Coalspur Mines Limited

Vista Coal Project, Alberta Canada

Project No. 04372

NI43-101 Independent Technical Report

Effective Date: 28 March 2014

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IMPORTANT NOTICE

This report was prepared as a National Instrument 43-101 Technical Report, in accordance with Form 43-101 F1, for Coalspur Mines Limited by Snowden. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Snowden's services, based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended to be used Coalspur Mines Limited, subject to the terms and conditions of its contract with Snowden. That contract permits Coalspur Mines Limited to file this report as a Technical Report with Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities law, any other use of this report by any third party is at that party's sole risk.

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1 Summary

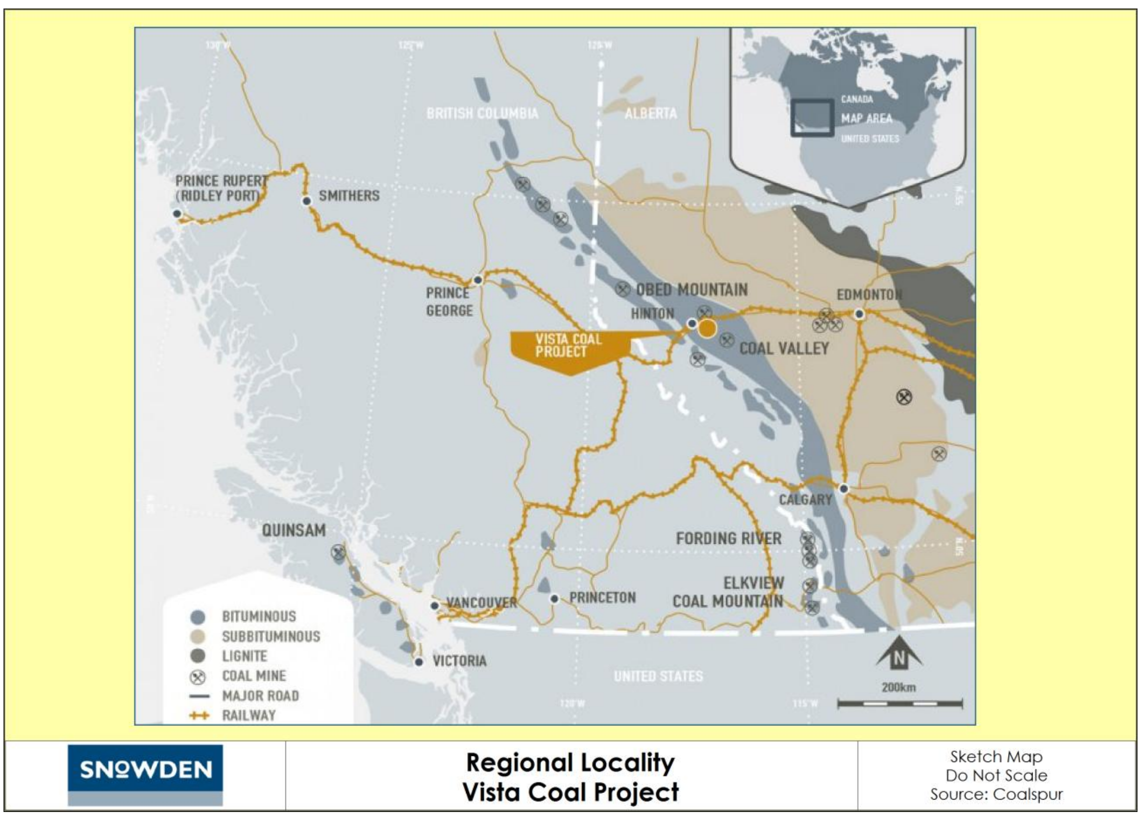
This Independent Technical Report ("ITR"), prepared by Snowden Mining Industry Consultants Inc. ("Snowden"), describes the Vista Coal Project (the "Project", "Vista"), a mineral exploration, development area located east of Hinton, in the Province of Alberta, Canada. The Vista Coal Project is owned by Coalspur Mines Limited ("Coalspur").

Coalspur retained Snowden to update the technical report entitled "Coalspur Mines: Updated Resource Estimate for the Vista Coal Project" dated September 12, 2012, to include previously announced revised capital expenditure estimates for the Vista Coal Project.

1.1 General

The Vista Coal Project is situated immediately east of Hinton in Alberta, Canada (Figure 1.1). The Vista Coal Project is targeting a gently dipping series of sub-cropping coal measures along a strike length of approximately 20 km at low strip ratio. Coalspur acquired the Vista property in several stages through the acquisition of various contiguous leases: Hinton West and Hinton East from Consolidated Tanager Limited in early 2009; Z Block and the McLeod River North blocks from Mancal Coal Inc. in June 2010. The consolidated leases are presented in Figure 1.2.

