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BULLETIN NO. 36

Coal Reserves of the

Hasler Creek-Pine River Area

British Columbia

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ILLUSTRATIONS

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Coal Reserves of the Hasler Creek-Pine River Area

INTRODUCTION

This report describes the results of an exploration, by means of geological mapping, trenching, and diamond drilling, of coal deposits in the Peace River District about 100 miles west of the village of Dawson Creek. The coalfield extends from about 1 mile north of the Pine River to some 18 miles southeastward, a little beyond Hasler Creek.

The object of the work was to provide an estimate of the tonnage of mineable coal that might be available contiguous to a proposed route of the Pacific Great Eastern Railroad into the Peace River District.

The basis for and the amounts of the coal estimates are given on pages 9 and 10. Coal is known to occur outside the areas in which exploratory work furnished data adequate for sound estimates. The estimates include no coal outside such areas nor more than 3,000 feet below the surface.

The field work was done in the seasons of 1946 to 1951, inclusive, by the Coal Division of the Department of Lands and Forests and was under the general direction of T. B. Williams, Controller of Coal, Petroleum and Natural Gas. From September, 1948, it was supervised directly by the writer. Actual operations were conducted by G. L. Kidd in 1946; G. L. Kidd, A. P. Fawley, and Bruce Woodsworth in 1947; G. L. Kidd, Austin L. Johnston, and F. K. North in 1948; F. K. North and E. A. Ramsay in 1949; by the writer in 1950; and by the writer and George S. Wilson in 1951.

All coal analyses were performed in the laboratories of the Coal, Petroleum and Natural Gas Branch by K. C. Gilbart, Chief Chemist.

Trenching was done by means of two bulldozers powered by an International T.D. 14 and a Caterpillar D6 tractor respectively. Diamond drilling was done under contract by Boyles Bros. Drilling Company Ltd., of Vancouver, using B.B. S2 drills equipped with hydraulic feed and N X core barrels yielding cores of approximately 2⅛-inch diameter.

Diamond-drill holes, trenches, and rock outcrops were surveyed by plane-table and transit-stadia traverses in closed loops. Elevations were taken from John Hart Highway bench marks; the datum is mean sea-level.

Access to the coalfield is by way of the John Hart Highway (Fig. 1), which connects it with Dawson Creek on the Northern Alberta Railway 100 miles to the east and with Prince George on the Canadian National and Pacific Great Eastern Railways 175 miles to the south and west. At present these are the nearest railways. The Hasler mine, from which a small tonnage was produced in 1944 and 1945, is reached by a road which follows Hasler Creek for 9 miles upstream from the John Hart Highway. The road is passable for trucks in dry weather and in winter.

The topography is that of the Foothills belt of the Rocky Mountains. The northeasterly trending, mile-wide Pine River valley, at 2,000 feet elevation, cuts across northwest-southeast trending ridges which rise to 4,700 feet above sea-level and are capped by hard sandstones and conglomerates. The ridges are separated by valleys of creeks which are tributary to the Pine River and are underlain by the softer sandstones, siltstones, and shales.

The region is well timbered. Poplar and some birch, dominant along the Pine River valley, give place to lodgepole pine, spruce, and fir at higher elevations. Timber in sizes suitable for mine props is plentiful, but larger timbers would have to be imported. Timberline is at an elevation of about 4,500 feet.

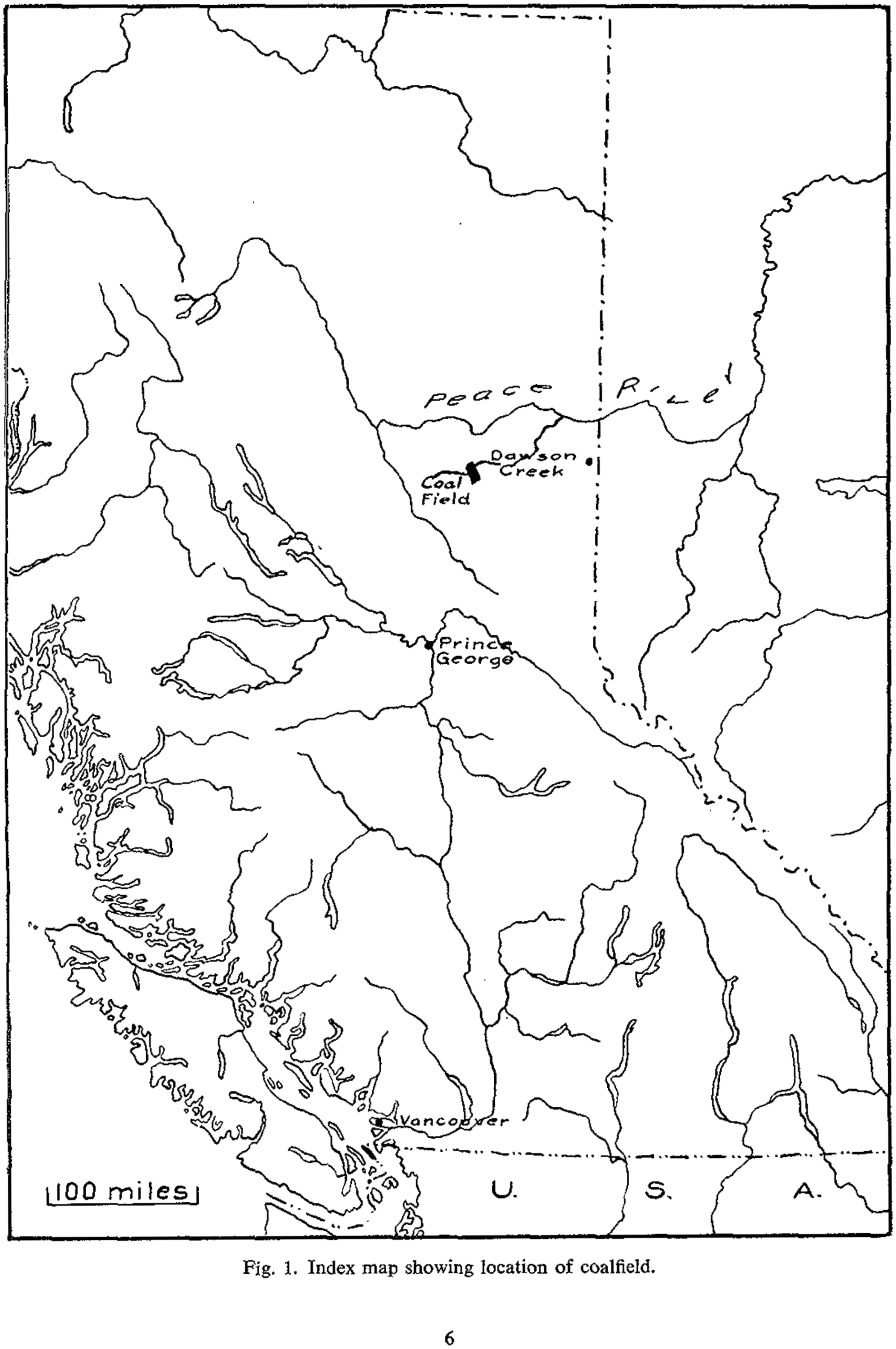

Fig. 1. Index map showing location of coalfield.

Overburden consists of glacial till, which appears to have filled pre-existing valleys, and glacial lake clays, silts, and gravels. Toward the headwaters of Willow Creek there is a marked change from dominantly glacial tills to lake deposits at about 3,700 feet elevation, and it is possible that such lakes were part of a drainage system which included the now hanging valley of the "Windgap" on Falls Mountain, west of Willow Creek and at an elevation of about 4,000 feet. Similar deposits are exposed on Hasler Creek at an elevation of about 3,000 feet. Later erosion cut down through the lake deposits and glacial till to form the present drainage pattern. Poorly drained flat areas underlain by muskegs are common, and constitute something of a hazard to the moving of heavy equipment. The depth of the overburden is commonly between 10 and 20 feet and in places depths are of the order of 75 feet. A few depths of the order of 200 feet were found.

A reconnaissance of the Moberly River valley west of Moberly Lake was made by Bruce Woodsworth in 1947. Only minor coal seams were found and no more work was done there.

GENERAL GEOLOGY

The geology in the vicinity is described in publications of the Geological Survey of Canada* and of the British Columbia Department of Mines.†

The consolidated rocks are conformable Lower Cretaceous sediments. These range from Dunlevy marine sandstones and shales west of the area, through Gething continental shales and sandstones and the marine shale and sandstone formations of the Fort St. John group, to the base of the Upper Cretaceous Dunvegan sandstone immediately to the east.

The Gething formation, to which the coal measures are confined, consists of about 3,000 feet of shales, siltstones, sandstones, and coal seams. The shales tend to be silty. The sandstones are fine grained, brownish in colour, show very poor porosity, and in general are cross-bedded. They are lenticular, range in thickness from a few inches to tens of feet, and can seldom be traced for more than a few hundred feet. They are most abundant in the upper 1,200 feet and in the lower 400 feet of the formation; the intervening beds contain only minor lenses of sandstone. Clay-ironstone concretions are common in the shales, particularly near the coal seams.

The principal coal seams occur in the upper 1,000 feet and lower 400 feet of the Gething formation.

No marker horizon has been recognized within the Gething. However, the basal conglomerate of the overlying Moosebar formation, which occurs as a thin and intermittent bed at the southeast end of the area, becomes continuous and thicker to the northwest and has been utilized as a marker bed to define the top of the Gething formation. It is a typical mud-flats conglomerate ranging from a few inches to about 4 feet thick, and is composed of well-rounded grey and black chert pebbles about one-quarter inch in diameter in a mudstone matrix. It differs from the chert pebble conglomerates found in the lower Gething sandstones in having a mudstone instead of a sandstone matrix.

The Gething formation is exposed in three northwest-southeast trending anticlinal structures (Fig. 2). The Pine River anticline, which is the principal one, is on the northeast, and the Noman Creek anticline and the Boulder Creek anticline lie southwest of it. Northeast of the Pine River anticline the strata dip gently into the broad basin which lies between it and the Commotion Creek anticline, which is 6 to 11 miles away and has a northwesterly diverging strike. To the southwest, toward the Rocky Mountains, the dips are steeper and the folds are more compressed in the anticlinorium which apexes at Boulder Creek. The axial plane of the Pine River anticline dips steeply southwest in the vicinity of Hasler Creek, steepens to nearly vertical in the Willow Creek

* Wickenden, R. T. D., and Shaw, G.: Prel. Paper 43-13.
Spivak, J.: Prel. Paper 44-7.
McLearn, F. H., and Kindle, E. D.: Mem. 259, 1950, pp. 184–188.
† Mathews, W. H.: Bull. 24, 1946.

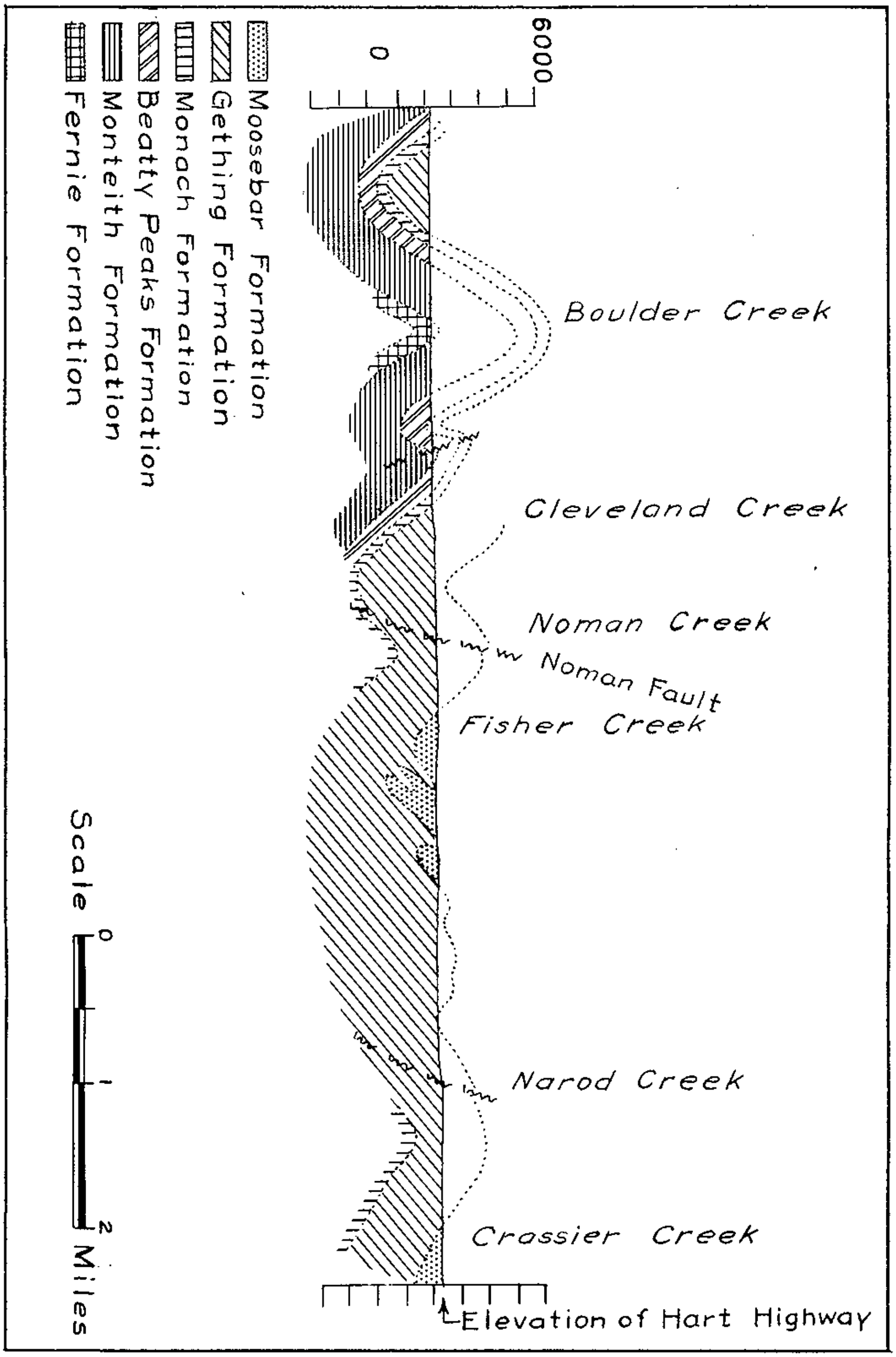

Fig. 2. Relationship of Pine River and Noman Creek anticline.

valley, and dips steeply northeast north of the Pine River at Crassier Creek. The plunge varies from flatly southeast to flatly northwest to flatly southeast again, forming a saddle between Hasler Creek and the headwaters of Willow Creek and another at the Pine River valley.

The Pine River anticline is cut by three sets of reverse faults, possibly of the same age, and by one normal fault which is probably younger. The Noman Creek anticline is cut by two reverse faults. These structures are described in detail in the following discussion of the coal deposits. It is interesting to note here, however, that the most numerous faults were encountered in the Willow Creek valley, between the opposite dips of the axial plane of the Pine River anticline.

The sharp westerly bends of Cleveland and Noman Creeks may indicate the presence of a northeasterly trending fault. Dunlevy sandstone and conglomerate are exposed north of the Cleveland Creek bend at an elevation of about 3,500 feet, whereas the lower part of Cleveland Creek is in Gething beds. No direct evidence of the existence of this fault was obtained.

The lack of marker beds within the Gething and the fact that fracture zones in soft shales may be inconspicuous suggests that in such closely folded rocks undetected minor faults may exist.

COAL DEPOSITS

The field work was done chiefly in the three areas indicated on Figure 3, from southeast to northwest, as: (1) Hasler mine area, (2) Willow Creek area, (3) Noman Creek area.

