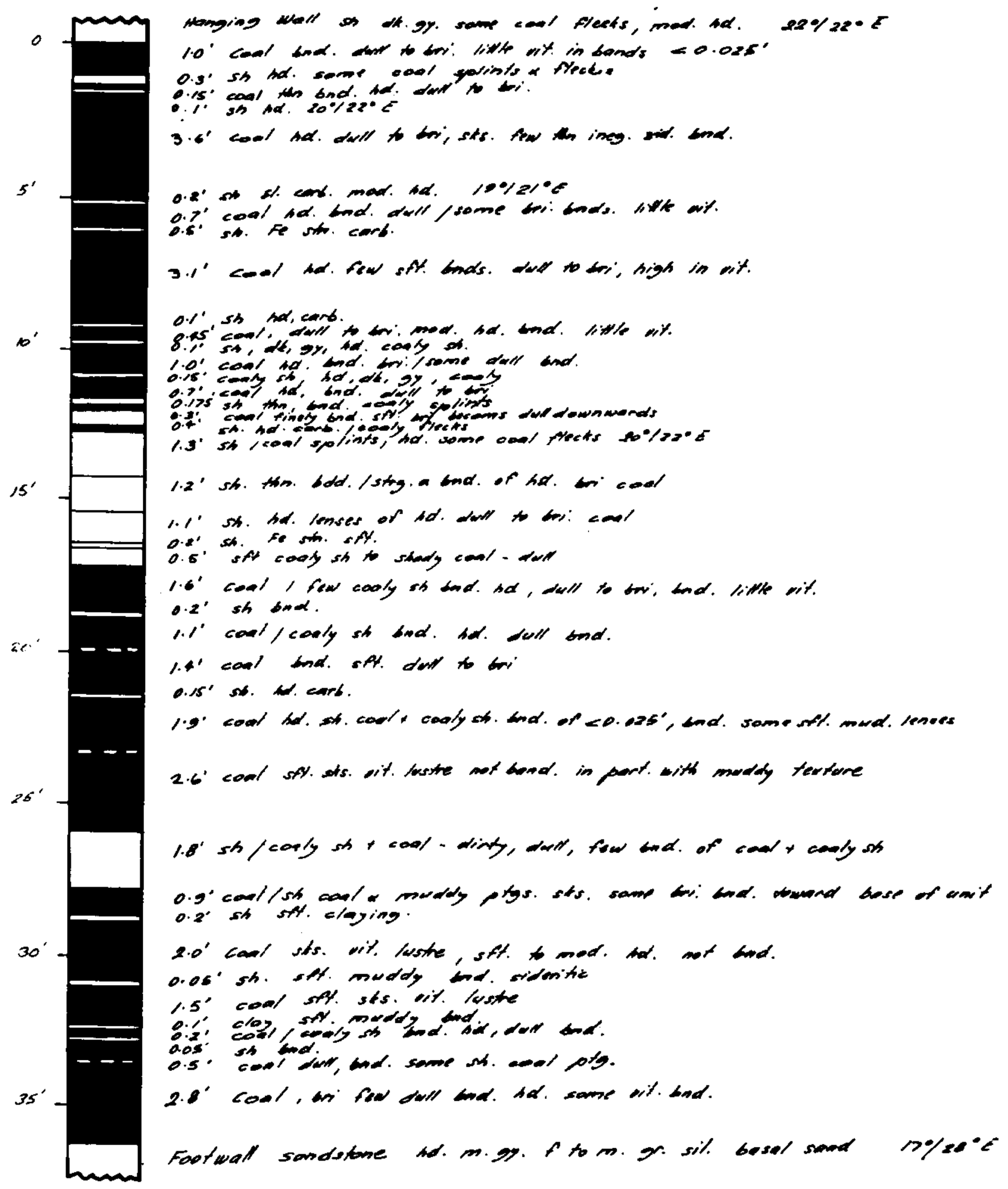
370 (2)

