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TG → Willow Cr.

@ 7th Ann. Coal Symposium
Tumbler Ridge
June 10/24

DRAFT NOTES ON THE--

WILLOW CREEK PROPERTY
PINE VALLEY COAL LIMITED
Barry Ryan 6/98

The Willow Creek property is south of Pine River about 45 km west of Chetwynd (Figure 1). The property consists of about 33 licenses in three blocks (Figure 2), Pine Pass, Falling Creek, Crassier and Willow Creek. The main block is along Willow Creek which flows north into the Pine River. The Willow Creek property was explored in the 1970s-1980s as a potential underground coal mine. At the same time the Pine Pass property north of Pine River was explored as a potential open pit mine. Licenses on both properties were dropped in the late 1980s and soon after (1990) key licenses were picked up by Gobaltex. Globaltex formed Falls Mountain Coal Inc. and conducted exploration under this name on the Willow Creek property. In 1996 Falls Mountain Coal Inc. formed a joint venture with Canada and the new company is called Pine Valley Coal limited (PVC). BCR ventures and Mitsui Matsushima financed additional exploration and in 1997 PVC submitted a project proposal to the BC government for a coal mine on the the Willow Creek property. Approval was granted in early 1998 [redacted]. It is planned to mine about 900 000 tonnes/year for 15 years from up to 7 seams in the Gething Formation. The property is close to the BC rail line and the coal will be transported via BC Rail and CN to Ridley Island. The coal will be sold as coking coal, weak coking coal and PCI coal. It is planned to employ between 100 and 120 people during the 15 year life of the mine.

Economic coal in the area is contained in the Lower Cretaceous Gething Formation (Figure 3), which is overlain in sequence by the Bluesky conglomerate, Moosbar marine shales and generally non marine Gates Formation. The Gates Formation does not contain economic coal north of the Sukunka River though non economic coal is found in the older Bickford Formation and the Upper Cretaceous Dunvegan Formation. The Gething Formation is traced from Williston Lake south to the Alberta border near the Kakwa recreational area. It thins progressively to the south and does not contain sufficient reserves for surface mining south of the Sukunka River but individual seams may be thick enough for underground mining.

The top of the Gething is marked by the distinctive Bluesky conglomerate underlain by a coal seam or carbonaceous zone called the Bird Seam, which is often pyrite rich. The formation is approximately 500 metres thick and coal seams are located through out it, though on the Willow Creek property economic seams are found only in the Upper Gething (130-150 metres thick) and the Middle Gething (120 to 140 metres thick). At least 10 potentially mineable seams, numbered from 1 at the top of the section, are identified in the Upper and Middle Gething (Figure 4). Seam correlation is difficult because seams are folded and faulted and also split and change thickness over the property.

The area is folded with open to tight chevron style folds trending northwest to southeast. West limbs are steep dipping and east limbs moderately dipping. East dipping thrusts and reverse faults displace the coal seams The Willow creek reserves are located on the east flank and hinge area of the major Pine River anticline associated with a number of smaller anticlines (Figure 5,6).

Summary coal quality for the seams is included in Table 1. The bird zone, which develops into a 2 metre clean seam in the south of the property is not considered for mining because of its high pyrite content and it is not included in the seam numbering system. The rank of the seams varies from medium-volatile to low-volatile. All seams generally wash to a low ash with good yields. The spread in FSI values for some seams indicates moderate and variable inertinite contents (Figure 7) similar to those that have been recognized in Gething seams else where in the Peace River coalfield. The lower seams are not coking on their own though they could be part of a metallurgical coal blend. The upper seams are metallurgical coal but have moderate to poor rheology similar to coals low in the Mist Mountain section.

A lot of proximate data are available from previous exploration (David Minerals, 1982) and it is possible to construct a number of plots for each seam (Figure 8). The rank of the seams varies from about 1.25 percent to 1.75 percent and combining these data with VM dmmf data provides estimates of the relative concentration of inertinite in the seams (Figure 9). The vertical distance that data plot below the Rmmax percent *versus* VM daf line in Figure 9 is proportional to the relative enrichment in inertinite in the samples and relative amounts can be estimated using the VM dmmf *versus* inertinite relationships.

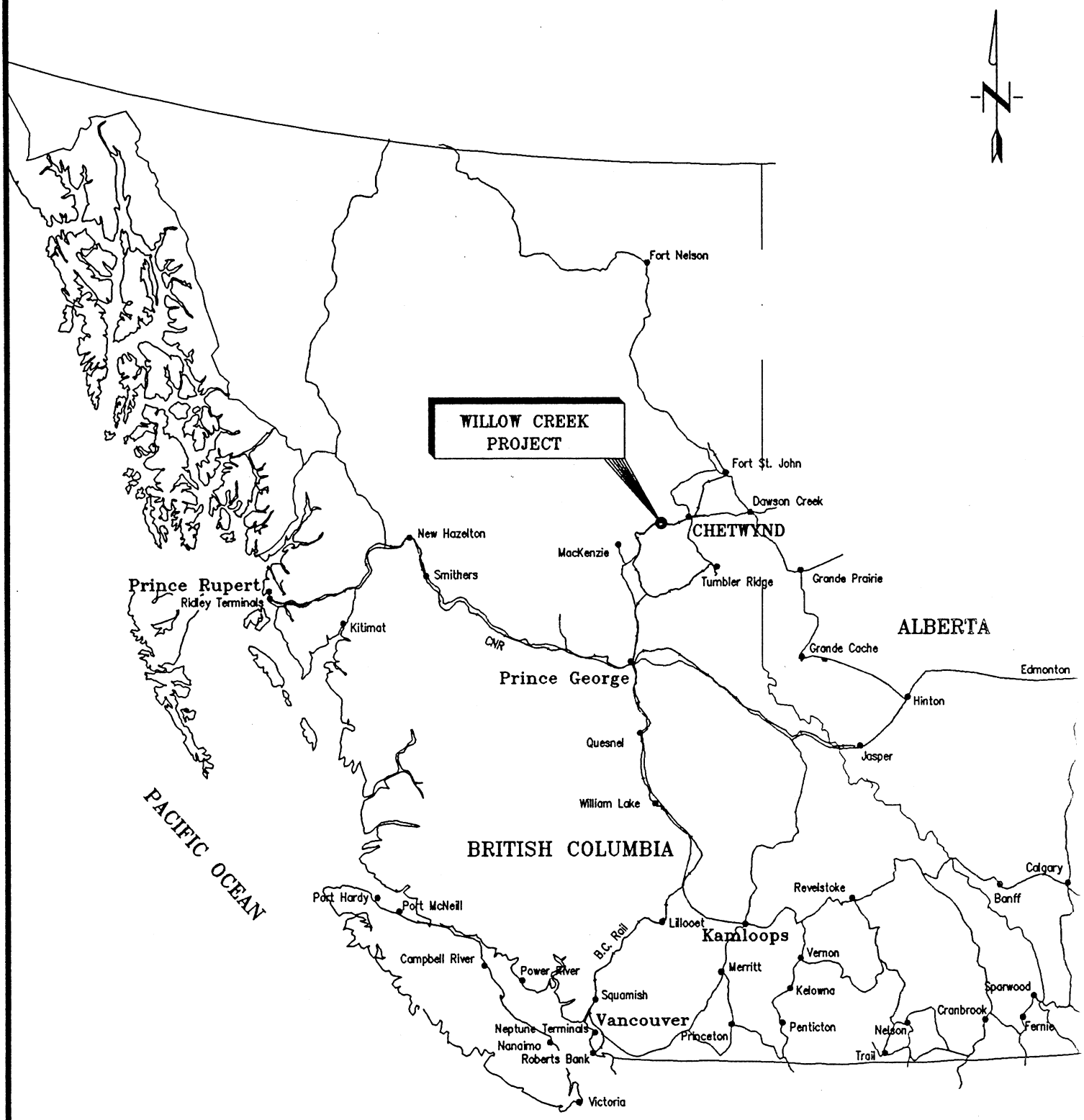
Relative estimates of the inert maceral content for the Willow Creek seams agree with the general distribution of FSI values for the seams (Figure 8) and it appears that seams 3, 5, 6 and 7 are enriched in inertinite.