The results of the drilling of three diamond-drill holes near the headwaters of Johnsen Creek (Fig. 6) will be described with those of the Hasler Creek area and, similarly, the results of five holes drilled between Crassier and Narod Creeks, north of the Pine River (Fig. 15), will be discussed with those of Noman Creek.

The total diamond drilling done on the project (Table I) was eighty-one holes amounting to 48,653 feet, of which coal seams 1 foot thick or thicker totalled 1,405 feet. A summary of coal analyses of diamond-drill core samples is shown in Table II.

Estimates of coal reserves are given under the following descriptions of the tested areas. In each estimate the minimum thickness for a mineable seam is taken as 4.0 feet. The mean specific gravity of the coal is taken as 1.32, or 82.5 pounds per cubic foot. It is assumed that 50 per cent of the coal is recoverable. The limiting depth for mining is taken as 3,000 feet vertically below surface. Mineable coal is assumed to persist in the direction of dip a distance equivalent to one-half its strike-length. This dip-length is taken to the nearest 1,000 feet. In two instances in which the field evidence made such an assumption reasonable a dip-length equivalent to the strike-length was used.

The percentages of coal seams recovered in drill cores listed in Tables II, III, V, VI, and VII are based on the seam thicknesses as reported by the drill runners. It was found that the action of the drill upon entering and leaving coal changed sharply enough to enable an experienced runner to measure a coal interval as small as half a foot or less. Some very highly carbonaceous shales were soft enough and black enough to cause a similar action of the drill and to produce a black sludge similar to that derived from a coal seam. It would thus be possible locally to assume a greater thickness of clean coal than in fact existed, but instances of such shales occurring with coal seams and without partings hard enough to be detected through the action of the drill appeared to be rare enough to be disregarded.

" Depth " is used to signify vertical depth, and " stratigraphic depth " is the distance measured normal to the bedding. " Thickness " means true thickness. " Interval," as in " coal interval," means the actual length of drill core.

Capacity moisture as an evaluation of the moisture which is an integral part of the coal seam was determined by the method of Stansfield and Gilbart* for the samples

* *Amer. Inst. Min. Met. Eng.*, Trans. Vol. 102, 1932.

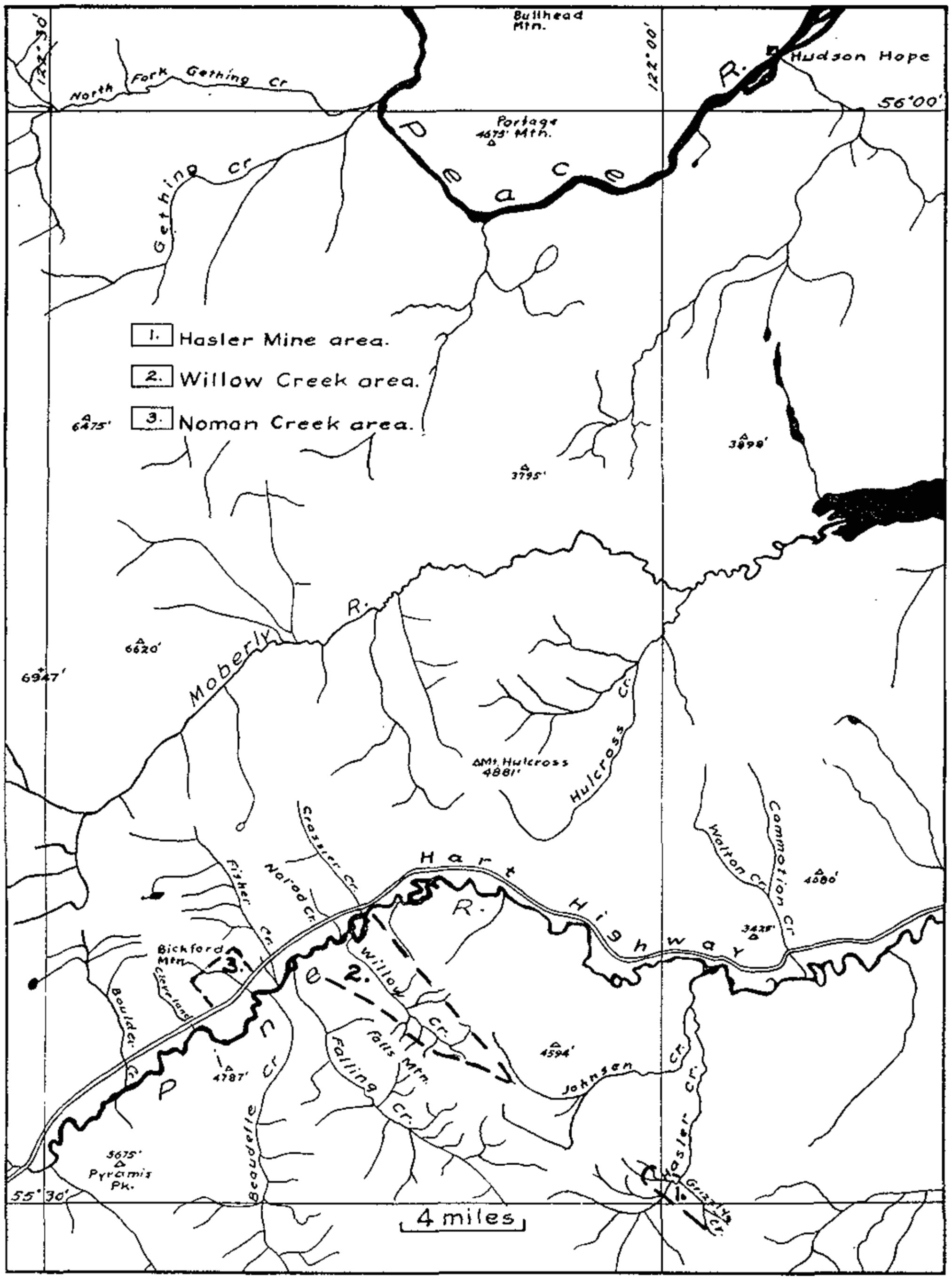

Fig. 3. Relative positions of tested areas.

listed in Table IV. Analyses in the other tables are on the dry basis. For dry-basis analyses the coal is dried for one hour at 105 degrees Centigrade.

Summary

The coal is of low to medium volatile rank; low in ash, averaging about 6 per cent; high in heat values, 13,000 to 15,000 B.t.u. per pound; and contains about 0.5 per cent sulphur. It is friable and non-weathering. The coking characteristics are fair to good.

The reserves estimated as recoverable in the three tested areas are:—

		Short Tons
Hasler mine area		8.0 million
Willow Creek area—		
Block A	10.2 million	
Block B	4.9 million	
Block C	2.0 million	
Block D	5.6 million	
Block E	1.0 million	
Block F	0.1 million	
		23.8 million
Noman Creek area		9.0 million
Total		40.8 million

Hasler Mine Area

This area lies along the Pine River anticline from about 3,000 feet northwest of Hasler Creek to about 2 miles southeast.

Maps and sections (Figs. 4 and 5*) were compiled by the writer from notes and sketches by G. L. Kidd, who did all the field work in this area.

The anticline here is unsymmetrical; the axial plane dips about 80 degrees southwestward and plunges about 5 degrees to the southeast. On the southwest limb the dip of the beds seldom exceeds 45 degrees and may flatten to 10 degrees and less within a few hundred feet (Section D-D′, Fig. 4). On the northeast limb the dips are from 55 degrees to more than 80 degrees, and two minor folds paralleling the major fold have been developed.

Three reverse faults having net slips of at least 200 feet have been recognized; the Hasler fault, striking north 40 degrees west and dipping 80 to 85 degrees northeast; the Goodrich fault, striking north 50 degrees west and dipping 40 degrees southwest; and a fault exposed only on Section B-B′ (Fig. 4), striking north 45 degrees west and dipping 75 degrees southwest. Their relative ages are not known.

Three coal seams of commercial thicknesses are indicated—the Discovery, the Goodrich, and the Quarter. Their stratigraphic depths below the top of the Gething formation (Fig. 5) are about 100 feet, 150 feet, and 250 feet respectively. As illustrated in Figure 5,* the Discovery and Goodrich seams appear to join locally to form a single seam. Coal at the horizon of the Point seam, described by Spivak,† did not show commercial thickness in any of the drill-holes.

The Discovery seam has been opened for a horizontal distance of 572 feet on the northeast limb of the northeast minor fold in the Hasler mine‡ where it shows an average thickness of 8 feet. Here the Hasler fault forms the roof of the seam.

Seam thicknesses and analyses of samples as obtained from diamond-drill cores are listed in Table III.

* *See* footnote on page 4.

† *Geol. Surv., Canada,* Prel. Paper 44-7.

‡ *Minister of Mines, B.C.,* Ann. Repts., 1944, 1945, 1946.

A bulk sample of 200 short tons was taken from the Hasler mine in 1949. The analysis of this coal is given in Table IV.

Coal reserves southwest of the Goodrich fault and to a depth of 1,000 feet were estimated as:—

	Short Tons
Discovery seam, 6 feet thick	5.0 million
Goodrich seam, 4 feet thick	1.5 million
Quarter seam, 4 feet thick	1.5 million
Total	8.0 million

Some of the coal northeast of the Goodrich fault, particularly that lying along the crests of the Pine River anticline and the two subsidiary anticlines, is certainly mineable, but because of the adverse structural conditions it is not included in the estimate. No account is taken of the coal northeast of the Hasler fault nor of any extension northwest beyond Section E-E′.

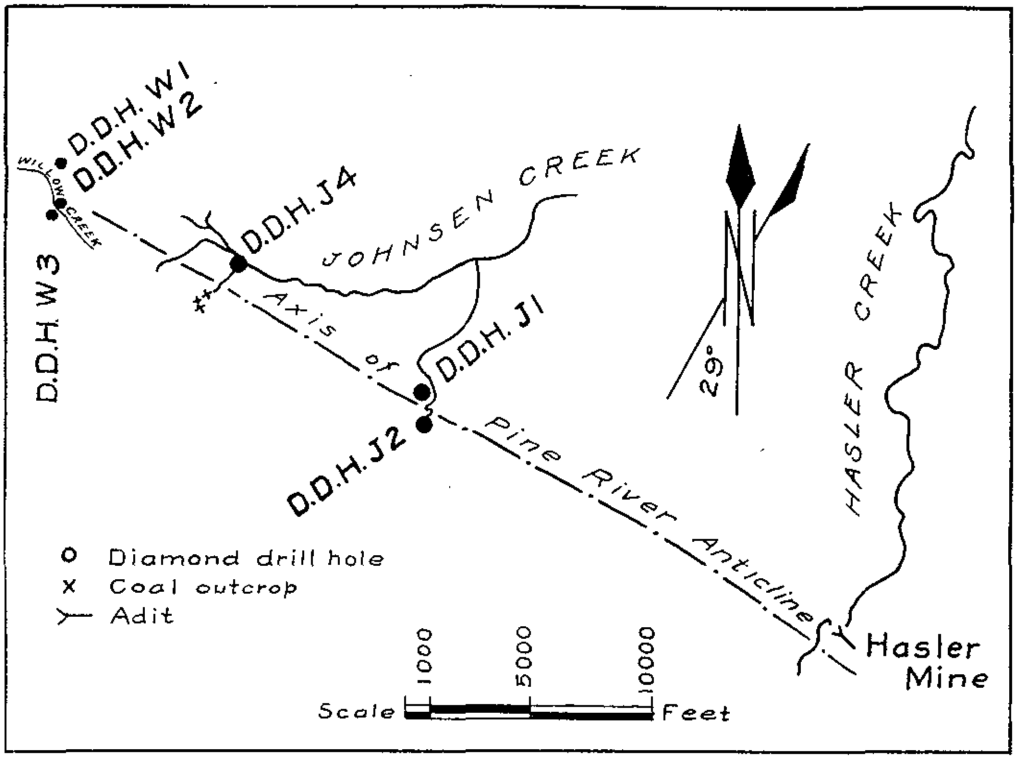

Fig. 6. Relationship of Johnsen Creek drill-holes to Hasler mine.

Three holes (Fig. 6) were drilled near the crest of the Pine River anticline at the headwaters of Johnsen Creek. Two holes, J 1 and J 2, were about 3.5 miles northwest of Hasler Creek, and the third, J 4, about 2 miles farther along the structure. All three holes cut seams which correspond stratigraphically (Fig. 5*) to the Discovery, Goodrich, and Quarter seams.

Seam thicknesses and sample analyses from diamond-drill cores are given in Table V.

No reserve tonnage is estimated on the basis of these three holes. They are too isolated both from the adjacent tested areas and from one another for the data to be more than indicative that an appreciable tonnage of coal may exist between Hasler Creek and the headwaters of Willow Creek.

* *See* footnote on page 4.

Diamond-drill hole J 4 encountered a pocket of gas in Moosebar shales at 155 feet. The gas ignited and destroyed the drill.

Willow Creek Area

This area (Fig. 7) is along Willow Creek, which flows northwest parallel to and just southwest of the axis of the Pine River anticline, for about 7 miles to join the Pine River.

The anticline is more nearly symmetrical here than in the Hasler mine area, with dips of 30 to 40 degrees common to both limbs. The plunge is about 10 degrees northwest.

The structure is badly faulted, twelve faults having been traced by surface exposures and diamond drilling. Of these, eleven are reverse faults and one is a normal fault. The reverse faults fall into three sets: strike north 50 degrees west, dip 55 to 75 degrees northeast; strike north 60 degrees west, dip 25 to 40 degrees southwest; strike north 45 degrees west and dip 70 to 80 degrees southwest. They have a common line of intersection, plunging flatly southeast, and they probably are conjugate. They are numbered 1 to 11 on Figure 7. The normal fault, termed the "Willow fault," strikes north 45 degrees west and dips 65 to 75 degrees northeast. It appears to cut the thrust faults, none of which are known to cross it, and so is presumed to be the younger. Apparent slips on the reverse faults range from a few tens of feet to several hundred. On the Willow fault a dip slip of about 600 feet is indicated, but the direction and magnitude of the strike slip, if any, is not known.

The reverse faults may pass into folds along their strikes or may be replaced by parallel breaks in echelon, as illustrated by Faults 8 and 9. Minor anticlines exposed on both limbs of the Pine River anticline strike more to the northwest than does the main structure and apparently have a southeast plunge. This relationship is indicated by the fold shown on Section D-D′, Figure 8, which, with the northwest plunge of the main structure, would bring the Gething-Moosebar contact below the ground-level at Section F-F′. With a flat southeast plunge parallel to the reverse fault intersection, the fold would bring the stratigraphically lower coal seams to the surface, as is indeed the case. This minor folding, therefore, is thought to be of the same age as the reverse faulting and consequently younger than the Pine River folding.

Movement on the Willow fault caused a northeasterly repetition of the southwest limb of the Pine River anticline. The Gething-Moosebar contact is repeated to a point about 600 feet northwest of Section E-E′ where it terminates against No. 3 fault.

Nine coal seams were found which showed commercial thicknesses in part. They are lenticular, discontinuous, and show considerable variations in stratigraphic depths along individual seams (Figs. 10* and 11*). Sandstone horizons as much as 150 feet thick show a similar lenticular habit and probably account in some part for differences in stratigraphic depths. The fact that the Moosebar conglomerate is continuous throughout this area, whereas it is discontinuous in the Hasler mine area, may indicate more erosion at the top of the Gething here. A coal seam was found immediately below the Moosebar conglomerate at a number of places (Figs. 10* and 11*); it showed a consistent thickness of between 2 and 4 feet and its distribution suggested that it had been eroded from some of the sections in which it was not found. No evidence of the depth of this erosion was obtained. It is apparent, however, that stratigraphic depths of coal horizons may be expected to vary appreciably from place to place. The seams were numbered from 1 to 9 in order of depth below the Moosebar conglomerate. Broadly speaking, the depths are No. 1, 100 feet; No. 2, 175 feet; No. 3, 300 feet; No. 4, 400 feet; No. 5, 550 feet; No. 6, 600 feet; No. 7, 775 feet; No. 8, 825 feet; and No. 9, 900 feet.