Figure 1.1 Vista Coal Project Locality Map



The coal bearing strata within the project area form part of the upper Saunders Group from the Coalspur Formation. There are three principal seams of economic interest: the Val d'Or; the McLeod; and the McPherson seams. Several minor seams are also known to occur below the McPherson seams but these are limited in extent and do not contribute materially to the overall Coal Resource estimates.

The coal is a moderate rank high volatile bituminous coal (ASTM Classification) suited to steam raising. Two products are contemplated: a premium product targeting a calorific value of 5,800 kcal/kg on a gross as received ("GAR") basis; and a secondary product targeting 5,550 kcal/kg GAR.

1.2 Location and Access

The project is located east of Hinton in Alberta, Canada, approximately 280 km west of Edmonton. The Vista Coal Project is directly accessible from Hinton via the McPherson Creek logging road (owned and maintained by West Fraser Mills Limited).

1.3 Geology, Structure and Hydrogeology

Coal associated with the Vista Coal Project occurs along the eastern margin of the Rocky Mountain Foothills Disturbed Belt. The most prominent structural feature is the Pedley Fault which trends northwest-southeast along the southwestern boundary of the Vista lease and separates the faulted, steeply dipping strata in the west from the gently dipping, monoclinal strata that underlie the Vista Coal Project.

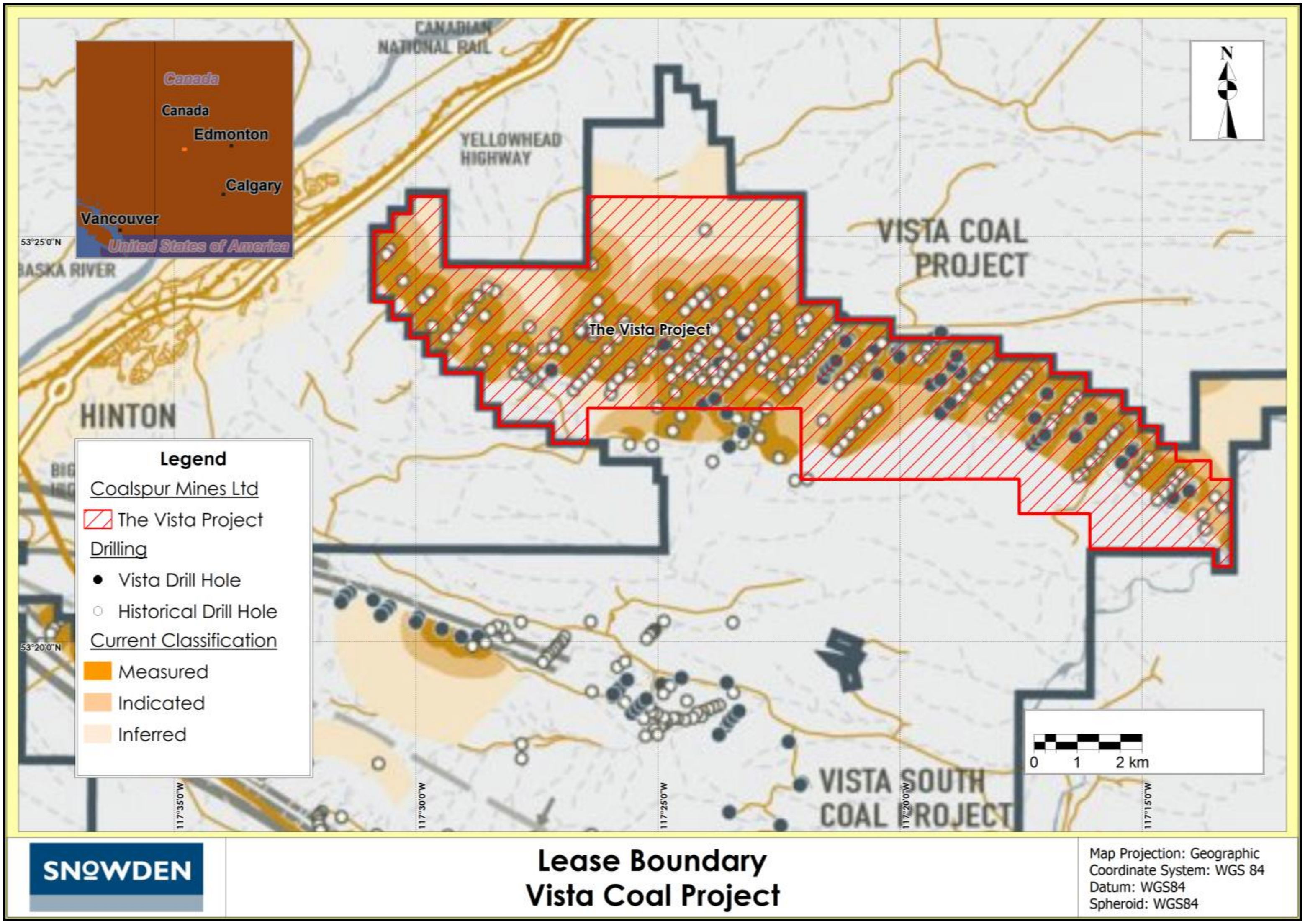
Four stratigraphically continuous and laterally persistent, sub-cropping coal zones have been intersected on the property along a 22 km strike length from the Athabasca Valley (NW) to the McLeod River (SE). The coal zones are named in descending order as the Val d'Or, McLeod, McPherson and Silkstone Zones. Each zone consists of multiple coal plies separated by clastic parting material of variable thickness. The aggregate total coal thickness of the combined zones averages approximately 28 m over some 200 m of vertical stratigraphic interval.