Data in ash *versus* FSI plots (Figure 8) are posted with different symbols depending on whether the VM dmmf values are above (star) or below (diamond) average. The plots indicate that most of the variation in FSI is caused by variation in inertinite content and not the result of oxidation.

The base-acid ratios of seams are estimated using data from VM daf plots and CV values at zero ash (Figure 10). It appears that seams 1 to 4 in the upper part of the section have higher base-acid ratios than seams 5 to 7 in the lower part of the section. The upper seams have coking potential, therefore it is be important to determine the base-acid ratios because of their effect on coke strength after reaction (CSR) (Ryan and Price, 1993). Higher base-acid ratios lower CSR

At the moment a 15 year 900 000 tonne per year operation is proposed with 15.6 million tonnes of raw coal identified. The insitu strip ratio is 3.76/1 and the plant yield is estimated to average about 81% for metallurgical coal and 85% for thermal coal. Summary reserve data (Table 2) indicate that seams 1, 4, A, 6, and 7 provide most of the coal. The reserves will be mined from 7 small pits and are split into 7.5 million tonnes metallurgical and 8.1 million tonnes weak coking coal PCI or thermal coal. The PCI or thermal coal will be characterized by high rank, high heat value and low ash. The metallurgical coal will be medium-volatile low ash moderate rheology with moderate to low phosphorus and sulphur concentrations. Potential coke quality is not known.

The Willow Creek project is a viable small coal mine. Operating costs will be low because of low strip ratios and location close to the existing BC Rail line. There is potential to extend mine life and annual production, though at the moment the proven reserve base is small. Coal quality is variable, which will make for challenges in terms of blending at the mine site and marketing the coal.



LEGEND

Roads

Railway

100 km 0 100 200 300 400 km

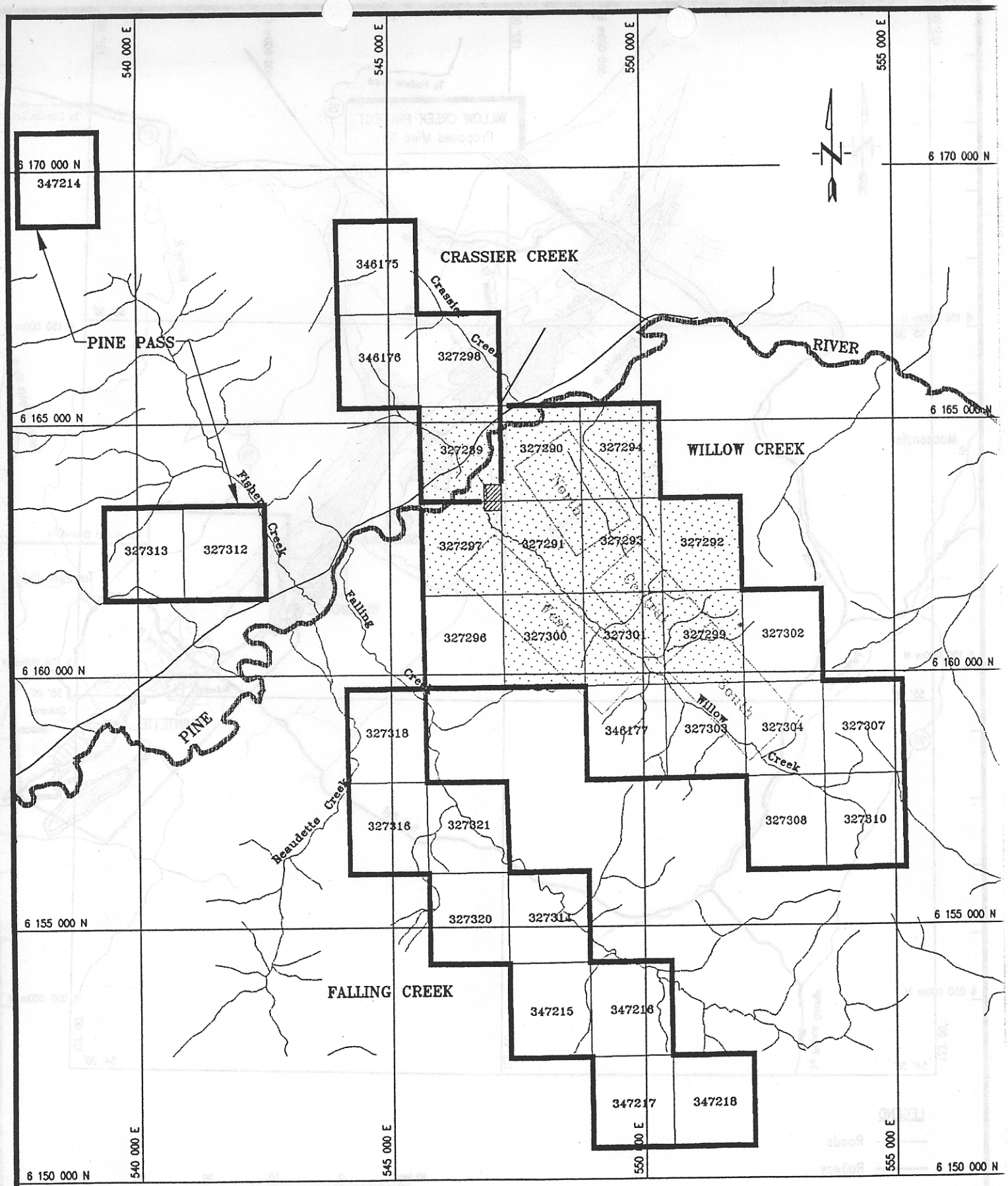
Scale

PINE VALLEY COAL LTD.