It is apparent that in this part of the coalfield the seams pinch out toward the southwest. On the southwest limb Seam 2 is not identifiable, and Seams 1 and 3 are limited to the southeast end; although appreciable thicknesses of coal occur at the horizons of Seams 4, 5, and 7, there is no evidence that they ever were continuous from the northeast limb.

* *See* footnote on page 4.

Mineable coal seams are confined to the northeast limb of the Pine River anticline, to the northeasterly faulted segment of the southwest limb, and to two short sections of this limb lying toward the southeast end of the area and near the Pine River valley respectively. Outside of these limited sections, seams in the southwest limb are too thin and too discontinuous to be worth developing. The central part of the anticline is too broken by faults and crumpled by folding for coal to be mined there.

Seam thicknesses and analyses of diamond-drill core samples are given in Table VI.

The mineable coal was estimated in six blocks as follows:—

Block A.—That part of the northeast limb of the Pine River anticline lying northeast of No. 9 fault:—

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
1	4,200	2,000	7.0	5.0	0.9
2	6,800	3,000	7.7	5.0	2.1
2A	8,800	4,000	7.8	6.0	4.4
4	5,000	2,000	11.0	6.0	1.2
7	5,800	2,000	6.5	4.0	1.0
9	3,900	2,000	19.9	4.0	0.6
Total	......	......	......	......	10.2

Block B.—That part of the northeast limb lying between diamond-drill hole W 35 and diamond-drill hole W 1A. This block is cut by No. 1 and No. 5 faults; the relative positions of the seam on either side of the fault are known.

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
1	8,400	4,000	9.0	7.0	4.9

Block C.—The easterly faulted segment of the southwest limb of the Pine River anticline:—

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
1	4,000	4,000	10.5	6.0	2.0

Block D.—That part of the southwest limb between diamond-drill hole W 28 and diamond-drill hole W 21:—

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
1	7,000	3,000	9.6	6.0	2.6
3	7,000	3,000	20.3	7.0	3.0
Total	......	......	......	......	5.6

Block E.—That part of the southwest limb lying between diamond-drill hole W 7 and diamond-drill hole W 21:—

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
4	3,000	1,000	7.5	4.0	0.3
5	4,000	2,000	9.2	4.0	0.7
Total	......	......	......	......	1.0

Block F.—That part of the southwest limb lying between diamond-drill hole W 16 and diamond-drill hole W 19:—

Seam	Strike Length	Dip Length	Maximum Thickness	Assumed Thickness	Millions of Short Tons
	Feet	Feet	Feet	Feet	
1A	1,200	1,000	12.0	4.0	0.1

The total estimated coal reserve in the Willow Creek area is 23.8 million short tons.

Two exposures of coal—one 4.5 feet thick and the other 5.5 feet—were found near the bed of Willow Creek about 1.5 miles and 2 miles respectively upstream from the trail crossing. They are believed to be close to the base of the Gething because of the presence of sandy conglomerate near by, but their actual stratigraphic position was not evident. No attempt was made to trace them, and they are noted here simply for completeness.

East of Willow Creek valley the dip of the formations flattens so that, according to contact elevations and formation attitudes recorded on the map of Wickenden and Shaw,* the top of the Gething formation is about 3,500 feet below the surface of the Pine River. Consequently, the coal measures reach the limiting depth of about 3,000 feet from surface at about 10,000 feet horizontally northeast of the axis of the Pine River anticline; this is equivalent to a slope distance of about 6,000 feet measured from the surface trace of the Moosebar conglomerate on the northeast limb of the anticline.

Noman Creek Area

This area (Fig. 12) lies immediately north of the John Hart Highway on the north side of Pine River valley between Fisher and Cleveland Creeks. It extends about 1 mile northwestward from the highway, and Noman Creek flows through the middle of it. The definitive field work here was done by F. K. North.

The structure (Fig. 13) consists of a sharp anticline trending northwest parallel to the Pine River anticline, but with the axial plane dipping to the northeast at about 65 degrees. The fold plunges at 5 to 8 degrees southeastward. As is illustrated in Figure 13, dips in both limbs are variable and range from nearly flat to more than 60 degrees. The structure is cut by two principal faults termed the Noman fault and the Eastern fault. The Noman fault strikes north 40 degrees west and dips 75 degrees southwestward. About 1,500 feet north of the highway the strike swings to north 20 degrees west, possibly deflected by thick sandstone beds on the nose of the anticline. It is a reverse fault with a dip-slip of about 550 feet; the total displacement is not known. The Eastern fault outcrops northeast of the anticlinal axis and is a reverse fault moving the northeast limb some 450 feet up the dip; neither magnitude nor direction of strike-slip is apparent. It strikes north 60 degrees east and dips 70 degrees northeastward so that it and the Noman fault must either join or cross on surface just northwest of the sharp westward bend of Noman Creek at an elevation of approximately 3,050 feet, the line of intersection plunging at about 30 degrees southeastward. There is no direct evidence of the relative ages of these faults. Their effect has been to form a structural rift-valley in the central part of the anticline, thus dividing the structure into major blocks with repetition of the Gething-Moosebar contact on the northeast side.

Two major coal seams were disclosed. Their stratigraphic depths below the top of the Gething vary within a range of about 100 feet (Fig. 14*), averaging about 550 feet for Seam 78 and 650 feet for Seam 76. Seam 39, Seam 60, and some negligible seams showed a tendency to thicken to the northwest, beyond the tested area, and are noted as having possibilities.

Seam 76, the most important seam in the three areas, has a maximum known thickness of 22 feet and an average thickness in its main bench of 16 feet. It underlies the

* *Geol. Surv., Canada,* Prel. Paper 43-13.

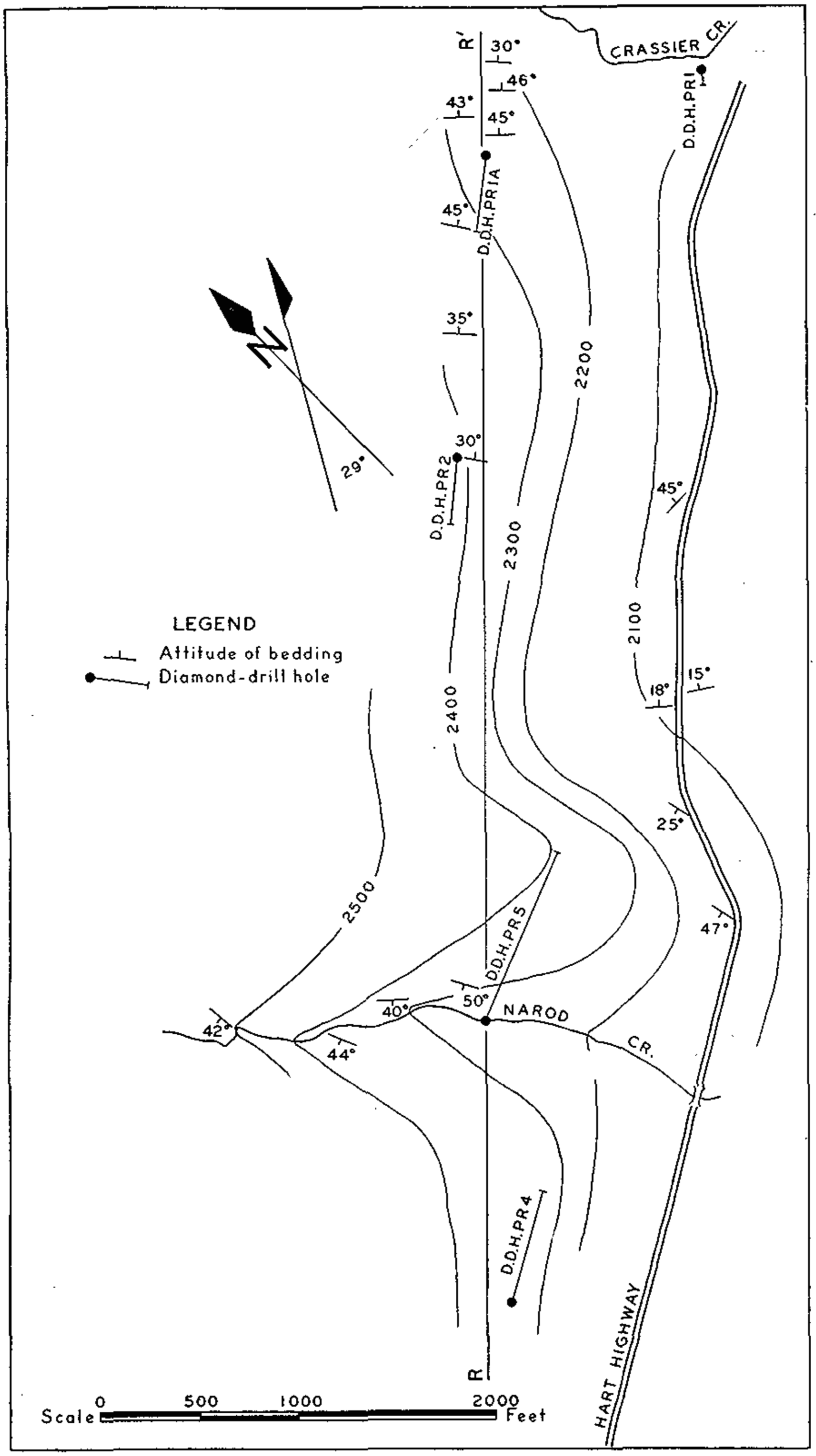

Fig. 15. Crassier Creek-Narod Creek area.

entire Noman Creek area as far west as its outcrop on the west limb of the syncline, and to the east it dips under the Moosebar in the Fisher Creek syncline (Fig. 13). In the northeast limb of the Pine River anticline, just west of Crassier Creek, it was identified in diamond-drill hole No. P.R. 1A (Figs. 9, 14,* and 15). The very thick overburden immediately east of Fisher Creek precluded drilling there, but diamond-drill hole P.R. 24, drilled 1 mile east of Fisher Creek on the edge of the heavy overburden, appeared to be too close to the base of the Gething to intersect Seam 76. Therefore, the seam must be presumed either to come to surface or to be cut off by a fault on the northeast limb of the Fisher Creek syncline. Farther to the northwest on the Pine River anticline, the horizon of the seam is below the level of erosion and it may be possible to trace it westward toward the Fisher Creek syncline. The seam reaches its greatest thickness immediately southwest of the Noman fault where the east limb of the minor syncline flattens out in the hangingwall of the fault. In general, however, it is here and in the anticlinal crest just northeast of the fault that the seam contains the greatest number and greatest thicknesses of partings. In holes P.R. 11, 12, and 20, all located near the fault, the seam consists of three distinct benches separated by partings and totalling as much as 20 feet thick. The lowest bench is always the thickest and represents the main seam. Elsewhere the seam is generally unparted but thinner. The thinnest surface exposure is at the level of the highway and northeast of P.R. 9 (Fig. 12) where the seam is 12 feet thick, but in P.R. 14 the seam is 5 feet thick.

Seam 78 is 75 to 100 feet stratigraphically above Seam 76. West of the Noman fault it has been traced in outcrops on both limbs of the minor syncline (Fig. 12) where it appears to be almost as thick and persistent as Seam 76. East of the fault, however, it is nowhere of commercial thickness or grade, and it thins rapidly eastward so that at P.R. 7 it is only 1 foot thick. It is tentatively correlated with the next seam above Seam 76 in P.R. 1A at Crassier Creek (Fig. 14*).

Seam thicknesses and analyses of diamond-drill core samples are listed in Table VII.

The tonnage of coal reserve is estimated as:—

	Short Tons
Southwest of Noman fault, Seams 78 and 76	5 million
Between Noman fault and the eastern Moosebar contact, Seam 76	4 million
Total reserve	9 million

On the west side of Cleveland Creek, between elevations of 2,000 and 2,150 feet, four seams of commercial thickness are exposed near the base of the Gething formation. They dip steeply northeastward at 65 to 75 degrees, and so for most of their extent would be more than 3,000 feet below surface. They are termed Seam 92 at about 250 feet stratigraphically above the base of the Gething, Seam 95 at 150 feet, Seam 97 at 120 feet, and Seam 100 at 65 feet.

Seam 92 is 6.5 feet thick and has several thin intercalations of carbonaceous shale.

Seam 95 is 3.8 feet thick.

Seam 97 consists of interbedded coal and shale as follows:—

	Feet
Coal with intercalations of carbonaceous shale	3.8
Coal	1.7
Carbonaceous shale	0.5
Shale and siltstone	5.0
Coal	1.3
Shale with streaks of coal	3.3
Coal	2.5
Total	18.1

This seam appears to have too many rock partings to be mineable.

* *See* footnote on page 4.

Seam 100 is 8 feet thick at the exposure, but the roof and floor appear to converge, indicating a variable thickness. The coal is clean and hard, and of good quality.

At the Boulder Creek exposure of the Gething formation, 2.5 miles west of Noman Creek, about 600 feet of beds above the base show six seams, all less than 2 feet thick, and of poor-quality coal, indicating that at least the lower seams pinch in this direction.

ORIGIN OF THE COAL

Factors bearing upon a possible origin of the coal are the discontinuity of the seams, the similarity of their stratigraphic positions in the three areas, and the markedly lenticular form and ubiquitous cross-bedding of the accompanying sandstones. These suggest that the coal was formed in basins on a widespread delta.

There is some evidence, although not very strong, that the seams of the Johnsen Creek-Hasler mine area may have formed in a basin separate from that of the Willow Creek area. Although the coal horizons indicated by the Hasler mine and Johnsen Creek drill-holes correspond very closely 5 miles apart, there is less correspondence between these seams and those of the first Willow Creek section only 1.5 miles farther northwest. There is no great difference in stratigraphic interval, but there is a distinct break in continuity at the Goodrich and Quarter horizons. The Discovery seam appears to continue thinly as Seam 1. The distribution of coal in holes J 4 and H 7 (Fig. 5*) suggests a possible shallowing of the basin to the northwest and southwest.

The generally low ash content of the coal and its banded character indicate an origin *in situ*. Some underclays were reported by Kidd† in the Hasler mine drill cores, but in the Willow Creek and Noman Creek areas none was observed.

Many of the very thin seams show partings of carbonaceous shale which would suggest rapidly changing conditions more appropriate to a drift origin. North‡ noted evidence of drift conditions in the Noman Creek area: "One large concretion, in a layer of such structures just above Seam 76, had a sandy centre and an outer shell composed ot curved foliæ of a shaly siltstone. These foliæ, when split, showed fragments of *Monotis subcircularis* Gabb at right angles to the foliæ. Since this fossil always lies on the bedding-planes in its native horizon, the Schooler Creek formation, the shells must have been washed into the concretionary band individually. . . ."

The evidence is not conclusive, but the coal appears to have been formed in local basins, and continuity even of the thickest seams cannot be assumed safely for great distances.

MINING NOTES

The mining of coal in this region would be essentially by underground operations. Limited possibilities for strip-mining exist southeast of Hasler Creek along the crest of the Pine River anticline, and even more limited ones on the north side of the Pine River valley at Noman Creek. Seams more than 20 feet thick cannot be expected even at the crests of folds, and such thicknesses do not permit the stripping of a great deal of overburden. This fact is particularly apparent at Noman Creek where the flatly pitching structure enters a steep slope of the mountain. The coal is deeply weathered, and at some apparently feasible stripping-sites may not be of marketable quality.

The steep dips and prevalent faulting preclude use of many of the mechanized methods and mining systems that lower the per ton costs in flat-seam mines. On the other hand, there may be some advantages in coal handling on steep slopes.

The roof conditions are not good. Most of the roof would be soft shale, which could not be expected to stand unsupported over even narrow widths. Fortunately the coal is strong, and the leaving of a strip of coal as roof would go far toward solving this difficulty. No caving or appreciable spalling of the coal in the back of the Hasler mine entries occurred even after five years.