K-SAGE CREEK 75 (2) E

M17

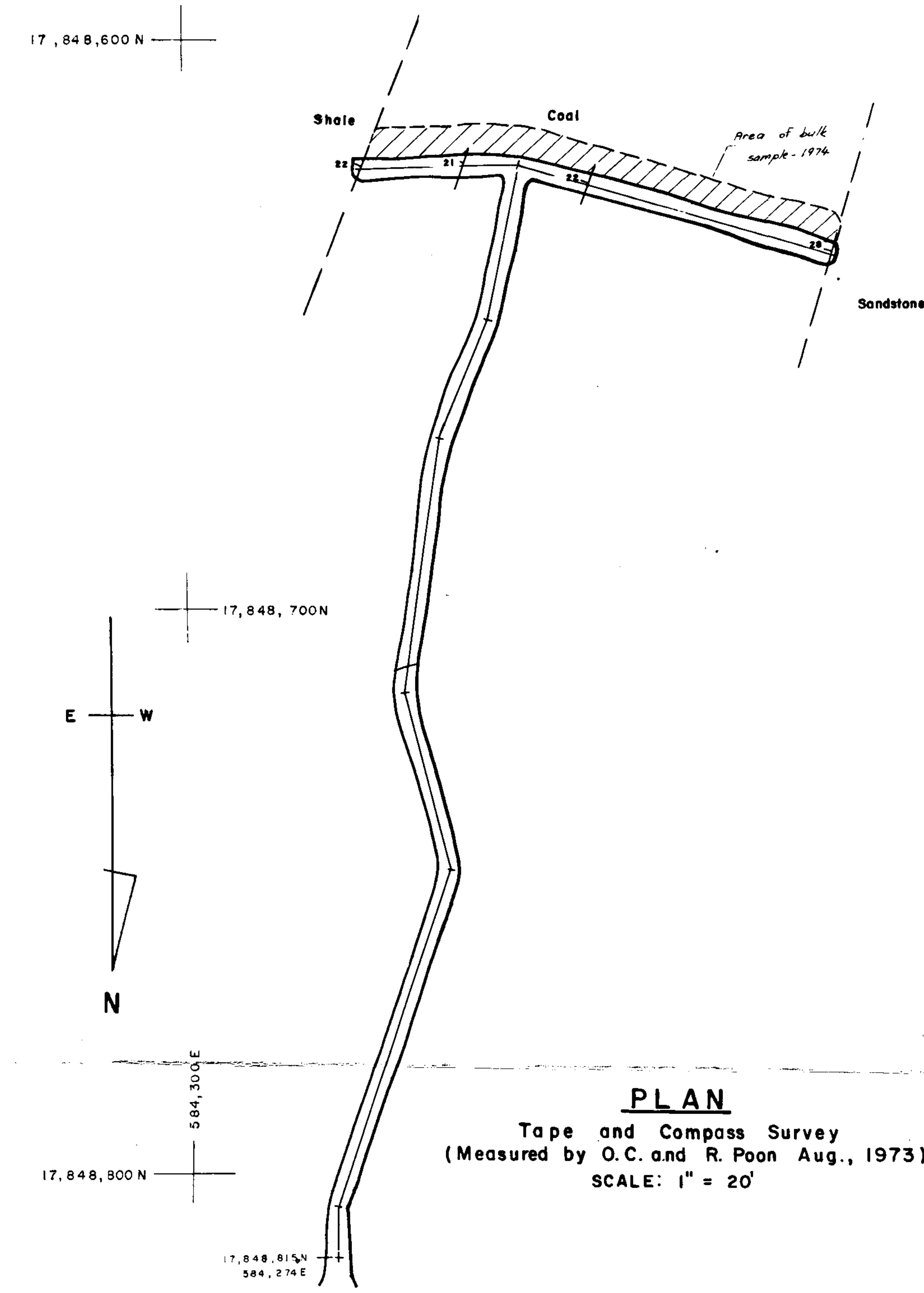
NORTH HILL

| RIO TINTO CANADIAN EXPLORATION LIMITED | | |
|---|---|---|
| SAGE CREEK COAL LTD. — B.C. | | |
| ADIT No. 73-2-N, SEAM 2 32-N | | |
| Dec, 1973 | O.C. / L. Nagy | DWG. G-3448-1 |