WILLOW CREEK PROJECT

LOCATION MAP

FIGURE 1



LEGEND

- 347215 — COAL LICENSES
- PLANT SITE AREA LICENSE OF OCCUPATION
- CONVERT COAL LICENSES TO COAL LEASE
- North — RESERVE AREAS

1000 m 0 1000 2000 3000 4000 m

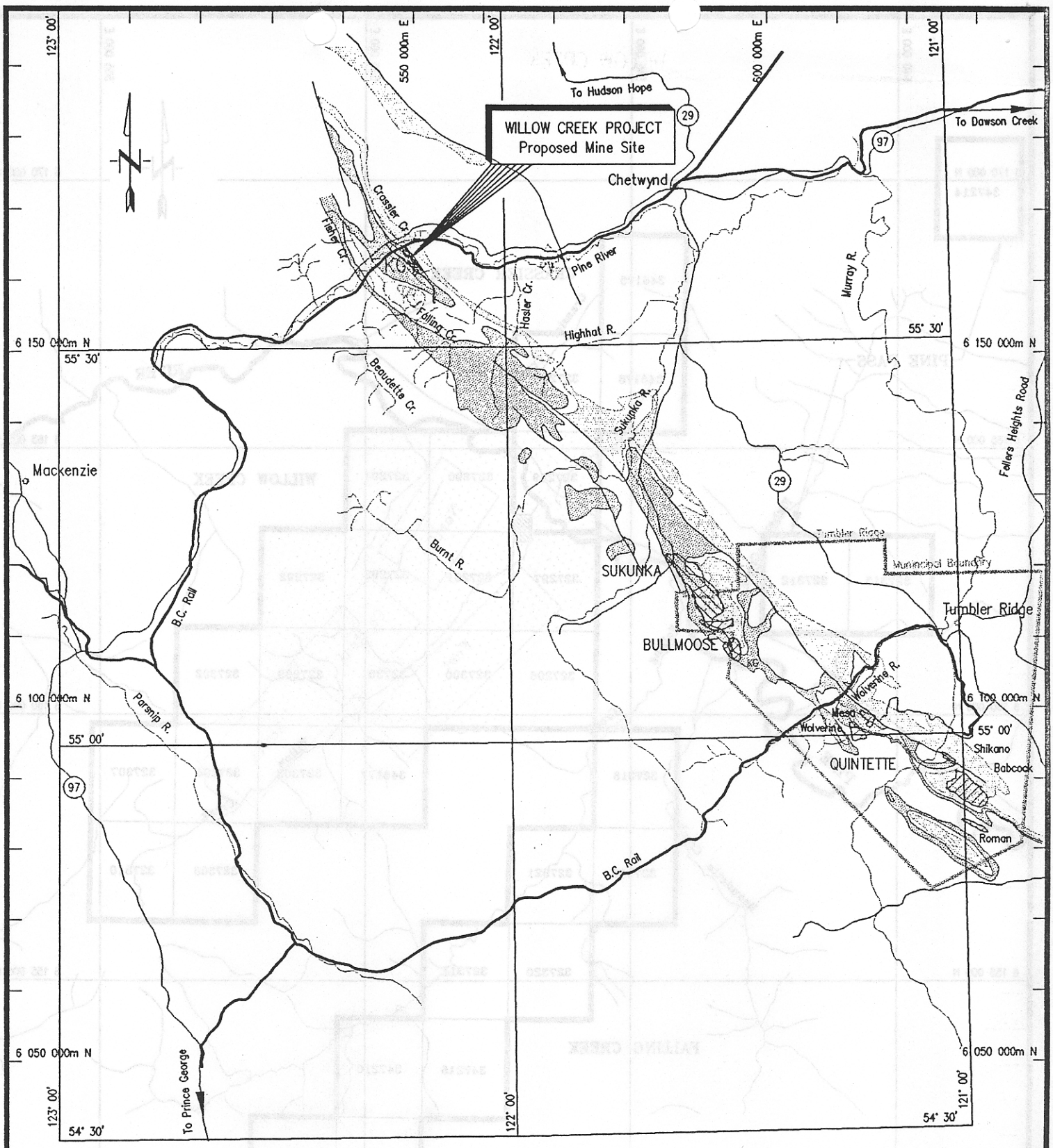
SCALE

PINE VALLEY COAL LTD.