* *See* footnote on page 4.
† Kidd, G. L., unpublished report.
‡ North, F. K., unpublished report.

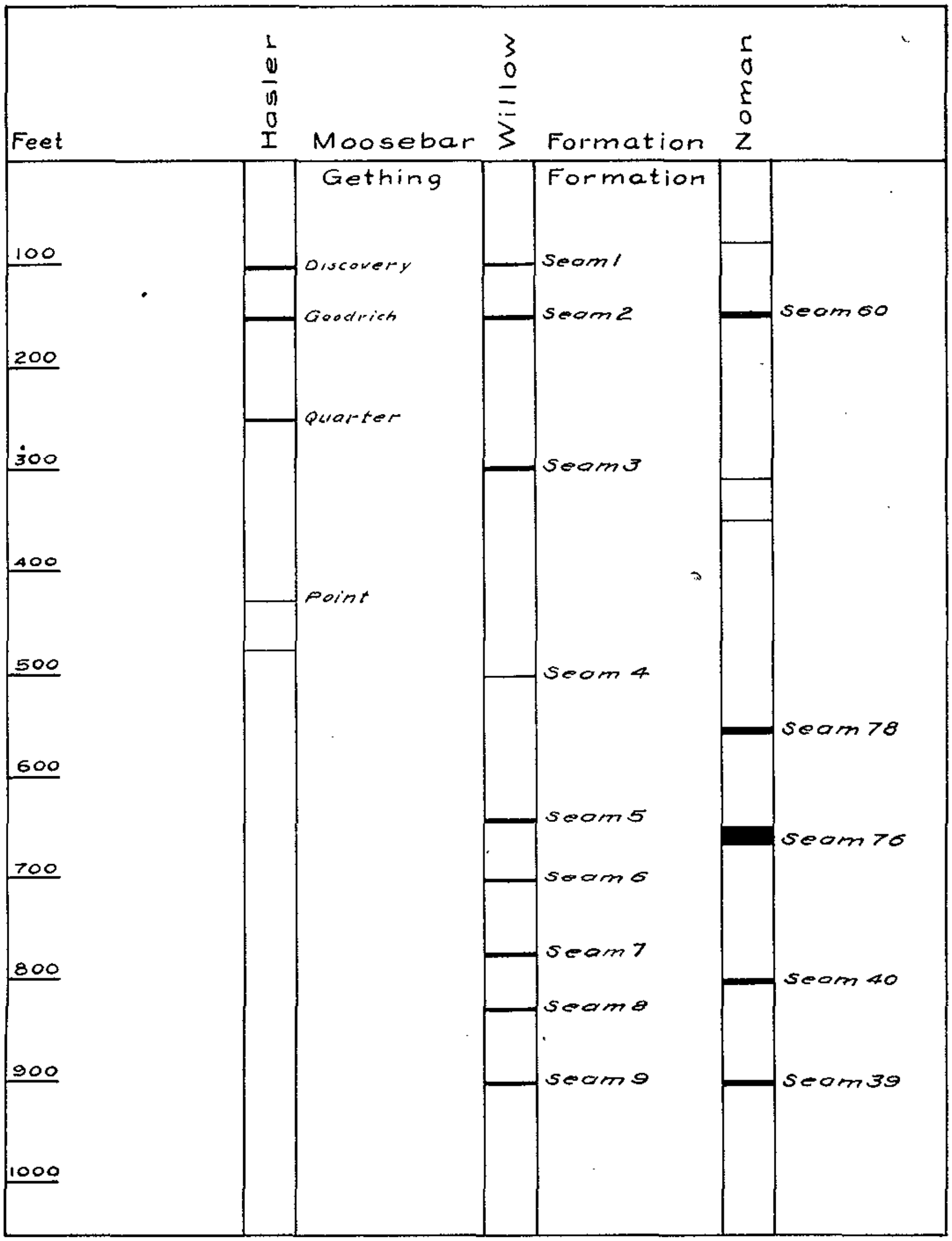

Fig. 16. Comparison of stratigraphic intervals of coal horizons at Hasler mine, Willow Creek, and Noman Creek areas.

It would be necessary to allow for higher costs than would be expected in flat-seam mines. Returns from strip-mining could be utilized during the initial stages to lower the over-all cost.

APPENDIX*

In the following tables and measured sections the essential information is given on which the estimates of quality of the coal and quantities of the reserves were based. Sections from surface cuts are given only in those instances where there were no diamond-drill holes near by. Detailed logs of all the drill-holes are in the files of the Department of Mines.

TABLE I.—SUMMARY OF DIAMOND DRILLING

Coal intersections of less than 1 foot are not included in the coal footages.

Hasler Mine Area

Hole No.	Direction	Inclination	Depth	Casing[1]	Footage[2] in Rock	Footage in Coal	Thickness of Overburden	Remarks
			Feet	Feet			Feet	
H 1	N. 42° E.	56°	481.5	35.0	460.5	27.1	17	
H 2	N. 22° E.	60°	353.0	20.0	330.0	19.5	20	
H 3	N. 67° E.	55°	397.5	95.0	392.0	11.2	5	
H 4	S. 10° W.	44°	851.0	120.0	731.0	44.0	83	
H 5	N. 12° E.	68°	593.0	25.0	568.0	14.7	23	
H 6	S. 50° W.	65°	541.0	20.0	521.0	*Nil*	18	All in Moosebar formation.
H 6A	N. 50° E.	45°	242.5	20.0	222.5	*Nil*	14	All in Moosebar formation.
H 7	N. 35° E.	65°	634.0	20.0	614.0	4.4	18	All in Moosebar formation.
H 8	....	----	....	....	....	....	---	Not drilled.
H 9	S. 35° W.	70°	1,148.0	30.0	1,118.0	*Nil*	28	All in Moosebar formation.
Totals	....	----	5,241.5	385.0	4,957.0	120.9	---	

Johnsen Creek

Hole No.	Direction	Inclination	Depth	Casing[1]	Footage[2] in Rock	Footage in Coal	Thickness of Overburden	Remarks
			Feet	Feet			Feet	
J 1	S. 29° E.	70°	543.0	30.0	513.0	21.3	28	
J 2	N. 29° E.	70°	600.0	50.0	552.0	29.5	45	
J 3	....	----	....	....	....	....	---	Not drilled.
J 4	S. 35° E.	75°	987.0	10.0	978.0	48.1	9	Gas at 155 feet in Moosebar.
Totals	....	----	2,130.0	90.0	2,043.0	98.9	---	

Willow Creek Area

Hole No.	Direction	Inclination	Depth	Casing[1]	Footage[2] in Rock	Footage in Coal	Thickness of Overburden	Remarks
			Feet	Feet			Feet	
W 1	S. 40° W.	60°	253.0	26.0	226.0	....	23	
W 1A	S. 40° W.	65°	696.0	264.0	661.0	15.4	32	
W 2	N. 40° E.	50°	354.0	50.0	329.0	12.6	19	
W 3	N. 40° E.	75°	206.0	70.0	186.0	6.9	25	
W 4	N. 35° E.	75°	197.0	20.0	177.0	3.1	19	
W 5	N. 35° E.	65°	239.0	15.0	228.0	8.7	10	
W 6	N. 35° E.	65°	223.0	136.0	112.0	3.5	100	
W 7	N. 35° E.	65°	303.0	10.0	297.0	19.9	5	
W 8	N. 35° E.	46°	501.0	22.0	479.0	2.0	16	
W 9	....	90°	368.0	75.0	293.0	16.4	75	
W 10	N. 35° E.	60°	648.0	60.0	588.0	29.2	52	
W 11	N. 35° E.	57°	957.0	53.0	904.5	8.0	45	
W 12	N. 35° E.	55°	716.5	30.0	686.5	10.0	25	
W 13	N. 35° E.	65°	543.0	12.0	531.0	12.7	11	
W 14	N. 35° E.	65°	641.0	7.0	634.0	32.0	6	
W 15	N. 35° E.	70°	750.0	10.0	740.0	4.7	9	
W 16	N. 35° E.	60°	921.0	85.0	891.0	6.8	26	
W 17	N. 35° E.	60°	794.0	30.0	764.0	25.2	26	
W 18	N. 35° E.	60°	983.0	82.0	930.0	10.1	46	

[1] In some holes includes some core footage.
[2] Includes coal footage.

* All coal analyses in the following tables were made by K. C. Gilbart, Chief Chemist of the Coal, Petroleum and Natural Gas Branch. Unless otherwise noted, analyses are on the dry basis as defined on page 11.

TABLE I.—SUMMARY OF DIAMOND DRILLING—*Continued*

Willow Creek Area—Continued

Hole No.	Direction	Inclination	Depth	Casing[1]	Footage[2] in Rock	Footage in Coal	Thickness of Overburden	Remarks
							Feet	
W 19	N. 40° E.	60°	549.0	140.0	409.0	26.9	121	
W 20	N. 35° E.	60°	902.5	70.0	834.5	9.0	59	
W 21	N. 35° E.	60°	836.0	20.0	818.0	35.8	16	
W 22	S. 32° W.	45°	847.0	20.0	827.0	35.0	14	
W 23	N. 35° E.	60°	742.0	15.0	723.0	36.0	16	
W 24	S. 35° W.	60°	775.0	25.0	760.0	12.6	13	
W 25	N. 35° E.	60°	160.0	140.0	*Nil*	*Nil*	?	Did not reach bedrock.
W 26	S. 45° W.	60°	647.0	15.0	632.0	13.0	13	
W 27	N. 35° E.	60°	770.0	135.0	636.0	39.4	29	
W 28	N. 35° E.	67°	1,072.0	18.0	1,055.0	37.5	15	
W 29	N. 35° E.	70°	600.0	53.0	547.0	12.5	50	
W 30	N. 35° E.	70°	70.0	70.0	*Nil*	*Nil*	70	Sloping rock surface.
W 30A	N. 35° E.	80°	785.0	72.0	713.0	6.0	70	
W 31	N. 35° E.	60°	750.0	162.0	600.0	18.0	140	
W 32	S. 35° W.	70°	544.0	15.0	529.0	25.5	14	
W 33	S. 35° W.	70°	708.0	10.0	708.0	37.4	0	
W 34	S. 35° W.	80°	523.0	15.0	507.0	18.2	15	
W 35	S. 35° W.	70°	721.0	139.0	585.5	13.6	130	
W 36	S. 50° W.	60°	683.0	80.0	602.0	21.0	70	
W 37	S. 50° W.	60°	653.0	17.0	636.0	24.5	15	
W 38	S. 35° W.	60°	1,030.0	82.0	1,013.0	47.5	15	
W 39	S. 45° W.	60°	786.0	7.0	779.0	61.5	6	
Totals	....	.....	25,447.0	2,367.0	23,571.0	758.1	—	

Crassier Creek-Nomian Creek Area

Hole No.	Direction	Inclination	Depth	Casing[1]	Footage[2] in Rock	Footage in Coal	Thickness of Overburden	Remarks
			Feet	Feet			Feet	
P.R. 1	S. 45° W.	65°	177.0	170.0	*Nil*	*Nil*	?	Did not reach bedrock.
P.R. 1A	S. 52° W.	45°	828.0	105.0	723.0	20.7	74	
P.R. 2	S. 52° W.	60°	1,038.0	10.0	1,028.0	12.0	9	
P.R. 3	N. 48° E.	48°	468.0	110.0	358.0	*Nil*	82	
P.R. 4	N. 60° E.	45°	803.0	11.0	792.0	7.0	8	
P.R. 5	N. 67° E.	40°	1,195.0	16.0	1,179.0	9.6	10	
P.R. 6	N. 75° E.	40°	171.0	100.0	71.0	*Nil*	64	
P.R. 7	S. 50° W.	40°	1,073.0	13.0	1,060.0	19.5	8	
P.R. 8	....	90°	471.0	111.0	360.0	17.3	111	
P.R. 9	....	90°	182.0	132.0	*Nil*	*Nil*	?	Did not reach bedrock.
P.R. 10	N. 55° E.	40°	868.0	10.0	858.0	18.9	6	
P.R. 11	....	90°	263.0	30.0	233.0	30.2	30	
P.R. 12	N. 51° E.	45°	544.0	26.0	523.0	39.7	15	
P.R. 13	....	90°	788.0	10.0	778.0	23.6	10	
P.R. 14	S. 53° W.	43°	838.0	30.0	808.0	21.4	20	
P.R. 15	S. 60° W.	60°	521.0	10.0	511.0	1.5	9	
P.R. 16	S. 60° W.	45°	861.0	33.0	828.0	18.0	23	
P.R. 17	S. 55° W.	60°	692.0	5.0	687.0	6.7	4	
P.R. 18	N. 82° E.	45°	472.0	20.0	470.0	28.0	1	
P.R. 19	S. 55° W.	45°	640.0	30.0	610.0	17.4	21	
P.R. 20	N. 60° E.	45°	255.0	22.0	233.0	21.3	16	
P.R. 21	N. 60° E.	45°	597.0	30.0	567.0	9.8	21	
P.R. 22	S. 60° W.	45°	642.0	51.0	594.0	11.6	34	
P.R. 23	S. 60° W.	45°	206.0	72.0	134.0	19.0	51	
P.R. 23A	S. 60° W.	45°	481.0	162.0	401.0	9.5	57	
P.R. 24	N. 60° E.	60°	761.0	30.0	731.0	4.4	26	
Totals	....	.....	15,835.0	1,349.0	14,547.0	427.1	.....	

[1] In some holes includes some core footage.
[2] Includes coal footage.

Table II.—Summary of All Coal Analyses from Diamond-drill Cores

Hasler Creek

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
H 1	126.0–133.0	29	Discovery	18.0[1]	15.7	66.3	0.6	12,390	4.2
H 2	121.0–126.0	60	Discovery	2.8	19.7	77.5	0.5	15,220	3.9
	224.3–238.0	26	Quarter	2.0	20.0	78.0	(2)	(2)	3.9
H 3	231.5–235.5	25	Quarter	8.6	20.6	70.8	(2)	(2)	3.5
H 7	341.0–345.0	100	Discovery	3.2	21.7	75.1	1.4	14,970	3.5
	520.0–523.0	100	Quarter	10.4	18.5	71.1	0.7	13,940	3.8

[1] High ash due in part to calcite stringers in coal.
[2] Not determined.