## SECTION

SOUTH FACE
(Measured at waist height by O.C. Aug., 1973)
SCALE: 1" = 5'

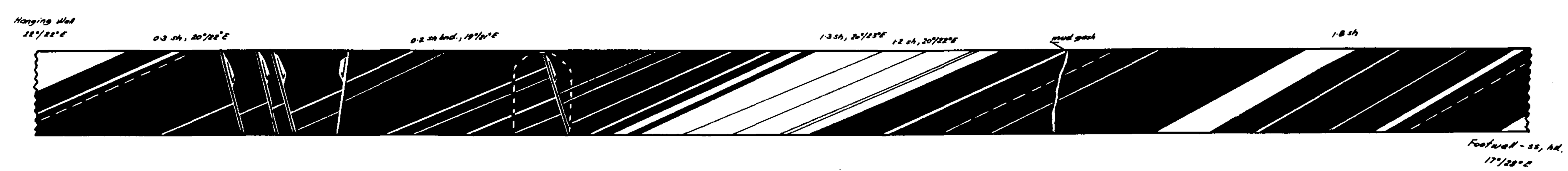



## PLAN

Tape and Compass Survey
(Measured by O.C. and R. Poon Aug., 1973)
SCALE: 1" = 20'

E.

W.




## CROSS - CUT

SOUTH FACE OF CROSS-CUT
(Measured by O.C. and R. Poon Aug., 1973)
SCALE: 1" = 5'

370 (2)
K-SAGE CREEK 75(2)E

SOUTH HILL

N.T.S.
82-G-1,2

M18

| | | |
|---|---|---|
| RIO TINTO CANADIAN EXPLORATION LIMITED | | |
| SAGE CREEK COAL LTD. - B.C. | | |
| ADIT No. 73-5a-S, SEAM 5 | | |
| 5SAS' | | |
| Dec, 1973 | O.C. / L. Nagy | DWG. G-3448-6 A |