WILLOW CREEK PROJECT

COAL LICENSES

FIG. 2



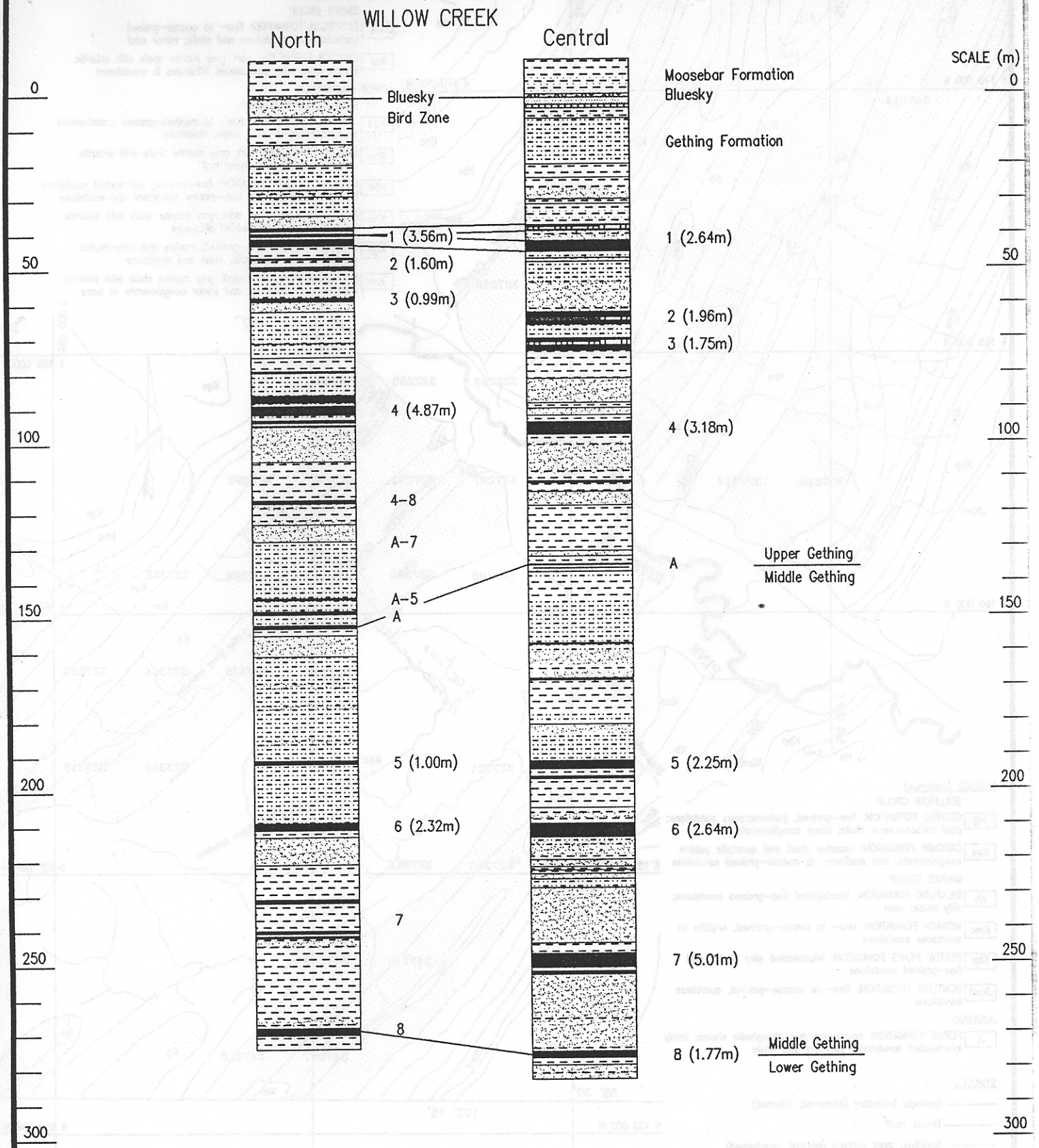
PINE VALLEY COAL LTD.

WILLOW CREEK PROJECT

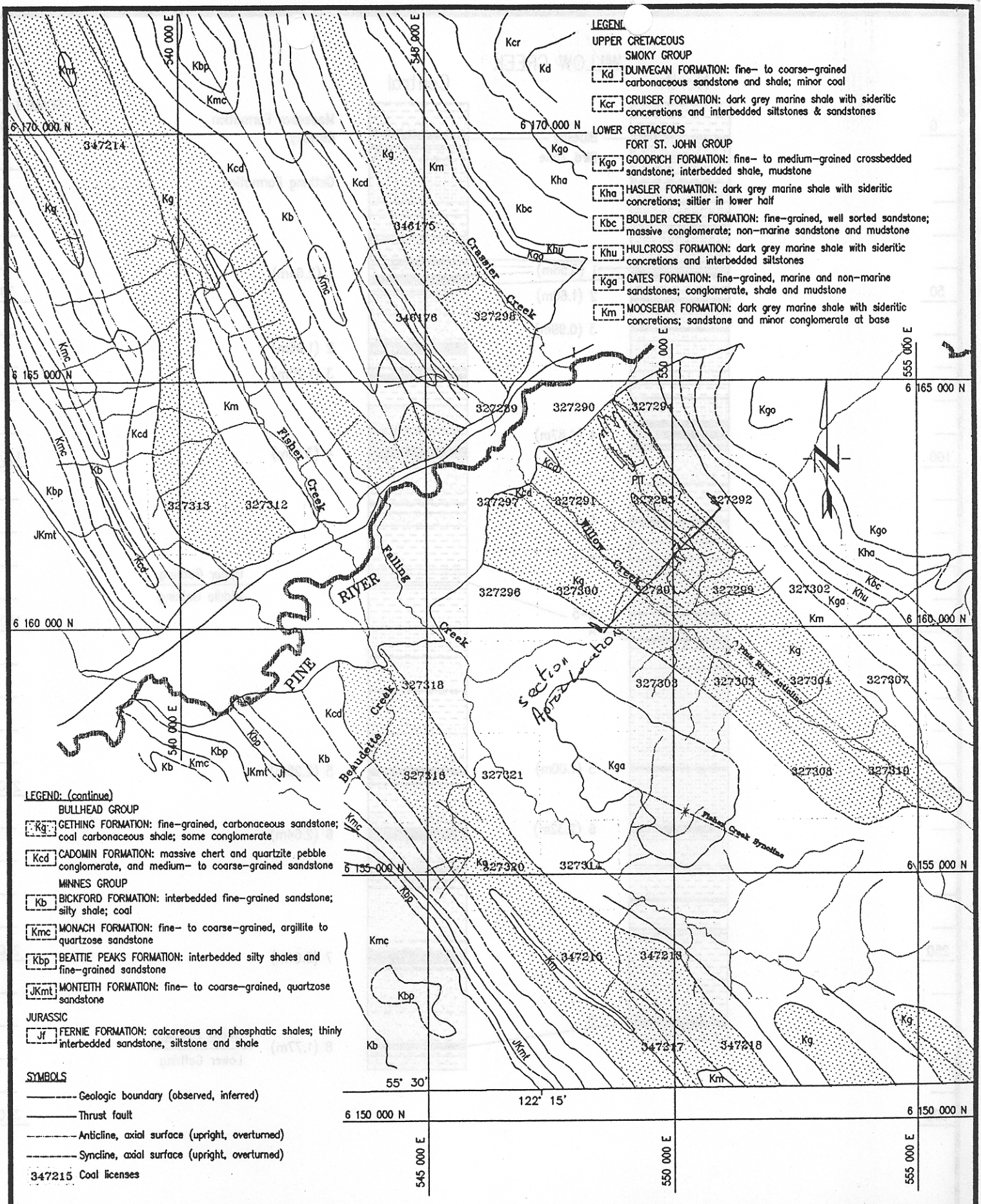
PEACE RIVER COAL FIELDS

DATE : AUG 31, 1997.

FIGURE 3



PINE VALLEY COAL LTD.
WILLOW CREEK PROJECT
GENERAL STRATIGRAPHY
FIGURE 4



PINE VALLEY COAL LTD.