Johnsen Creek

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
J 1	488.0–502.0	86		4.5	19.5	76.0	0.4	14,820	3.9
J 2	472.2–474.9	100		8.9	18.4	72.7	0.4	14,240	4.0
	488.8–515.0	92		6.0	19.7	74.3	0.4	14,360	3.8
J 4	523.5–528.6	100		4.1	21.4	74.6	0.6	14,730	3.5
	591.3–594.0	100		10.4	20.8	68.8	0.5	13,910	3.3
	597.3–604.0	84		10.5	19.8	69.7	0.5	13,810	3.5
	740.0–746.8	100		9.3	20.2	70.5	0.4	13,920	3.5
	951.0–956.5	91		4.3	18.3	77.4	0.4	14,700	4.2

Willow Creek

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
W 1A	336.0–341.7	33	1	9.6	19.9	70.5	0.5	13,900	3.5
W 5	62.0– 71.6	72	1	8.0	21.8	70.2	0.4	14,040	3.2
W 6	171.5–178.0	62	1	7.4	20.9	71.7	0.4	14,180	3.4
	178.0–178.6	67	1	12.4	21.7	65.9	0.4	13,410	3.0
	179.0–179.5	100	1	14.9	21.3	63.8	0.4	12,990	3.0
W 7	152.7–160.5	76	4	8.3	20.0	71.7	0.6	14,130	3.6
	272.0–281.5	28	5	2.1	18.5	79.4	0.6	15,150	4.3
W 8	75.5– 77.5	100		3.6	25.5	70.9	0.9	14,940	2.8
W 9	113.0–119.0	100	2	11.1	20.6	68.3	0.5	13,570	3.3
	120.0–127.7	26	2	6.6	21.6	71.8	0.5	14,510	3.3
	129.7–132.5	68	2	7.0	21.5	71.5	0.5	14,530	3.3
W 10	261.0–266.9	37	4	6.0	20.2	73.8	0.6	14,540	3.7
	355.0–361.4	10	5	8.3	18.9	72.8	0.5	14,090	3.8
	537.8–549.5	34		4.4	18.7	76.9	0.7	14,540	4.1
W 14	151.0–157.3	78	2	4.4	20.4	75.2	0.4	14,700	3.7
	624.1–629.4	64		1.5	15.8	82.7	0.6	15,170	5.2
W 15	721.6–724.9	55		2.6	16.5	80.9	0.6	15,090	4.9
W 16	385.0–387.9	100	1	4.3	23.2	72.5	0.7	14,760	3.1
	847.1–848.0	100		8.2	18.8	73.0	0.5	14,150	3.9
	884.8–887.6	100		9.7	21.5	68.8	0.6	13,570	3.2
	915.5–918.5	13		1.6	17.5	80.9	0.8	15,310	4.6
W 17	142.7–149.9	100		5.5	21.6	72.9	0.4	14,600	3.4
	264.0–265.4	100		4.4	21.4	74.2	0.6	14,720	3.5
	285.5–288.2	100		8.7	24.7	66.6	0.8	13,860	2.7
	439.9–446.4	100		8.1	19.5	72.4	0.6	14,140	3.7
	462.1–464.0	100		8.5	19.3	72.2	0.6	13,880	3.7
	495.6–496.3	100		10.9	21.3	67.8	0.7	13,420	3.2
	606.0–608.0	100		2.1	15.9	82.0	0.6	15,110	5.2
	623.9–627.1	100		1.4	16.1	82.5	0.5	15,320	5.1
W 18	365.0–368.0	67		4.0	21.5	74.5	0.7	14,990	3.5
	570.0–572.5	100		13.9	26.7	59.4	0.5	12,770	2.2
	601.2–604.2	100		14.0	26.0	60.0	0.7	12,880	2.3
	932.0–934.0	25		28.6	16.6	54.8	(3)	(3)	3.3
W 19	158.7–160.6	100		5.5	22.4	72.1	1.0	14,570	3.2
	210.8–223.0	100	2	9.6	20.8	69.6	0.5	13,880	3.4
W 19	365.0–370.0	10		15.5	18.0	66.5	0.8	13,120	3.7
W 20	278.0–283.0	40		6.6	23.8	69.6	4.2	14,350	2.9
	387.0–389.0	5		14.9	20.7	64.4	0.7	12,950	3.1
	402.0–404.0	30		12.0	20.1	67.9	1.0	13,610	3.4

[3] Not determined.

Table II.—Summary of All Coal Analyses from Diamond-drill Cores—*Cont'd*

Willow Creek—Continued

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
W 21	38.1– 39.4	100		3.5	26.9	69.6	2.2	15,040	2.6
	222.0–223.0	100		5.0	21.5	73.5	0.7	14,660	3.4
	224.0–226.0	35		12.2	25.2	62.6	0.7	13,800	2.5
	413.0–418.8	100	3	8.2	20.6	71.2	0.5	14,190	3.5
	593.0–595.0	15	4	3.7	19.5	76.8	0.8	14,960	3.9
	657.0–661.0	20	5	7.1	17.2	75.7	0.5	14,290	4.4
	720.5–721.2	100	6 (?)	17.9	14.9	67.2	0.6	12,610	4.5
	722.5–726.0	50	6 (?)	2.5	18.3	79.2	0.7	15,170	4.3
	774.5–786.0	23	7 (?)	1.8	16.0	82.2	0.7	15,260	5.1
W 22	327.8–335.5	32	2	8.5	20.4	71.1	0.6	14,130	3.5
	369.1–376.1	4	2A	9.7	19.8	70.5	0.5	14,010	3.6
	565.0–571.0	5	4	17.4	19.6	63.0	1.1	12,850	3.2
	677.0–682.0	8	5	11.3	21.1	67.6	1.1	13,820	3.2
W 23	40.9– 43.0	100		5.8	28.0	66.2	2.4	14,510	2.4
	117.0–118.2	70	1	4.0	23.9	72.1	0.8	14,800	3.0
	137.0–138.0	40		8.3	21.7	70.0	0.8	14,120	3.2
	173.3–181.7	27	2	11.2	21.1	67.7	0.5	13,710	3.2
	198.0–201.0	48		6.4	22.7	70.9	0.7	14,300	3.1
	219.0–220.0	60		19.1	23.7	57.2	0.9	12,370	2.4
	290.0–292.0	20		7.9	24.5	67.6	0.7	14,220	2.8
	370.0–373.0	47	3	3.2	22.4	74.4	0.6	15,140	3.3
	377.0–381.0	25	3	6.1	24.3	69.6	0.6	14,250	2.9
	534.0–537.0	33		3.3	21.8	74.9	0.8	15,130	3.4
	574.0–580.0	75	4	6.7	20.2	73.1	0.6	14,450	3.6
	604.5–607.0	68	5	5.3	18.3	76.4	1.3	14,610	4.2
	610.5–611.5	50	5	9.5	18.8	71.7	0.9	13,940	3.8
	662.0–664.0	30		4.9	17.1	78.0	0.5	14,600	4.6
W 24	80.0– 80.5	100		3.1	16.9	80.0	0.8	14,700	4.8
	94.0– 97.6	3		6.5	24.5	69.0	2.4	14,540	2.8
	183.0–183.5	100	1	7.3	15.0	77.7	0.6	14,390	5.2
	287.7–288.5	100	2	14.3	20.1	65.6	0.6	13,070	3.3
	313.0–318.0	70	2A	2.4	21.3	76.3	0.5	15,140	3.6
W 24	384.0–385.4	100		10.8	17.0	72.2	0.6	13,710	4.2
	483.0–483.6	100		5.5	17.0	77.5	0.6	14,750	4.6
	585.0–585.4	100		4.0	15.8	80.2	0.6	15,000	5.1
	603.8–604.1	100		16.3	15.9	67.8	0.6	12,950	4.3
	679.2–679.9	100		5.6	16.3	78.1	0.5	14,680	4.8
	696.0–697.4	21		8.5	15.5	76.0	0.7	14,080	4.9
	737.0–740.1	52	4	13.9	17.4	68.7	0.7	13,390	4.0
	743.1–744.0	100	4	5.7	18.6	75.7	0.7	14,730	4.1
W 27	249.0–259.0	66	3	5.6	21.2	73.2	0.4	14,540	3.5
	259.0–265.0	80	3	8.0	20.7	71.3	0.4	14,140	3.4
	265.5–270.0	100	3	10.2	24.6	65.2	0.5	14,000	2.6
W 28	242.0–244.0	25		2.6	26.2	71.2	2.3	15,210	2.7
	310.4–311.4	40		21.3	30.1	48.6	0.6	11,190	1.6
	340.5–347.0	77	1	5.6	21.7	72.7	0.4	14,640	3.3
	349.6–351.0	64		6.5	27.9	65.6	0.5	14,580	2.3
	408.0–410.0	25		3.5	26.8	69.7	0.6	15,140	2.6
	606.7–608.7	85		3.6	24.7	71.7	2.4	15,000	2.9
	705.5–715.0	23	1	9.9	20.6	69.5	0.5	13,860	3.4
	874.0–875.3	23	3	4.5	23.2	72.3	0.7	15,160	3.1
	901.0–905.0	13		25.4	23.0	51.6	([3])	([3])	2.2
W 29	462.4–463.8	57		1.5	25.3	73.2	1.2	15,430	2.9
	531.0–531.5	60		33.9	29.8	36.3	([3])	([3])	1.2
	548.0–548.5	40		15.6	20.9	63.5	0.8	13,120	3.0
	569.2–584.0	58	1	8.6	22.0	69.4	0.5	14,230	3.1
W 30A	757.6–762.6	20	1	5.8	21.5	72.7	1.0	14,730	3.4
W 31	329.0–331.5	20	2	5.5	27.9	66.6	0.4	14,900	2.4
	533.0–534.5	33	3	10.4	19.4	70.4	0.5	13,910	3.6
W 32	108.0–117.0	24	1	5.9	21.3	72.8	0.5	14,670	3.4
	176.0–179.0	22	2	2.3	21.3	76.4	0.7	15,320	3.6
	195.0–198.0	25		27.7	18.1	54.2	0.6	11,180	3.0
	253.5–254.5	100		2.3	20.2	77.5	0.9	15,240	3.8
	265.0–267.0	25		1.8	22.1	76.1	0.7	15,490	3.4
	283.5–284.0	100	3	9.3	19.4	71.3	0.6	14,020	3.7
	362.8–363.4	100		8.1	24.6	67.3	0.6	14,170	2.7
W 33	178.0–179.0	33		7.3	22.8	69.9	0.8	14,370	3.1
	211.0–218.0	86	1	5.1	21.5	73.4	0.5	14,700	3.4

[3] Not determined.

Table II.—Summary of All Coal Analyses from Diamond-drill Cores—*Cont'd*

Willow Creek—Continued

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
W 33	220.0–222.0	50		16.1	18.9	65.0	0.4	13,140	3.4
	318.0–320.0	42		7.3	18.9	73.8	0.7	14,400	3.9
	332.0–333.5	55		8.8	18.9	72.3	0.8	14,150	3.8
	373.0–375.0	29	3	7.1	19.9	73.0	0.8	14,470	3.7
	555.0–558.0	31	4	6.8	18.0	75.2	0.8	14,590	4.2
	647.0–649.0	42		9.1	16.7	74.2	0.8	14,180	4.5
	685.0–688.0	61	5	16.0	14.7	64.3	0.8	13,050	4.7
W 34	156.0–157.0	83		11.0	21.4	67.6	1.0	13,850	3.2
	183.0–195.0	62	2	8.0	20.8	71.0	0.4	14,210	3.4
	203.0–204.0	50		27.3	18.1	54.6	0.4	11,210	3.0
	281.5–283.0	95		4.1	19.7	76.2	0.9	14,920	3.9
	337.0–338.0	84	3	4.9	19.4	75.7	0.7	14,770	3.9
	404.0–405.0	67		10.9	19.9	69.2	0.8	13,810	3.5
	435.0–436.0	58		6.9	19.0	74.1	0.9	14,410	3.9
W 35	345.0–348.0	56	2	4.5	22.5	73.0	0.6	14,870	3.2
	349.0–352.0	11	2	13.4	19.0	67.6	0.4	13,400	3.6
	355.0–357.0	88	2	17.1	20.8	62.1	0.4	12,920	3.0
	360.0–362.0	37	2	3.0	20.4	76.6	0.5	15,110	3.8
	364.0–365.3	80	2	18.6	28.6	52.8	0.4	11,590	1.8
W 36	220.0–221.0	67		22.1	19.5	58.4	1.2	11,960	3.0
	245.0–247.0	67	1	15.4	21.0	63.6	0.7	13,010	3.0
	305.0–307.0	92	2	7.7	20.3	72.0	0.5	14,330	3.6
	308.5–310.0	33	2	14.1	20.7	65.2	0.4	13,240	3.1
	313.0–314.0	42	2	12.4	19.4	68.2	0.5	13,610	3.5
	408.0–409.0	58	4	3.8	20.5	75.7	0.8	15,030	3.7
W 37	212.0–215.0	32	2	8.2	20.8	71.0	0.7	14,270	3.4
	270.0–277.0	12	2A	24.8	33.5	41.7	0.5	10,530	1.2
	288.0–297.0	20		17.8	22.9	59.3	0.4	12,220	2.6
	427.0–428.5	53	4	19.5	27.9	52.6	0.7	11,670	1.9
W 38	181.0–183.0	25		2.1	23.5	74.4	0.7	15,260	3.2
	191.0–197.0	72	1	6.2	22.4	71.4	0.4	14,350	3.2
	247.0–251.0	40	2	4.0	24.9	71.1	0.6	15,070	2.9
	291.0–298.0	50	2A	6.4	22.6	71.0	0.3	14,290	3.1
	311.0–315.0	58	2A	5.5	20.9	73.6	0.4	14,510	3.5
	429.0–437.0	32	4	6.1	21.1	72.8	0.5	14,410	3.4
W 38	778.0–780.0	75	6	5.3	18.3	76.4	0.6	14,580	4.2
	790.0–791.0	66	6	2.5	17.7	79.8	0.8	15,220	4.5
	841.0–847.5	31	7	2.3	16.6	81.1	0.6	15,180	4.9
	957.5–963.0	95	9	2.4	14.8	82.8	0.4	15,050	5.6
W 39	54.0– 58.0	58	5	13.1	18.4	68.5	1.0	13,290	3.7
	157.0–168.5	66	6	3.8	16.9	79.3	0.6	14,900	4.7
	236.0–242.0	50	7	4.1	16.3	79.6	0.4	14,800	4.9
	428.0–432.0	67	8	7.1	17.9	75.0	0.7	14,510	4.2
	446.0–477.0	100	8	2.3	15.1	82.6	0.5	15,120	5.5
	660.0–680.0	100	9	3.0	15.3	81.7	0.5	15,020	5.3

Noman Creek

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
P.R. 5	254.0–257.0	50	39	1.8	14.2	84.0	0.5	15,240	5.9
P.R. 7	466.0–470.0	25		3.7	25.5	70.8	0.6	14,880	2.8
	541.0–542.0	33		26.5	17.7	55.8	0.6	11,080	3.2
	543.0–544.0	33		39.5	17.0	43.5	0.5	9,080	2.6 ?
	692.0–693.0	42		14.3	20.3	65.4	0.9	13,120	3.2
	761.0–762.0	58	78	3.8	26.5	69.7	0.9	15,030	2.6
P.R. 8	334.0–336.0	37	78	15.5	22.3	62.2	1.0	13,110	2.8
P.R. 11	168.0–176.0	31		2.9	18.2	78.9	0.7	14,960	4.3
P.R. 14	122.0–128.0	38		8.1	24.6	67.3	0.5	13,910	2.7
	137.0–140.0	33		4.2	24.3	71.5	0.5	14,660	2.9
	362.0–364.0	55	78	1.5	22.2	76.0	0.7	15,200	3.4
	410.0–415.0	26	76	6.3	20.9	72.8	0.7	14,420	3.5
	440.0–446.0	35		2.1	17.9	80.0	0.7	15,120	4.5
	449.0–452.0	20		2.5	18.2	79.3	0.6	15,050	4.4
	500.0–506.0	30		2.0	17.2	80.8	0.6	15,090	4.7
	549.0–550.0	40		3.5	27.4	69.1	0.6	14,850	2.5
	612.0–620.0	44		3.8	17.4	78.8	0.7	14,850	4.5