The structural style is a simple monocline trending 300° and dipping gently at 6° northeast at the northern boundary of the property to maximum of 15° at the southern boundary on the McLeod River.

The property is overlain entirely by a mantle of glacial till and alluvium which varies from 5 m to 30 m in thickness. Consequently, all stratigraphic and structural conclusions are based entirely on drillhole data modelling and interpretations.

Investigations indicate that near-surface groundwater flow follows ground surface topography in a south to southeasterly direction towards McPherson Creek. The water table is generally about 5 m below surface except at elevated areas in the northwest and in the southeast areas of the McLeod River Block where the groundwater table is interpreted much deeper at about 12 m to 17 m below the surface.

Figure 1.2 Vista Coal Project Lease Boundaries (from Coalspur)



1.4 Adjacent Properties

Sherritt International Ltd ("Sherritt") owns and operates the nearby Coal Valley mine (located to the south of the Vista Coal Project), which produces export thermal coal from the Coalspur Formation.

Sherritt also owns the Obed Mountain Mine (currently inactive) 25 km northeast of the Vista Coal Project. The coal at Obed Mountain Mine occurs in the Paskapoo Formation, which is of lower rank and is stratigraphically above the Coalspur Formation.

Sherritt has announced in December 2013 that Westmoreland Coal Company ("Westmoreland") will acquire Sherritt's operating coal assets. Sherritt will continue to work with Westmoreland on the Obed Mountain Mine remediation plan, and will continue to meet all financial obligations resulting from the October Obed Mountain Mine containment pond breach.

1.5 Status of Exploration and Drilling

The most recent exploration drilling was undertaken by Coalspur and was completed in 2011. The drilling was primarily aimed at verifying previous exploration drilling results and this has been successful. A certain amount of in-fill drilling has also been completed by Coalspur.

Currently there is no exploration underway at the Vista Coal Project.

1.6 Coal Resource Estimates

Coal Resources have been estimated from geological models constructed using the exploration drill hole data. Several iterations of the models using various software systems and methodologies have been undertaken recently.

As part of the Vista Coal Project Feasibility Study, Snowden reported in its ITR, dated 26 January 2012, Coal Resources for the Vista Coal Project and these estimates are reproduced in Table 1.1.

Table 1.1 Coal Resource Estimates for the Vista Coal Project (Snowden, 2012)[1]

Description	Measured (Mt)	Indicated (Mt)	Measured + Indicated (Mt)	Inferred (Mt)
In Situ Coal Resources	688.0	342.9	**1,030.9**	290.7

[1] *Coal Resources are inclusive of Coal Reserves*

1.7 Feasibility Study Mine Design

The coal seams on the Vista property are exploitable by modern open pit methods. The mine plan contemplates an initial phase of waste movement through truck and shovel mining using a prime contractor for all activity. The mine plan maintains an option to introduce dragline methodology employing two large draglines with an associated dozer and truck-shovel fleet of equipment. The excavated slopes will be double benched with a 65° inter-bench slope angle. All rock zones will be drilled and blasted and the coal will be free dug with hydraulic excavators and loaded into trucks for transport to a double rolls crusher and subsequent conveying to the preparation plant.

The current mine plans have been produced for the mine to be primarily viewed as a dragline operation in the long term, with dozer push and truck/shovel assist for upper seam waste material. To enable the option to adopt a dragline mining method the long term plans have been geared to strip mining methodology which also provides flexibility to be carried out by a range of mining equipment and mining method.

Snowden understands that Coalspur has optimisation studies into terrace mining underway. These studies include ongoing investigations into extended or broader contract mining possibilities. Snowden believes that such scenarios do not pose any particular material risks to the economic results or the feasibility of the project.