WILLOW CREEK PROJECT

PROJECT AREA GEOLOGY

FIGURE 5

FIGURE 6

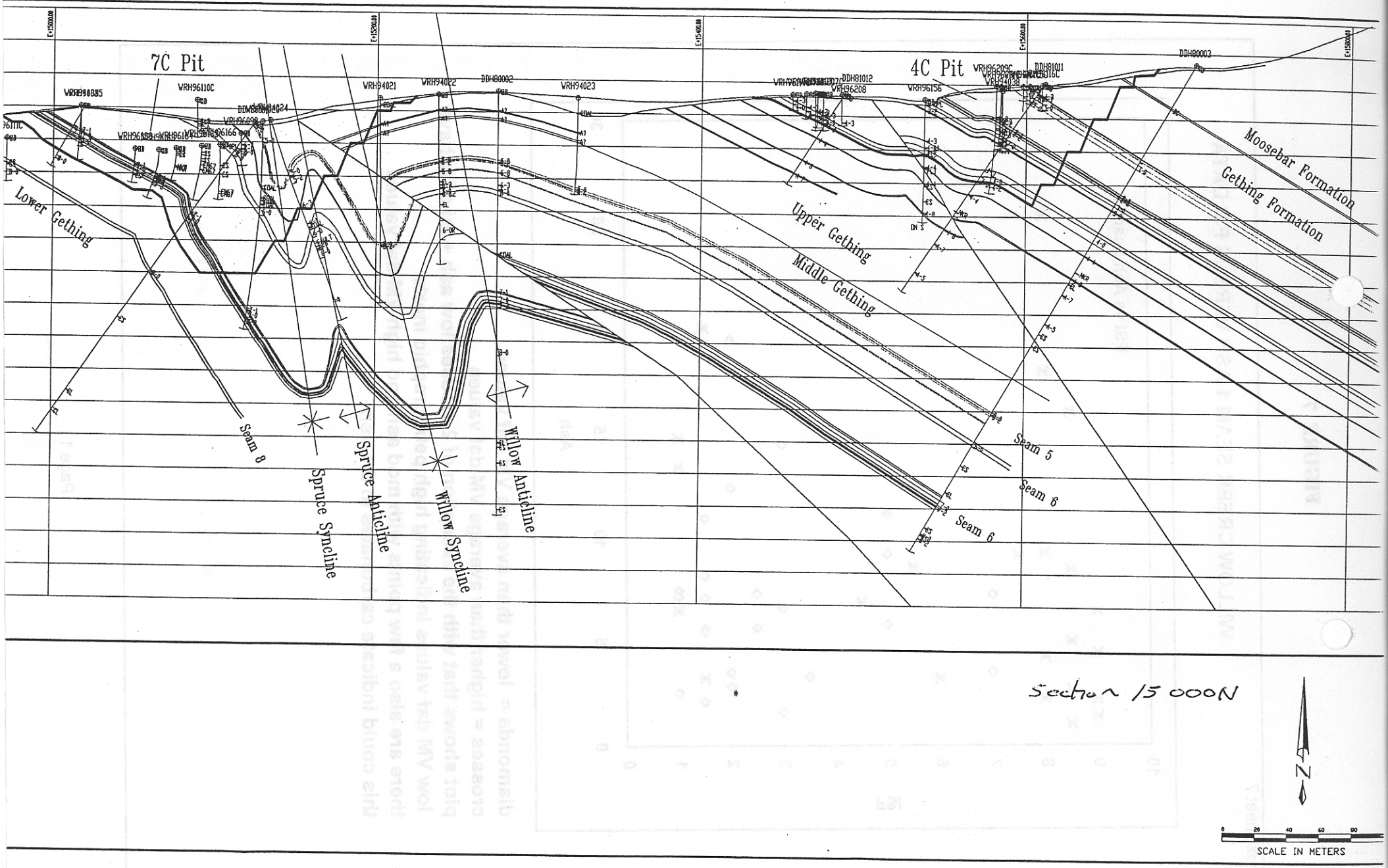
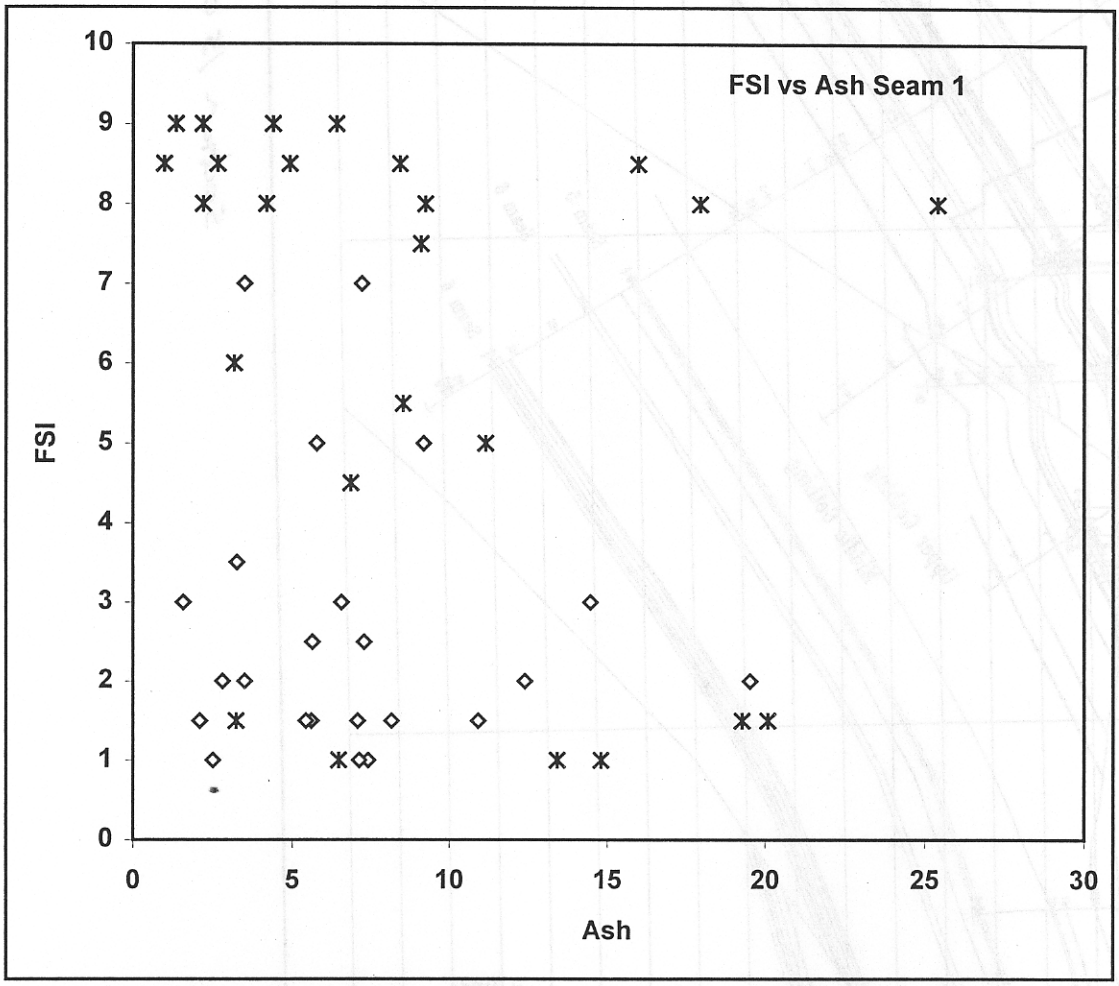