Table II.—Summary of all Coal Analyses from Diamond-drill Cores—*Cont'd*

Noman Creek—Continued

Hole No.	Coal Interval	Per Cent Coal Recovered	Seam	Ash	V.C.M.	F.C.	Sulphur	Heat Value	F.C./V.C.M.
	Feet			Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.	
P.R. 16	208.0–213.0	18		3.9	17.4	78.7	0.7	14,860	4.5
	215.0–216.0	50		14.2	21.9	63.9	0.4	13,060	2.9
	506.0–511.0	100		3.2	24.3	73.5	0.6	15,000	3.0
	582.0–601.0	44	76	2.5	23.1	74.4	0.4	15,070	3.2
	604.0–607.0	27	76	8.9	25.3	65.8	0.5	14,210	2.6
P.R. 17	74.0– 83.0	90	60	2.8	25.0	72.2	0.5	14,830	2.9
	114.0–115.0	70		1.6	29.8	68.6	0.8	15,360	2.3
	149.0–154.0	20		9.0	25.6	65.4	0.6	13,950	2.6
	608.0–627.0	41	76	2.4	22.5	75.1	0.4	15,080	3.3
P.R. 18	203.0–204.5	40		5.7	22.0	72.3	0.8	14,200	3.3
	212.0–214.0	35		7.6	24.3	68.1	0.8	14,080	2.8
	295.0–324.0	22	76	5.0	20.5	74.5	0.7	14,810	3.6
P.R. 19	51.0– 54.0	50	60	4.6	27.6	67.8	0.8	14,320	2.5
	381.0–383.0	45		3.4	24.2	72.4	0.8	14,760	3.0
	515.0–518.0	33	78	7.2	29.9	62.9	0.8	14,270	2.1
	575.0–584.0	100	76	9.8	26.9	63.3	0.4	13,570	2.4
	586.0–600.0	100	76	2.9	22.0	75.1	0.3	14,980	3.4
P.R. 20	132.0–138.0	47		4.3	29.3	66.4	0.6	14,770	2.3
	222.0–246.0	31	76	11.9	28.0	60.1	0.5	13,070	2.2
P.R. 21	275.0–281.0	32	78	6.8	27.5	65.7	0.7	14,230	2.4
P.R. 22	475.0–482.0	43	78	7.6	26.9	65.5	0.5	14,010	2.4
	576.0–588.0	35	76	3.3	22.4	74.3	0.4	14,930	3.3
P.R. 23	107.0–110.0	33	76	13.3	28.0	58.7	0.6	12,720	2.1
P.R. 23A	107.0–111.0	27	76	13.8	27.7	58.5	0.6	12,720	2.1
P.R. 23	124.0–142.0	18	76	1.5	21.4	77.1	0.5	15,210	3.6
P.R. 23A	125.0–140.0	31	76	1.6	23.1	75.3	0.5	15,210	3.3
	383.0–389.0	38		4.7	20.6	74.7	0.9	14,820	3.6
	414.0–416.0	25		8.5	21.2	70.4	0.7	14,060	3.3

Table III.—Analyses of Diamond-drill Core Samples Used in Estimates, Hasler Creek

Hole No.	Thickness	Per Cent Coal Recovered	Ash	V.C.M.	F.C.	Sulphur	Heat Value	Coking Qualities	Carbon Ratio
Discovery Seam	Feet		Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.		
H 1	7.0	29	18.0	15.7	66.3	0.6	12,390	Agglom.	4.2
H 2	5.0	60	2.8	19.7	77.5	0.5	15,220	Good	3.9
H 4	22.0	—	—	—	—	—	—	—	—
H 4	16.0	—	—	—	—	—	—	—	—
H 7	4.0	100	3.2	21.7	75.1	1.4	14,970	Good	3.5
Goodrich Seam									
H 2	1.4	—	—	—	—	—	—	—	—
Quarter Seam									
H 1	10.5	—	—	—	—	—	—	—	—
H 2	13.7	26	2.0	20.0	78.0	—	—	—	3.9
H 3	4.0	25	8.6	20.6	70.8	—	—	—	3.5
H 4	8.0	—	—	—	—	—	—	—	—
H 4	4.0	—	—	—	—	—	—	—	—
H 5	3.0	—	—	—	—	—	—	—	—
H 7	3.7	100	10.4	18.5	71.1	0.7	13,940	Coking	3.8

TABLE IV.—ANALYSIS OF BULK SAMPLE FROM HASLER MINE[1]

	As Received	Capacity Moisture	Dry
Moisture (per cent)	2.6	2.2	....
Ash (per cent)	3.5	3.5	3.6
Volatile matter (per cent)	19.8	19.9	20.3
Fixed carbon (per cent)	74.1	74.4	76.1
Sulphur (per cent)	0.5	0.5	0.5
Gross calorific value (B.t.u.)	14,710	14,780	15,110
Fuel ratio	....	3.8	....
Coking properties	....	Good coking	....
Mineral matter—			
Free dry (F.C.)	....	79.2	....
Free dry (B.t.u.)	....	15,730	....
Free moist (B.t.u.)	....	15,380	....
Classification (A.S.T.M.)	....	Low volatile bituminous	....
Ash fusion	....	2,580° F. (medium bituminous)	....

[1] "Tests of Hasler Mine Coal," B.C. Dept. of Railways, 1950.

TABLE V.—ANALYSES[1] OF DIAMOND-DRILL CORE SAMPLES, JOHNSEN CREEK

Hole No.	Thick-ness	Per Cent Coal Recovered	Ash	V.C.M.	F.C.	Sulphur	Heat Value, Gross	Coking Qualities	Carbon Ratio
Discovery Seam	Feet		Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.		
J 1	11.5	......	......	......	......	......	....	....	......
J 2	2.0	100	8.9	18.4	72.7	0.4	14,240	....	4.0
J 4	5.0	100	4.1	21.4	74.6	0.6	14,730	....	3.5
Goodrich Seam									
J 1	14.0	86	4.5	19.5	76.0	0.4	14,820	Coking	3.9
J 2	15.7	92	6.0	19.7	74.3	0.4	14,360	....	3.8
J 4	2.7	100	10.4	20.8	68.8	0.5	13,910	....	3.3
J 4	9.0	84	10.5	19.8	69.7	0.5	13,810	....	3.5
Quarter Seam									
J 4	6.6	100	9.3	20.2	70.5	0.4	13,920	....	3.5
?									
J 4	5.5	91	4.3	18.3	77.4	0.4	14,700	....	4.2

[1] Air dried. *See* paragraph on dry-basis analysis, page 11.

TABLE VI.—ANALYSES OF DIAMOND-DRILL CORE SAMPLES USED IN ESTIMATES, WILLOW CREEK

Hole No.	Thick-ness	Per Cent Recovered	Ash	V.C.M.	F.C.	Sulphur	Heat Value	Coking Qualities	Carbon Ratio
Seam 1	Feet		Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.		
W 1A	5.7	33	9.6	19.9	70.5	0.5	13,900	Coking, no swelling	3.5
W 32	4.5	24	5.9	21.3	72.8	0.5	14,670	Coking	3.4
W 33	7.6	86	5.1	21.5	73.4	0.5	14,700	Agglom.	3.4
W 36	1.9	67	15.4	21.0	63.6	0.7	13,010	Good coke	3.0
W 24	0.5	100	7.3	15.0	77.7	0.6	14,390	Agglom.	5.2
W 38	5.9	72	6.2	22.4	71.4	0.4	14,350	Coking	3.2
W 5	9.6	72	8.0	21.8	70.2	0.4	14,040	Coking	3.2
W 6	6.5	62	7.4	20.9	71.7	0.4	14,180	Coking, no swelling	3.4
W 28	6.5	77	5.6	21.7	72.7	0.4	14,640	Good coke	3.3
W 28	8.9	23	9.9	20.6	69.5	0.5	13,860	Good coke	3.4
W 29	10.5	58	8.6	22.0	69.4	0.5	14,230	Good coke	3.1
W 30A	2.5	20	5.8	21.5	72.7	1.0	14,730	Good coke	3.4
W 23	1.1	70	4.0	23.9	72.1	0.8	14,800	Good coke	3.0

TABLE VI.—ANALYSES OF DIAMOND-DRILL CORE SAMPLES USED IN ESTIMATES, WILLOW CREEK—*Continued*

Hole No.	Thick-ness	Per Cent Recovered	Ash	V.C.M.	F.C.	Sulphur	Heat Value	Coking Qualities	Carbon Ratio
Seam 2	Feet		Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.		
W 32	3.0	22	2.3	21.3	76.4	0.7	15,320	Good coke	3.6
W 34	12.0	62	8.2	20.8	71.0	0.4	14,210	Coking	3.4
W 9	6.0	26	6.6	21.6	71.8	0.5	14,510	Good coke	3.3
W 9	1.7	68	7.0	21.5	71.5	0.5	14,530	Good coke	3.3
W 35	2.6	56	4.5	22.5	73.0	0.6	14,870	Good coke	3.2
W 35	2.6	11	13.4	19.0	67.6	0.4	13,400	Coking	3.6
W 36	2.0	92	7.7	20.3	72.0	0.5	14,330	Coking	3.6
W 36	1.5	33	14.1	20.7	65.2	0.4	13,240	Coking	3.1
W 24	0.8	100	14.3	20.1	65.6	0.6	13,070	Good coke	3.3
W 37	3.0	32	8.2	20.8	71.0	0.7	14,270	Good coke	3.4
W 22	7.7	32	8.5	20.4	71.1	0.6	14,130	Coking	3.5
W 38	4.0	40	4.0	24.9	71.1	0.6	15,070	Good coke	2.9
W 23	8.4	27	11.2	21.1	67.7	0.5	13,710	Soft coke	3.2
W 31	2.2	20	5.5	27.9	66.6	0.4	14,900	Good coke	2.4
Seam 2A									
W 24	5.0	70	2.4	21.3	76.3	0.5	15,140	Coking	3.6
W 37	6.6	12	24.8	33.5	41.7	0.5	10,530	Good coke	1.2
W 22	7.0	4	9.7	19.8	70.5	0.5	14,010	Soft coke	3.6
W 38	6.6	50	6.4	22.6	71.0	0.3	14,290	Coking	3.1
W 38	4.0	58	5.5	20.9	73.6	0.4	14,510	Poor coke	3.5
Seam 3									
W 32	0.5	100	9.3	19.4	71.3	0.6	14,020	Coking	3.7
W 33	2.0	29	7.1	19.9	73.0	0.8	14,470	Good coke	3.7
W 34	1.0	84	4.9	19.4	75.7	0.7	14,770	Coking	3.9
W 28	1.3	23	4.5	23.2	72.3	0.7	15,160	Good coke	3.1
W 27	9.7	66	5.6	21.2	73.2	0.4	14,540	Coking	3.5
W 27	5.8	80	8.0	20.7	71.3	0.4	14,140	Coking	3.4
W 27	4.3	100	10.2	24.6	65.2	0.5	14,000	Good coke	2.6
W 23	3.0	47	3.2	22.4	74.4	0.6	15,140	Good coke	3.3
W 23	4.0	25	6.1	24.3	69.6	0.6	14,250	Good coke	2.9
W 21	5.8	100	8.2	20.6	71.2	0.5	14,190	Good coke	3.5
W 31	1.3	33	10.4	19.4	70.2	0.5	13,910	Soft coke	3.6
Seam 4									
W 36	1.0	58	3.8	20.5	75.7	0.8	15,030	Coking	3.7
W 24	3.0	52	13.9	17.4	68.7	0.7	13,390	Good coke	4.0
W 24	0.9	100	5.7	18.6	75.7	0.7	14,730	Good coke	4.1
W 37	1.0	53	19.5	27.9	52.6	0.7	11,670	Coking	1.9
W 22	5.8	5	17.4	19.6	63.0	1.1	12,850	Good coke	3.2
W 38	7.8	32	6.1	21.1	72.8	0.5	14,410	Poor coke	3.4
W 7	7.8	76	8.3	20.0	71.7	0.6	14,130	Poor coke	3.6
W 23	6.0	75	6.7	20.2	73.1	0.6	14,450	Good coke	3.6
W 10	5.2	37	6.0	20.2	73.8	0.6	14,540	Good coke	3.7
W 21	2.0	15	3.7	19.5	76.8	0.8	14,960	Soft coke	3.9
Seam 5									
W 7	9.5	28	2.1	18.5	79.4	0.6	15,150	Coking	4.3
W 23	2.5	68	5.3	18.3	76.4	1.3	14,610	Soft coke	4.2
W 23	1.5	50	9.5	18.8	71.7	0.9	13,940	Agglom.	3.8
W 10	6.2	10	8.3	18.9	72.8	0.5	14,090	Agglom.	3.8
W 21	3.6	20	7.1	17.2	75.7	0.5	14,290	Agglom.	4.4
Seam 6									
W 38	2.0	75	5.3	18.3	76.4	0.6	14,580	Poor coke	4.2
W 38	1.0	66	2.5	17.7	79.8	0.8	15,220	Poor coke	4.5
W 39	9.9	66	3.8	16.9	79.3	0.6	14,900	Agglom.	4.7
Seam 7									
W 38	6.5	31	2.3	16.6	81.1	0.6	15,180	Agglom.	4.9
W 39	3.8	50	4.1	16.3	79.6	0.4	14,800	Poor coke	4.9
Seam 8									
W 39	0.7	67	7.1	17.9	75.0	0.7	14,510	Poor coke	4.2
W 39	5.4	100	2.3	15.1	82.6	0.5	15,120	Non-coking	5.5
Seam 9									
W 38	5.5	95	2.4	14.8	82.8	0.4	15,050	Non-coking	5.6
W 39	19.0	100	3.0	15.3	81.7	0.5	15,020	Agglom.	5.3

Table VII.—Analyses of Diamond-drill Core Samples Used in Estimates, Noman Creek

Hole No.	Thickness	Per Cent Recovered	Ash	V.C.M.	F.C.	Sulphur	Heat Value	Coking Qualities	Carbon Ratio
	Feet		Per Cent	Per Cent	Per Cent	Per Cent	B.t.u. per Lb.		
Seam 60									
P.R. 17	9	90	2.8	25.0	72.2	0.5	14,830	....	2.9
P.R. 19	3	50	4.6	27.6	67.8	0.8	14,320	....	2.5
Seam 78									
P.R. 7	1	58	3.8	26.5	69.7	0.9	15,030	....	2.6
P.R. 8	2	37	15.5	22.3	62.2	1.0	13,110	....	2.8
P.R. 14	2	55	1.5	22.2	76.0	0.7	15,200	....	3.4
P.R. 19	3	33	7.2	29.9	62.9	0.8	14,270	....	2.1
P.R. 21	4	32	6.8	27.5	65.7	0.7	14,230	....	2.4
P.R. 22	10	43	7.6	26.9	65.5	0.5	14,010	....	2.4
Seam 76									
P.R. 14	5	26	6.3	20.9	72.8	0.7	14,420	....	3.5
P.R. 16	10	44	2.5	23.1	74.4	0.4	15,070	....	3.2
	3	27	8.9	25.3	65.8	0.5	14,210	....	2.6
P.R. 17	15	41	2.4	22.5	75.1	0.4	15,080	....	3.3
P.R. 18	22	22	5.0	20.5	74.5	0.7	14,810	....	3.6
P.R. 19	6	100	9.8	26.9	63.3	0.4	13,570	....	2.4
	10	100	2.9	22.0	75.1	0.3	14,980	....	3.4
P.R. 20	21	31	11.9	28.0	60.1	0.5	13,070	....	2.2
P.R. 22	10	35	3.3	22.4	74.3	0.4	14,930	....	3.3
P.R. 23	2	33	13.3	28.0	58.7	0.6	12,720	....	2.1
	13	18	1.5	21.4	77.1	0.5	15,210	....	3.6
P.R. 23A	4	27	13.8	27.7	58.5	0.6	12,720	....	2.1
	14	31	1.6	23.1	75.3	0.5	15,210	....	3.3

Measured Sections of Coal Seams

The following measured sections of seams were obtained from surface cuts and diamond-drill cores as noted:—

Discovery Seam

	Feet
Station G 12—	
COAL	7.2
Bone	0.5
COAL	4.8
	12.5
Station G 14—	
COAL	2.3
Bone	0.5
COAL	3.2
Bone	0.1
COAL	9.3
Brashy coal, not merchantable	4.5
	19.9
Station G 16B—	
Bone	0.6
COAL	5.1
Bone	0.3
COAL	8.2
Bone	3.9
	18.1
Station G 16C—	
COAL	4.9
Bone	0.5
COAL	7.8
	13.2
Station G 22D—	
Bone	0.2
COAL	1.3
Bone	0.5
COAL	4.5
Bone	0.5
COAL	2.8
	9.8
Diamond-drill hole H 2—	
COAL with 1-inch bone parting	5.0
Diamond-drill hole H 4—	
COAL and bone	0.2
Core lost	0.3
Bone	0.8
COAL	4.5
Bone	1.8
Core lost	1.9
COAL	2.0
Core lost	3.5
COAL	8.0
	23.0
Diamond-drill hole H 7—	
COAL	2.9
Bone	0.1
COAL	1.1
	4.1

Goodrich Seam

	Feet
Station G 14—	
COAL	8.0
Station G 16B—	
COAL	0.5
Bony clay and shale	1.1
COAL	2.8
(Upper bench)	4.4
Shale	4.1
COAL	2.9
Sandstone	0.3
COAL	4.4
(Lower bench)	11.7
Station G 16D—	
COAL	7.3

COAL ANALYSIS REPORT

SEAM 76

		1/76 Lab. Sample No. 407 P	2/76 Lab. Sample No. 411 P	3/76 Lab. Sample No. 412 P
Moisture as received	%	9.4	11.8	11.9
Dried: Ash	%	2.0	4.0	1.6
Volatile Matter	%	26.4	27.9	25.4
Fixed Carbon	%	71.6	68.1	73.0
Ultimate Analysis: Sulphur	%	0.4	0.3	0.3
Calorific Value, gross	BTU	12820	12370	13020
Fuel Ration (F.C./V.M.)		2.7	2.4	2.9
Coking Properties:		Non-coking	Non-coking	

SEAM 78

		Lab. Sample No. 410 P
Moisture as received	%	9.7
Dried: Ash	%	1.4
Volatile Matter	%	25.6
Fixed Carbon	%	73.0
Ultimate Analysis: Sulphur	%	0.3
Calorific Value, gross	BTU	12950
Fuel Ration (F.C./V.M.)		2.9
Coking Properties:		Non-coking

Victoria, B.C.,
December 10th, 1957.