# ADIT 74-4 (FAULT) S

## GEOLOGY

FEET 0 10 20 30 40
METERS 0 3 6 9 12

JULY 10, 1974 — B. PEWSEY, W. HENNESSEY

REVISED & EXTENDED AUGUST 1, 1974 — A. BEDFORD, W. HENNESSEY

PREPARED FOR
SAGE CREEK COAL LTD.
BY
W.J. HENNESSEY CONSULTING LTD.
AUGUST 5, 1974

DWG. G-3504-1

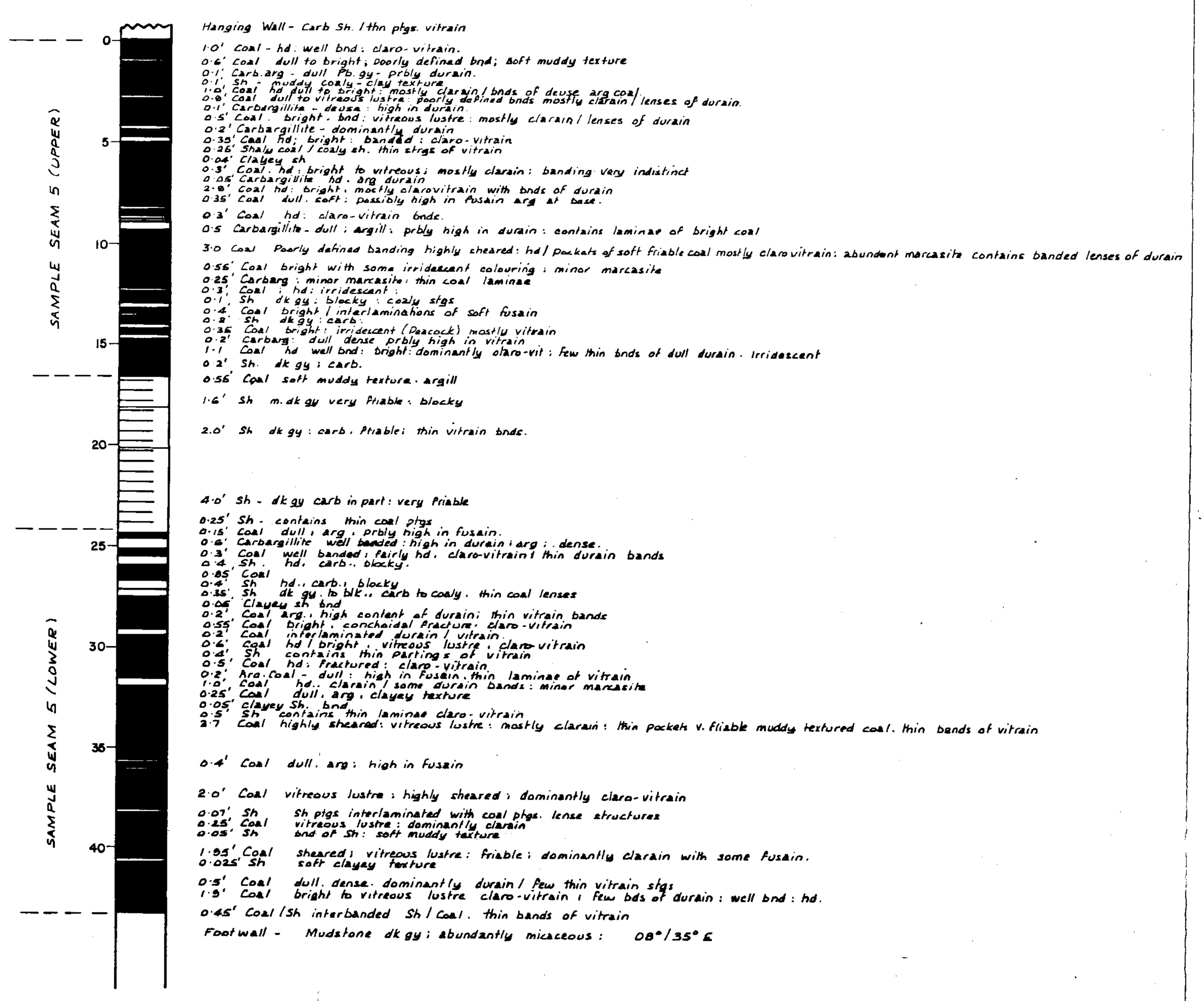
K-SAGE CREEK 75(2)E (2) 370

M19

44 FS

LEGEND
Tk Tertiary Kishnehn Formation
KBL Cretaceous Blairmore Group
Kk Cretaceous Kootenay Formation
Jf Jurassic Fernie Group
Coal, outcrop or proven subcrop
Coal, approximate subcrop
Coal, thin bands
Conglomerate
Sandstone
Siltstone
Shale
Rock outcrop area
Geological boundary (defined, approximate, projected)
Coal seam & horizon (defined, approximate, projected)
Bedding (inclined)
Fault (approximate, projected) (downthrow block indicated)
7410 Drill hole and number
T-75-4-IV-N Trench and number
75-5-N Adit and number
Plant fossils
SCALE
FEET 0 200 400 600 800
METERS 0 25 50 100 150 200
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
NORTH HILL
GEOLOGY
K-SAGE CREEK 75(2)E
DATE - APRIL 1976
BY - O.C. / M·A·P·S
DWG. - G 4471-1
370
ASSUMED TRACE HARVEY FAULT
FAULT No. 1
FAULT No. 2
FAULT No. 3
FAULT No. 4
Howell Creek
Cabin Creek
5443000
5442500 N
5442000 N
5441500 N
179,000 E