7C Pit
4C Pit
WRH96110C
WRH94021
WRH94022
DDH80002
WRH94023
DDH80003
DDH81012
WRH96208
WRH96156
Lower Gething
Upper Gething
Middle Gething
Gething Formation
Moosebar Formation
Seam 8
Seam 5
Seam 6
Seam 6
Spruce Syncline
Spruce Anticline
Willow Syncline
Willow Anticline
Section 15 000N
N
0 20 40 60 80
SCALE IN METERS

FIGURE 7

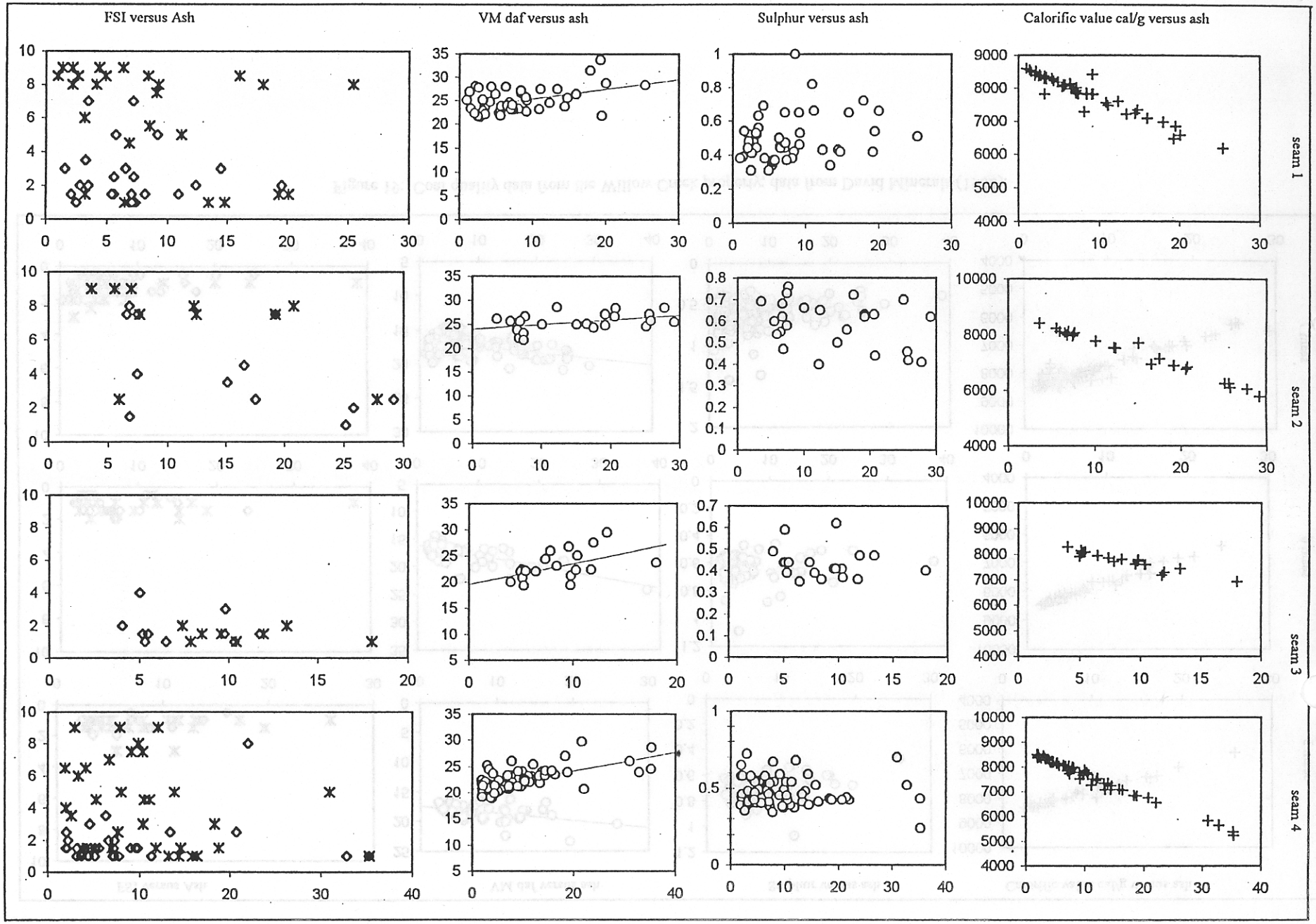
wilprox sheet 7

WILLOW CREEK SEAM 1 ASH VERSUS FSI DATA



diamonds = lower than average VM daf values
crosses = higher than average VM daf values
plot shows that with the exception of 2 crosses low ash + fsi data have low VM daf values indicating high petrographic inerts
there are also a few points with mod ash and high VM daf values
this could indicate carbonates in the ash

FIGURE 8


FSI versus Ash
VM daf versus ash
Sulphur versus ash
Calorific value cal/g versus ash
seam 1
seam 2
seam 3
seam 4