Report on Sampling Coal Seams 76 and 78
Pine River, September 1957.

SEAM 76

The sample from Seam 76 was taken from an exposure shown on the Noman Creek map of Bulletin No. 36 as in Section E-F immediately west of D.D.H. P.R. 18. Here the seam was exposed by a cross-trench in 1948. Overburden in the immediate vicinity consists of three feet and more of clayey glacial gravels and sands.

Preparation for taking the sample was made by stripping the surface material down to the weathered upper surface of the coal for about 100 feet northwest of the original trench. The surface material was bulldozed off, and the bottom of the original trench was then deepened to the floor of the seam, a depth in coal of about 6 feet. The trench was then widened by bulldozing off the northerly side until hard, fresh-appearing coal was found. This coal first appeared near the floor of the seam and increased in thickness as the trench was widened on the northerly side, into the hill. Lump and slack coal alike was pushed over the side of the hill until the cut was advanced about ten feet from the original trench at the floor and about twenty feet at the top of the hard coal. The surface of the hard coal then was cleaned of weathered material by the bulldozer. Cuts were then made into the hard coal by the bulldozer. As the cuts advanced, caving weathered material from the upper part of the seam was pushed over the hill. The seam here is about 20 feet thick and the sample represents the lower half to two-thirds of the total thickness.

The coal was considerably fractured by a fault that was exposed during the sampling and so broke up before the blade more than it normally would have done.

The 130 pound sacked sample sent to Ottawa was from near the end of the sampling cut, about thirty feet into the hill from the original cross-trench and at least as much from the original surface of the ground.

A sample from drill hole P.R. 10, southeast of the pit, at 100 feet depth, was found to have agglomerating qualities and one from hole P.R. 22, northwest of the pit at 300 feet depth was found to have coking properties. These depths given are vertically below surface.

The writer believes that the coal obtained for the

........2

130 lb. sample sent to Ottawa was as fresh as could be hoped for from surface stripping operations in this seam.

SEAM 78

One truckload, near 12 tons, was taken from Seam 78. The coal was found to be badly shattered, apparently due to abortive attempts to blast it, and so probably weathered to depths beyond reach of a bulldozer. It is unlikely to be of as good quality as that from Seam 76. It is probable that the coal from Seam 78 is now in Squamish. As soon as we have notice of its arrival we shall obtain a sample.

N.D. McKechnie,
Department of Mines,
Victoria, B.C.,
October 23, 1957.

SUPPLEMENT TO TABLE VII

Page 28, Bulletin No. 36

Hole No.	Thickness	Depth Interval	Coking Properties
Seam 78	Feet		
P.R. 7	1	761 - 762	Good coke
P.R. 8	2	334-- 336	Good coke
P.R. 14	2	362 - 364	Coking
P.R. 19	3	515 - 518	Good coke
P.R. 21	4	275 - 281	Good coke
P.R. 22	10	475 - 482	Good coke
Seam 76			
P.R. 14	5	410 - 415	Aggl.
P.R. 16	10	582 - 601	Good coke
	3	604 - 607	Good coke
P.R. 17	15	608 - 627	Good coke
P.R. 18	22	295 - 324	Coking
P.R. 19	6	575 - 584	Good coke
	10	586 - 600	coking (soft)
P.R. 20*	21	222 - 233 - 246	Aggl.
P.R. 22	10	576 - 588	Coking
P.R. 23	2	107 - 110	Aggl.
	13	124 - 142	Coking
P.R. 23A	4	107 - 111	Aggl.
	14	125 - 140	Coking

* 21 ft. clean coal from 24' section.

	Feet
Station G 17G—	
Bone	2.2
COAL	6.6
Bone	2.6
	11.4
Station G 17H—	
Bone	3.0
COAL	7.9
Bone	0.6
	11.5
Diamond-drill hole H 2—	
COAL	1.4
Diamond-drill hole H 7—	
COAL	1.0
Core lost	6.8
Bone	2.5
	10.3

Quarter Seam

	Feet
Diamond-drill hole H 2—	
Bony COAL	1.5
Mudstone with coal seamlets	2.0
COAL	6.7
Bone and sandstone	1.0
COAL	2.5
Sandstone	0.5
COAL	3.0
Bone	1.5
	18.7
Diamond-drill hole H 4—	
COAL	1.0
Shale	0.4
COAL	6.6
	8.0
Diamond-drill hole H 5—	
COAL	3.0
Diamond-drill hole H 7—	
Core lost	0.3
COAL	3.0
COAL fragments	0.4
	3.7

Discovery Seam

	Feet
Diamond-drill hole J 1—	
Bone	0.3
COAL	2.0
Bone and sandstone	0.5
COAL	0.6
Bone	2.3
COAL	2.5
Bone	2.5
	10.7
Diamond-drill hole J 2—	
COAL	0.4
Bone	1.5
COAL	2.7
Core lost	1.0
Bone and COAL	3.3
	8.9
Diamond-drill hole J 4—	
COAL	4.3
Core lost	0.7
Bone	0.2
	5.2

Goodrich Seam

	Feet
Diamond-drill hole J 1—	
COAL	14.0
Core lost, probably COAL	2.6
	16.6
Diamond-drill hole J 2—	
COAL	9.1
Core lost, probably COAL	1.2
COAL	5.4
	15.7
Diamond-drill hole J 4—	
Bone	0.5
COAL	2.0
Bone	2.5
COAL	2.0
Bone	0.5
Shale	3.7
Bone	0.5
COAL	0.4
Sandstone	0.7
Bone	0.1
COAL	3.8
Bone	2.7
COAL	1.6
Sandstone	0.5
COAL	1.0
Bone	0.3
COAL	2.8
Bone	0.7
COAL	1.4
	27.7
Shale	10.0
COAL may belong with Goodrich seam	3.2
	13.2

Quarter Seam

	Feet
Diamond-drill hole J 4—	
Bone	0.3
COAL	6.6
Bone	0.4
Carbonaceous shale	3.1
COAL	2.5
Interbedded coal and bone	1.5
COAL	3.9
Bone	0.4
COAL	4.5
	23.2

Seam 1

	Feet
Diamond-drill hole W 1A—	
COAL with bone	3.8
Sandstone with coal	1.8
COAL	1.9
	7.5
Diamond-drill hole W 32—	
COAL	0.6
Shale	0.6
COAL	0.5
Shale	1.1
COAL	0.8
Sandstone	0.4
Shale	0.2
COAL	0.3
Core lost, believed to be COAL	4.5
	9.0
Diamond-drill hole W 33—	
COAL	7.6
Sandy shale	0.5
Bony coal	2.4
	10.5
Diamond-drill hole W 38—	
COAL	5.9
Diamond-drill hole W 5—	
COAL	6.5
Bone	1.0
COAL	2.1
	9.6
Diamond-drill hole W 6—	
COAL	2.0
Core lost	1.5
COAL	1.5
Core lost	1.0
COAL and bone	1.7
	7.7

Diamond-drill hole W 28—	Feet
COAL	0.5
Bone	0.1
COAL	4.4
Core lost	1.5
	6.5

Diamond-drill hole W 28 (faulted limb)—	
COAL	0.7
Core lost	1.5
COAL	1.4
Core lost	5.3
	8.9

Diamond-drill hole W 29—	
COAL	0.9
Core lost	0.3
COAL	1.6
Carbonaceous shale	0.3
COAL	0.1
Core lost	2.6
COAL	2.3
Sandstone	0.5
COAL	0.1
Core lost	1.2
COAL	0.6
	10.5

Seam 2

Diamond-drill hole W 34—	
COAL	2.8
Core lost	1.1
Shale	0.2
COAL	2.7
Sandstone	0.5
COAL	0.5
Sandstone	0.8
COAL	0.4
Core lost	1.2
COAL	1.8
	12.0

Diamond-drill hole W 9—	
COAL	4.8
Sandstone	0.1
COAL	0.7
Sandstone	0.3
COAL	0.4
Sandstone	0.4
COAL	0.2
Sandstone	0.2
COAL	2.0
	9.1

Diamond-drill hole W 22—	
COAL	0.7
Core lost	3.1
COAL	0.4
Core lost	0.8
Sandstone	0.3
COAL	1.4
Core lost	3.0
	9.7

Diamond-drill hole W 38—	
Core lost	1.0
COAL	0.6
Core lost	1.4
Carbonaceous shale	1.3
Siltstone	0.4
COAL	1.0
	5.7

Diamond-drill hole W 23—	
COAL	1.5
Core lost	2.2
COAL	0.5
Core lost	2.5
Siltstone	0.3
COAL	0.4
Core lost	1.0
	8.4

Seam 2A

Diamond-drill hole W 24—	Feet
COAL	1.9
Core lost	1.1
COAL	1.6
Core lost	0.4
	5.0

Diamond-drill hole W 37—	
COAL	0.6
Siltstone with coal stringers	0.6
COAL	0.5
Core lost	5.5
COAL	0.6
	7.8

Diamond-drill hole W 22—	
COAL	0.3
Core lost	6.7
	7.0

Diamond-drill hole W 38—	
COAL	3.9
Core lost	2.1
COAL	0.6
(Upper bench)	6.6
COAL	3.0
Core lost	1.0
(Lower bench)	4.0

Seam 3

Diamond-drill hole W 27—	
COAL	6.6
Core lost	3.4
COAL	4.2
Core lost	1.8
COAL	0.6
Siltstone	0.2
COAL	0.2
Siltstone	0.6
COAL	2.7
	20.3

Diamond-drill hole W 23—	
COAL	1.9
Core lost	1.1
Shale and siltstone	2.5
Core lost	1.5
COAL	2.6
Core lost	1.4
	11.0

Diamond-drill hole W 21—	
COAL	0.7
Siltstone	0.3
COAL	2.4
Core missing	2.4
	5.8

Seam 4

Diamond-drill hole W 22—	
COAL	0.3
Core missing	6.7
	7.0

Diamond-drill hole W 38—	
COAL	0.3
Core missing	2.7
COAL	2.5
Core missing	5.5
	11.0

Diamond-drill hole W 7—	
COAL	0.5
Core lost	0.8
COAL	0.9
Bone	1.1
COAL	4.3
Core lost	0.2
	7.8

MEASURED SECTIONS OF COAL SEAMS—*Continued*

Diamond-drill hole W 23—

	Feet
Core lost	1.5
COAL	4.5
	6.0

Diamond-drill hole W 10—

COAL	0.5
Bone	0.1
Core lost	0.8
COAL	1.5
Core lost	2.3
	5.2

Seam 5

Diamond-drill hole W 7—

COAL	1.1
Core lost	1.4
COAL	1.2
Core lost	5.3
COAL	0.5
	9.5

Diamond-drill hole W 10—

COAL	2.0
Core lost	1.0
COAL	0.7
Core lost	2.8
	6.5

Seam 6

Diamond-drill hole W 39—

COAL	1.6
Core lost	2.3
COAL	6.0
	9.9

Seam 7

Diamond-drill hole W 38—

	Feet
Core lost	4.0
COAL	2.5
	6.5

Seam 8

Diamond-drill hole W 39—

COAL	5.4

Seam 9

Diamond-drill hole W 38—

COAL	5.5
Carbonaceous shale	0.8
COAL	0.6
	6.9

Diamond-drill hole W 39—

COAL	3.3
Core lost	1.8
COAL	1.3
Core lost	1.2
Carbonaceous shale	0.2
COAL	1.8
Core lost	1.2
Carbonaceous shale	1.6
COAL	1.1
Carbonaceous shale	0.4
COAL	1.5
Core lost	3.5
COAL	1.0
	19.9

MEASURED SECTIONS OF COAL SEAMS—*Continued*

Seam 76

Hole No.	Coal Intervals	True Thickness of Main Bench	Remarks
	Feet	Feet	
P.R. 7	798–816	18	Apparently unparted.
P.R. 8	429–459	21	Apparently unparted.
P.R. 10	96–108	12	Lower 2 feet shaly.
P.R. 11	145–150, 164–180, 191–210	17	Two upper benches shaly; main bench bright.
P.R. 12	470–474, 477–487, 503–529	22	
P.R. 13	593–612	17	1-foot shale parting at 605 feet.
P.R. 14	410–415	5	
P.R. 15	----	----	Not encountered.
P.R. 16	582–607	19	Lower 6 feet consists of 3 feet carbonaceous shale underlain by 3 feet of vitrinite.
P.R. 17	599–600, 608–627	15	Two thin partings in main bench.
P.R. 18	289–324	22	2-foot parting at 293 feet; two thin partings near base.
P.R. 19	568–571, 575–581, 586–602	10	
P.R. 20	192–194, 198–200, 222–246	20	Sandy parting in centre of main bench.
P.R. 21	387–406	19	Sandy parting near top.
P.R. 22	576–588	10	
P.R. 23	96–100, 106–109, 124–142	13	
P.R. 23A	107–114, 124–139	14	Top bench not present in core.

Measured Sections of Coal Seams—*Continued*

Seam 78

Hole No.	Coal Intervals	True Thickness of Main Bench	Remarks
	Feet	Feet	
P.R. 7	762–763	1	Not commercial.
P.R. 8	334–337	2	Not commercial.
P.R. 10	0– 18	12	Thickness approximate; at least three partings.
P.R. 11	....	—	Not encountered.
P.R. 12	402–408, 412–413	4½	
P.R. 13—			
Fault, hangingwall	220–222		
Fault, footwall	480–485	3½	Seam encountered twice.
P.R. 14	362–364	2	Not definitely Seam No. 78.
P.R. 15	365–367, 371–376	4	Lower 1 foot sandy.
P.R. 16	499–511	4	4 feet coal; 3 feet carbonaceous shale; 2 feet coal; 2 feet carbonaceous shale; 1 foot coal.
P.R. 17	535–536	1	Not commercial.
P.R. 18	?	?	Not certainly encountered.
P.R. 19	515–518	3	Not commercial.
P.R. 20	132–138, 143–144	5	
P.R. 21	275–280	4	
P.R. 22	475–486	10	Two partings.
P.R. 23	?	?	Cut in casing.
P.R. 23A	?	?	Cut in casing.