Cabin Creek
5440500
5440000N
5439500N
5439000
FAULT No 10
FAULT No 9
FAULT No 8
FAULT No 7
FAULT No 2
FAULT No 1
LEGEND
Tk Tertiary Kishnehn Formation
KBL Cretaceous Blairmore Group
Kk Cretaceous Kootenay Formation
Jf Jurassic Fernie Group
Coal, outcrop or proven subcrop
Coal, approximate subcrop
Coal, thin bands
Conglomerate
Sandstone
Siltstone
Shale
Rock outcrop area
Geological boundary (defined, approximate, projected)
Coal seam & horizon (defined, approximate, projected)
Bedding (inclined)
Fault (approximate, projected) (downthrow block indicated)
7410 Drill hole and number
T-75-4-IV-N Trench and number
75-5-N Adit and number
M21
370
SCALE
FEET 0 200 400 600 800
METERS 0 25 50 100 150 200
RIO TINTO CANADIAN EXPLORATION LTD.
SAGE CREEK COAL LTD. - B.C.
SOUTH HILL
GEOLOGY
K-SAGE CREEK 75(2)E
DATE - April, 1976
BY - O.C. / M·A·P·S
DWG. - G 4471-2



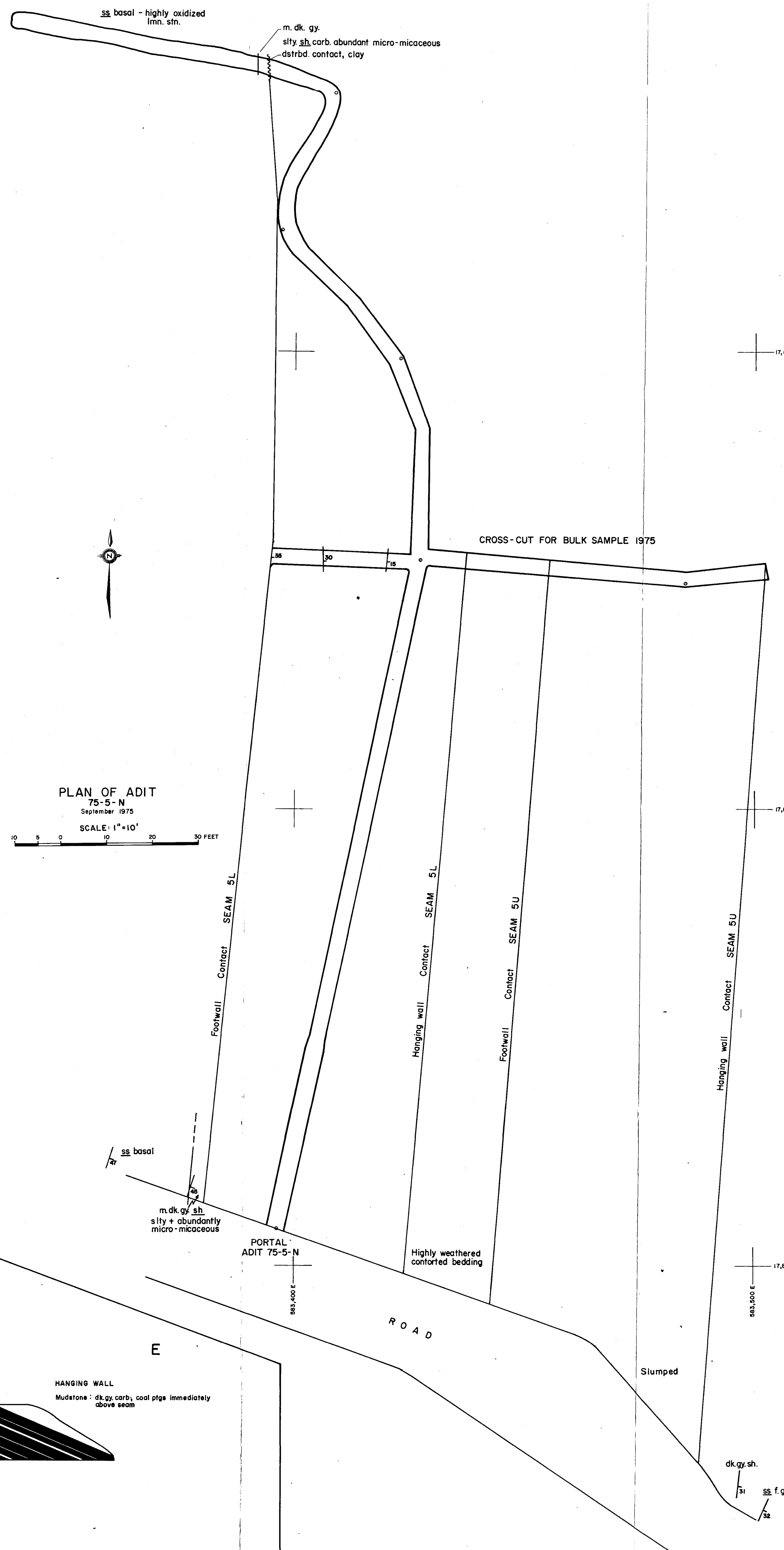

## SECTION

NORTH WALL

(Measured at waist height by O.C. & E.W. OCT. 1975)

SCALE: 1" = 5'

5 2.5 0 5 10 15 FEET



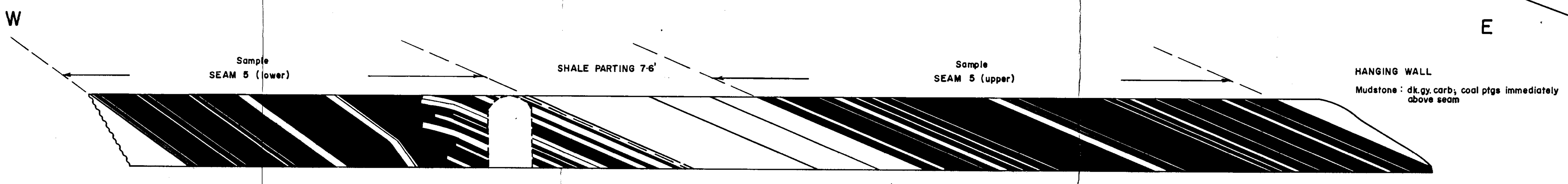

## PLAN OF ADIT

75-5-N

September 1975

SCALE: 1" = 10'

10 5 0 10 20 30 FEET




## CROSS - CUT

NORTH WALL OF CROSS-CUT

(Measured by O. Cullingham & E. Wilson)

October 1975

SCALE: 1" = 5'

5 2.5 0 5 10 15 FEET

(M22)

370 (2)

R - SAGE CREEK 75 (7) E

RIO TINTO CANADIAN EXPLORATION LTD.

SAGE CREEK COAL LTD - B.C.

NORTH HILL

**ADIT No. 75-5-N, SEAM 5**

SURVEY PLOT 55-N

| DATE: April 1976 | BY: O.C. / M.A.P.S. | DWG. G 4473 |
|---|---|---|


M23

370 (2)

K-SAGE CREEK 75(2)E

RIO TINTO CANADIAN EXPLORATION LTD.

SAGE CREEK COAL LTD. – B.C.

SOUTH HILL 4415

**ADIT No.74-4F-S Seams 4U&4L**

SURVEY PLOT

| DATE: April 1976 | BY: O.C. / M.A.P.S. | DWG: G 4472 |
|---|---|---|