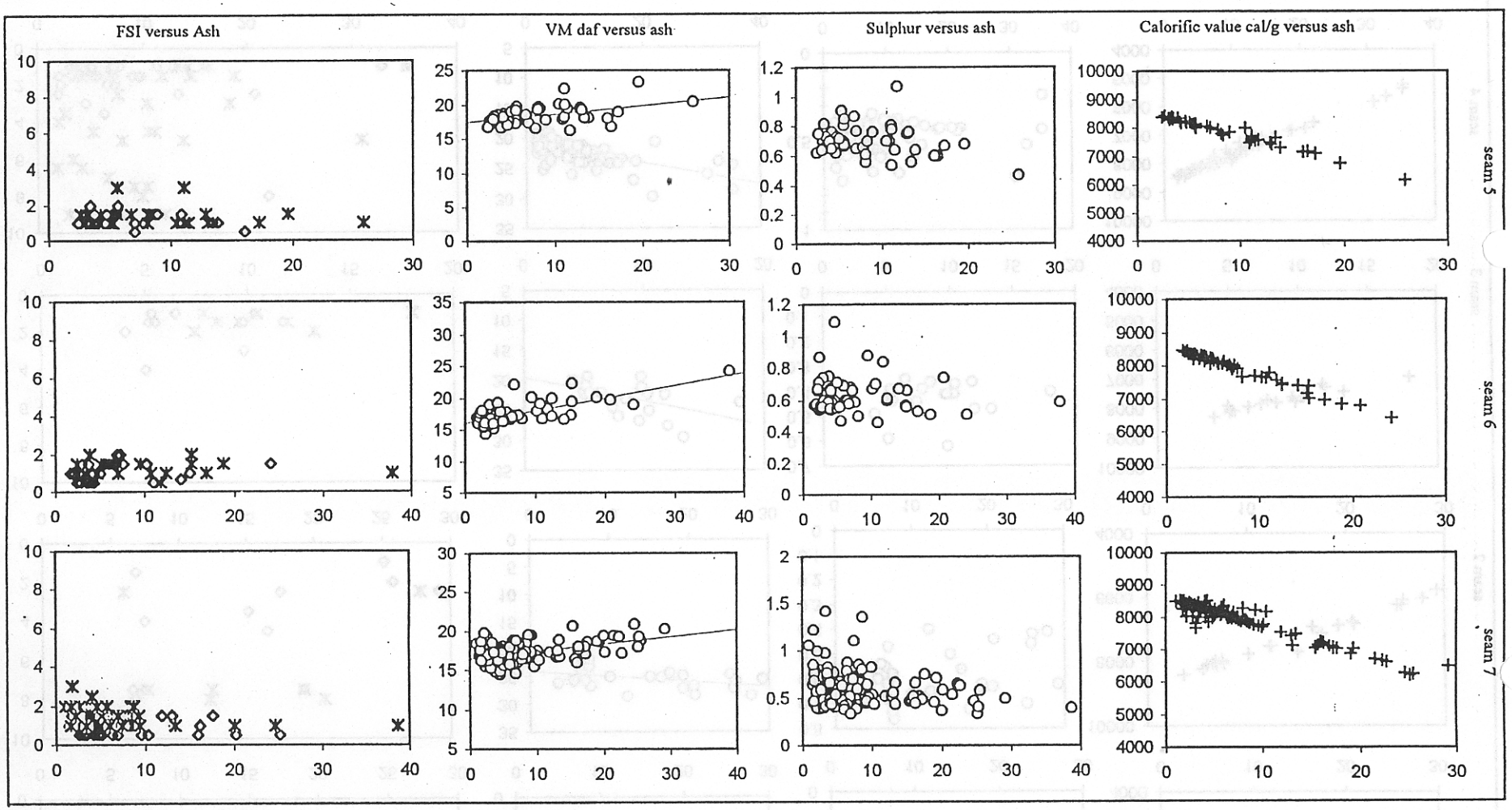
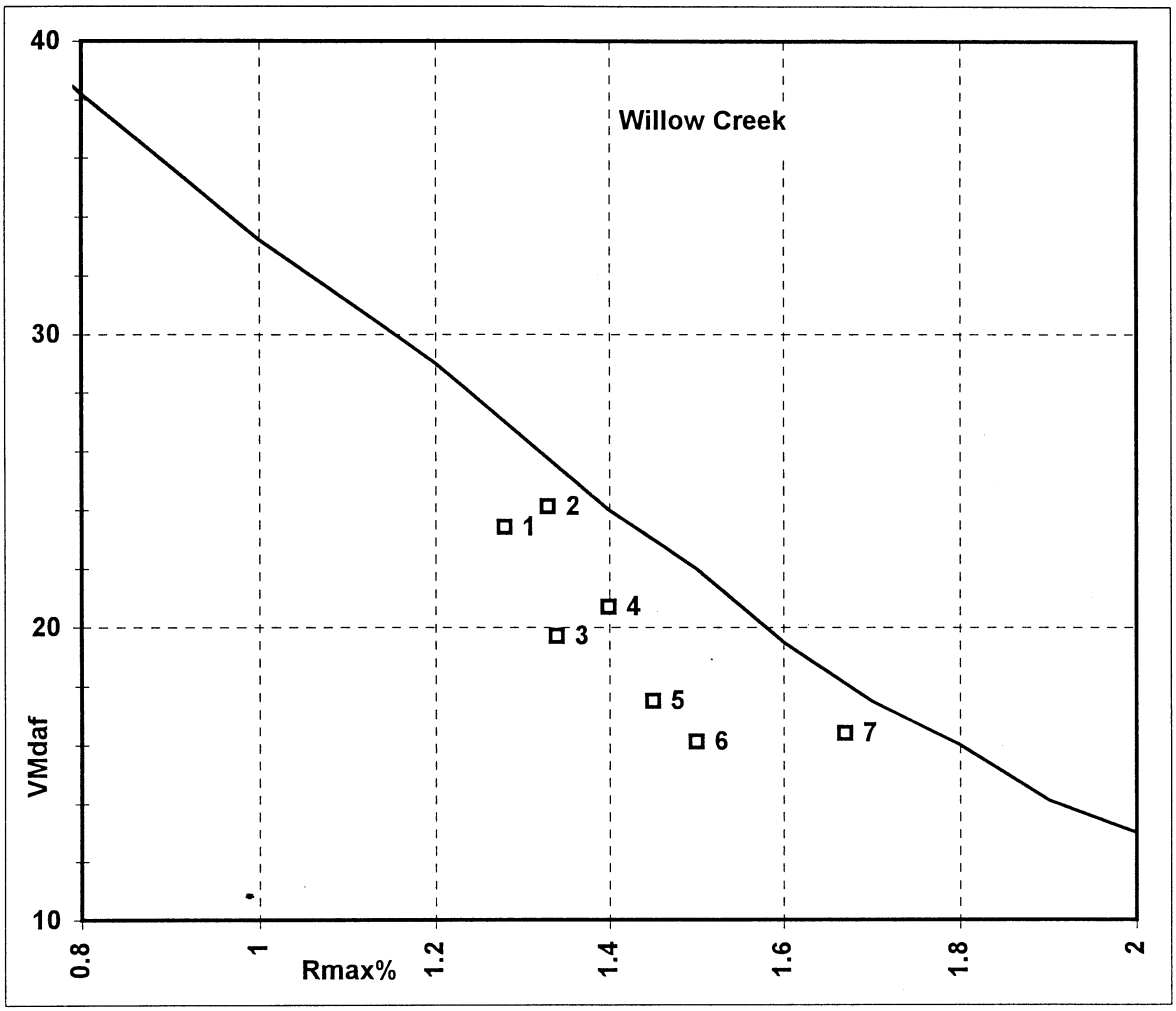


Figure 19: Coal quality data from the Willow Creek property; data from David Minerals (1982).

reflectance versus vm daf from stach astm
file astmwil.xls

FIGURE 9

WILLOW CREEK VM dmmf VERSUS ASTM PREDICTED RANK



All Willow Creek data appears to be high in inerts seams 3,5 and 6 are the highest