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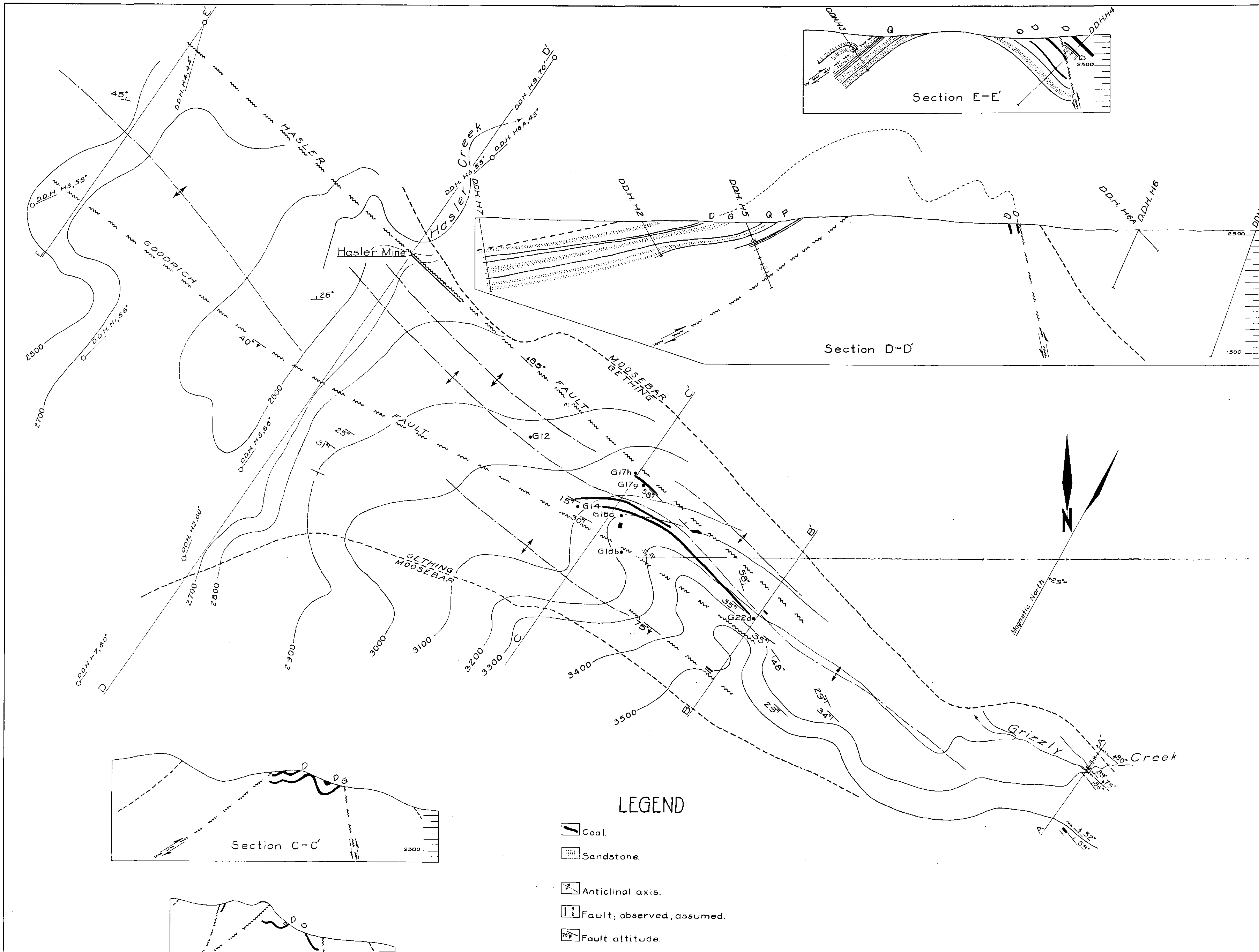


Figure 4

HASLER MINE AREA

To accompany B.C. Department of Mines Bulletin 36
"Coal reserves of the Hasler Creek - Pine River area"
by N.D. McKechnie, 1955.

#36 (1)

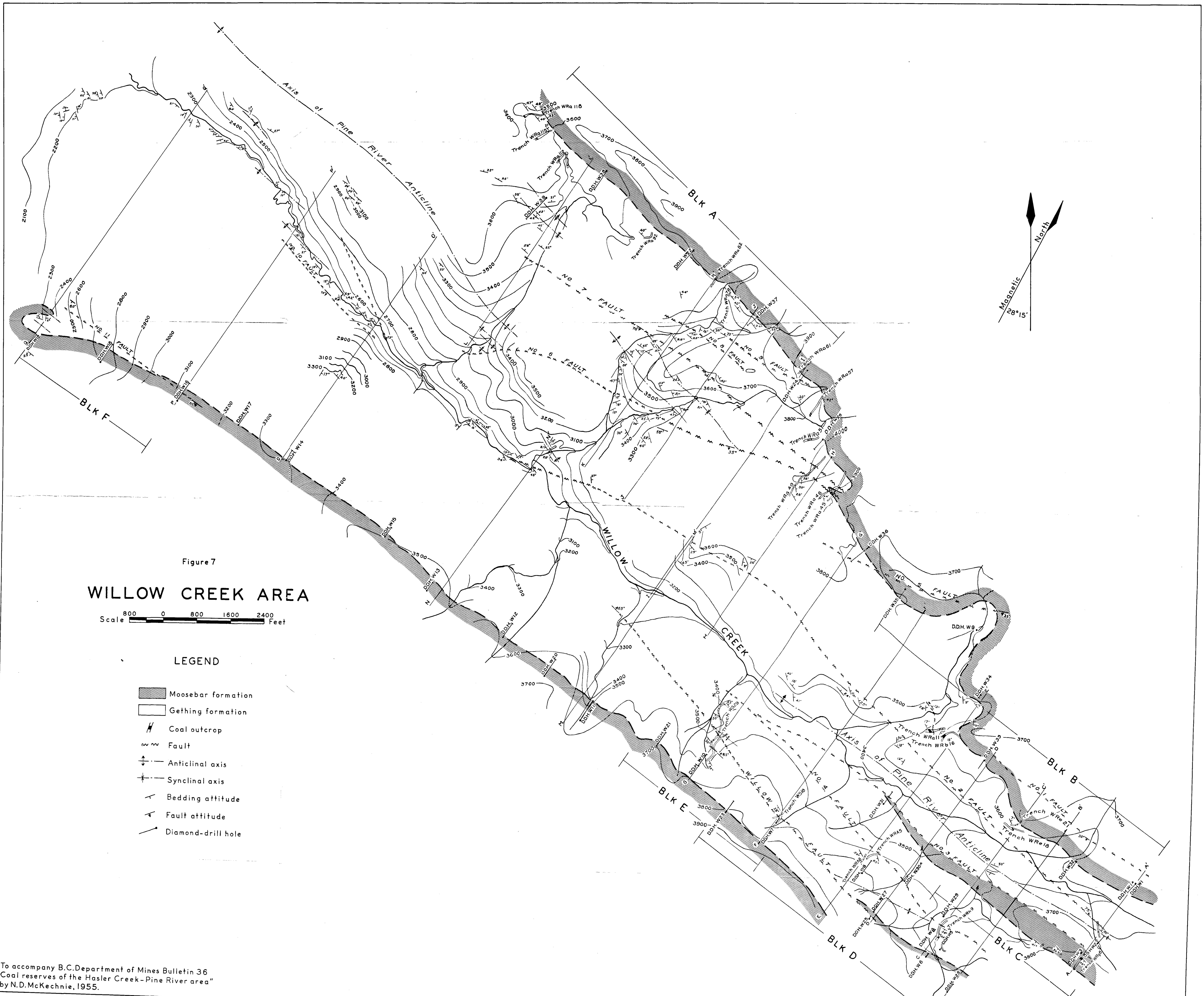
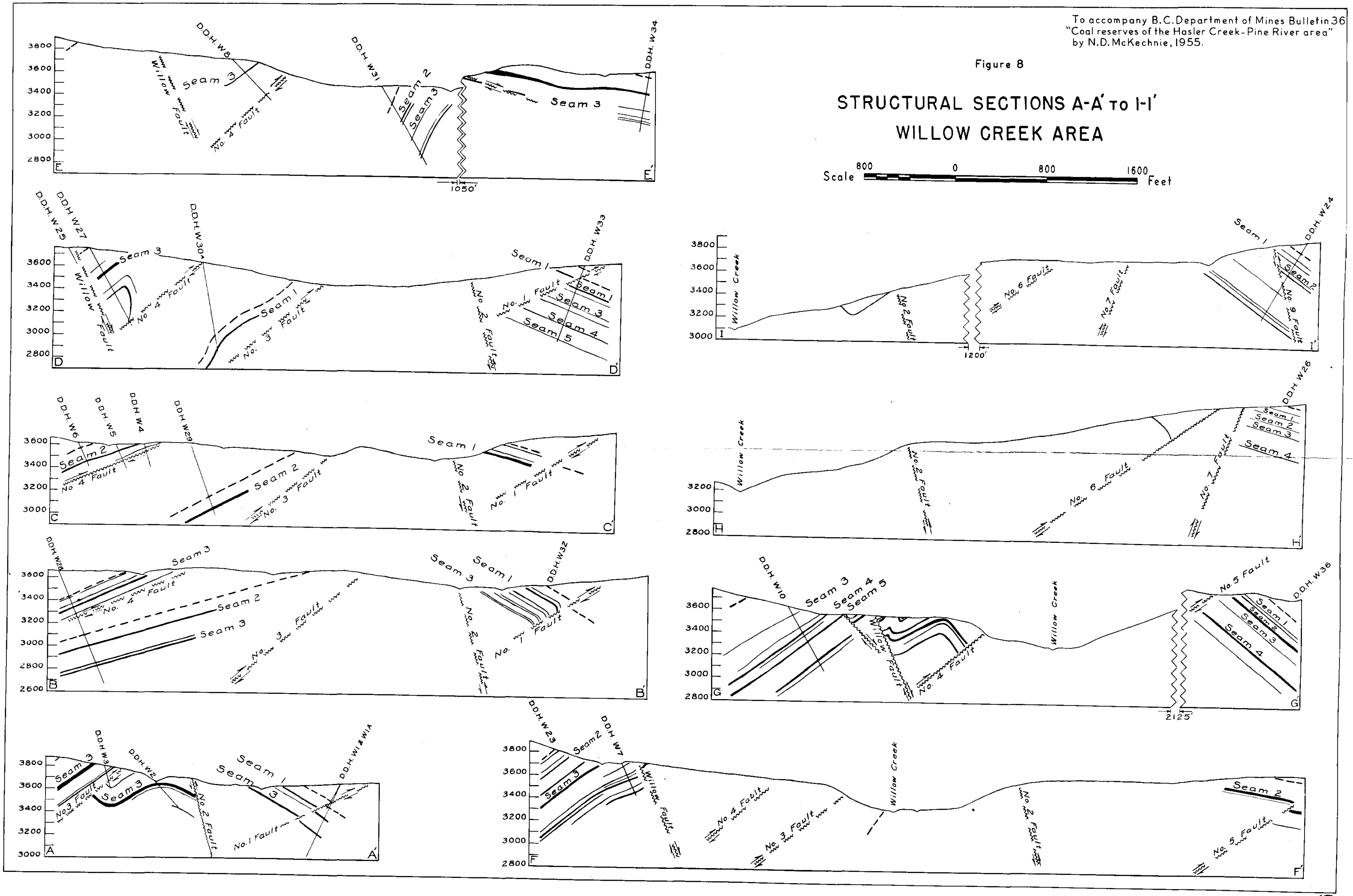


Figure 7

WILLOW CREEK AREA

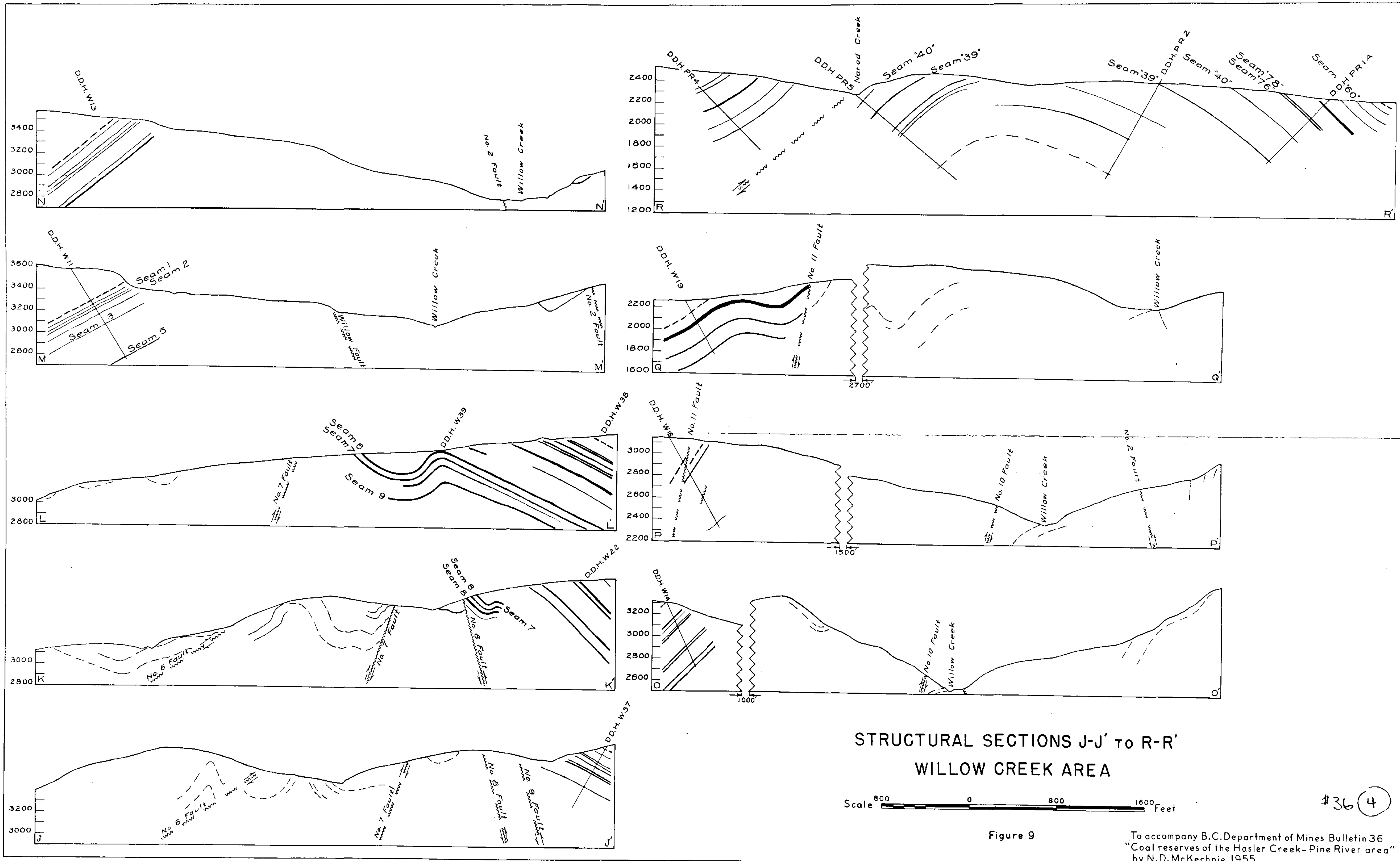


To accompany B.C. Department of Mines Bulletin 36
"Coal reserves of the Hasler Creek-Pine River area"
by N.D. McKechnie, 1955.

Figure 8

STRUCTURAL SECTIONS A-A' TO I-I'
WILLOW CREEK AREA

#36 (3)



STRUCTURAL SECTIONS J-J' TO R-R'
WILLOW CREEK AREA

Scale 800 0 800 1600 Feet

#36 (4)

Figure 9

To accompany B.C. Department of Mines Bulletin 36
"Coal reserves of the Hasler Creek - Pine River area"
by N.D. McKechnie, 1955.