Based on petrographic data from Falling Creek a 1% drop in VM daf corresponsds to a 10% decrease in reactive macerals
If the relationship in Stach (1982) is based on a 90% reactive samples then the relative petrography of samples can be estimated

curve based on 90 % reactives

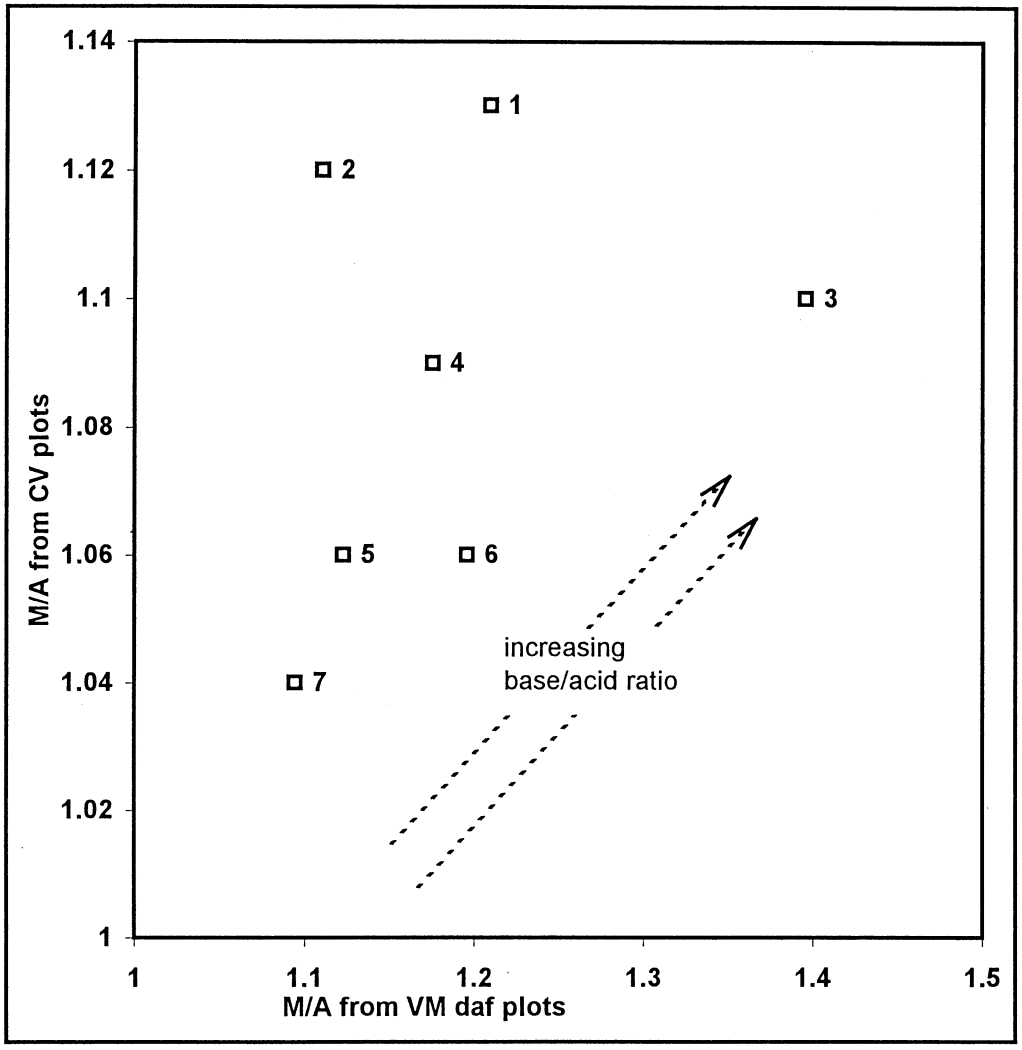
seam	Rmax	M daf	delta	CV daf
1	1.28	23.4	-2	8637
2	1.33	24.1	-1	8753
3	1.34	19.7	-3	8549
4	1.4	20.7	-2	8624
5	1.45	17.5	-6	8642
6	1.5	16.1	-5	8606
7	1.67	16.4	-1	8589

ASTM values

Rmax%	M daf
0.3	60
0.4	51
0.5	46.5
0.6	44.2
0.7	40.9
0.8	38.2
1	33.2
1.2	29
1.3	26.5
1.4	24
1.5	22
1.6	19.5
1.7	17.5
1.8	16
1.9	14.1
2	13

Willow Creek CV *versus* ash and VM daf *versus* ash data

FIGURE 10



M/A (mineral matter/ash ratio) can be calculated from VM daf versus ash plots and CV versus ash plots

seam	M/A (VM)	M/A (CV)
1	1.21	1.13
2	1.11	1.12
3	1.396	1.1
4	1.175	1.09
5	1.122	1.06
6	1.196	1.06
7	1.094	1.04

IF BOTH VALUES ARE HIGH THEN THE BASE/ACID IS PROBABLY ALSO HIGH

TABLE 1

SUMMARY QUALITY WILLOW CREEK PROPERTY

seam	metres from Moosbar	thickness north	thickness central	raw ash%	VM%	CV cals/g	Megajoules/kg	Sulphur	FSI raw data	Rmax%
1	40	3.56	2.64	7.9	23.5	7870	32.95	0.5	4.5	1.28
2	55	1.6	1.96	14.5	23	7734	32.38	0.59	6	1.33
3	70	1	1.75	8.7	21.1	7729	32.36	0.43	2	1.34
4	100	4.87	3.18	10.1	20	7688	32.19	0.48	3	1.4
A	140	?	?	?	?	?	?	?	?	1.49
5	190	1	2.25	8.3	16.9	7898	33.07	0.7	1	?
6	210	2.32	2.64	7.3	16.3	7957	33.31	0.62	1	?
7	250	?	5.01	8	16.1	7897	33.06	0.65	1.5	1.67
8	280	?	1.77	?	?	?	?	?	?	?
9	?	?	?	?	?	?	?	?	?	?

TABLE 2

RESERVES WILLOW CREEK

seam	met coal yield	met coal tonnes	thermal coal yield	thermal coal tonnes	total recoverable	total clean
1	80.8	1.35	85	0.155	1.505	1.22
2	80.8	0.703	85	0.078	0.781	0.63
3	80.8	0.519	85	0.056	0.575	0.47
4	80.8	2.579	85	0.158	2.737	2.22
A	67.3	2.36	85	0.145	2.505	1.71
5	80.8	0	85	0.449	0.449	0.38
6	80.8	0	85	1.225	1.225	1.04
7	80.8	0	85	5.619	5.619	4.78
8	80.8	0	85	0.253	0.253	0.22
total		7.511		8.138	15.649	12.67
raw coal strip ratio 3.78			clean coal strip ratio 4.64			