The minimum mineable thickness assumed is 0.50 m and the minimum separable parting thickness is 0.30 m. A detailed evaluation of seam and waste plies was undertaken but generally a 15 cm loss of coal at the seam roof contact was assumed along with 15 cm out-of-seam-dilution at the seam floor. Partings, or interburden, less than 1.5 m will be ripped by dozers while partings greater than 1.5 m will be blasted.

1.8 Coal Reserve Estimates

The Coal Reserve estimates are based on the Coal Resources after waste dilution and coal recovery criteria are applied at every coal:waste interface. The reserves are then those coal resources which have been conditioned and are contained within a pit outline and production forecast which is demonstrated to yield both a technically and economically feasible design. The coal reserves are shown in Table 1.2.

Table 1.2 Coal Reserve Estimates for the Vista Coal Project (Snowden, 2012)

Coal Seam	Recoverable Coal Reserves			Marketable Coal Reserves		
	Proven (Mt)	Probable (Mt)	Total (Mt)	Proven (Mt)	Probable (Mt)	Total (Mt)
Val d'Or and McPherson	429.3	45.9	475.2	248.5	26.5	275.0
McLeod	74.4	16.0	90.4	31.5	6.9	38.4
Total	503.7	61.9	565.6	280.0	33.4	313.4

1.9 Coal Quality, Preparation Plant Design and Product Shipping

The coal preparation plant ("CPP") was designed based on pilot plant test results and using a coal quality database consisting of:

- *ca.* 1,200 proximate sample results across the full geographic extent of the project,
- detailed washability test results including yield, ash and calorific value by density on approximately 300 working sections,
- detailed clean coal analysis on some 200 working section simulated product samples,
- *ca.* 200 attrition tests (drop shatter and wet tumble) on both coal and stone samples to support CPP design studies.

The CPP yields anticipated in meeting the average gross calorific value ranges targeted from the deposit (5,550 kcal/kg to 5,800 kcal/kg) are expected to range from slightly more than 50% to slightly less than 60%. The material less than 0.2 mm will be discarded and sent to the fine rejects settlement facilities. The design includes two separate settlement ponds which will together provide sufficient storage for the life of the mine.

The marketable export products will be transported by rail to the 24 Mtpa[2] Ridley Coal Terminal, at Port of Prince Rupert in British Columbia, for shipment to international markets. To date, Coalspur has secured up to 10.7 Mtpa export allocation through two separate agreements with Ridley Terminals Inc. The agreements are in place for 14 years with an option to extend for seven years.

Coalspur has also signed a transportation agreement and a siding construction agreement with Canadian National Railways under which they will develop a high-quality logistics supply chain to transport export thermal coal from Coalspur's Vista Coal Project to western Canadian ports.

1.10 Marketing

There is a general expectation that the worldwide demand for thermal coal will exceed supply capabilities due to the expected future coal demand from China, India, Japan and South Korea.

Global demand for coal to fuel electricity generation is forecast to grow from about 4.9 Bt currently to about 8.3 Bt in 2035. Coal demand for non-power purposes is expected to mirror the growth in demand for electricity generation, and combined, the total demand for thermal coal will grow to 11.9 Bt in 2035 from its current level of 7.2 Bt.

Declining coal self-sufficiency in regions with increasing demand provides a basis for growing imports, the majority of which will be seaborne. Seaborne thermal coal demand is expected grow by 1.13 Bt, from approximately 0.95 Bt currently to an estimated 2.08 Bt in 2035. The demand for thermal coal will be increasingly focused in Asia, the target market for Coalspur.

[2] *Expected maximum capacity on completion of the current upgrades, current capacity is 12Mtpa.*

In 2035, supply is forecast to have increased significantly reaching 2.1 Bt. A large amount of the supply expansion is expected from low cost mines. Much of this low cost increase is a result of growth in the low rank seaborne coal market sourced from Indonesia, and later, from the US. Cost of mining operations is estimated to increase in real terms over the forecast period.

Pricing is generally directly proportional to the calorific value relative to a reference coal. This approach has been adopted in the Feasibility Study price forecast. For example the price of Product 1, Vista's premium product (Val d'Or and McPherson Seam blend), is calculated as follows:

$$Forecast\ FOB\ Price, US\$ = \frac{5{,}800}{6{,}300} * Newcastle\ Reference\ Price$$

1.11 Economic Analysis

A cash flow model was developed by Snowden in 2012 to allow an after tax economic evaluation of the Vista project. The model was subsequently reviewed by BDO Canada LLP to ensure that the taxation considerations were entirely consistent with current Revenue Canada regulations. For the current work Snowden has updated the model with new cost and coal pricing data and recalculated the economic results;

- Internal Rate of Return (IRR) of 13.4% after taxes and royalties
- Net Present Value (NPV) of $498 million at an 8% discount rate
- 7.9 year payback period
- 30 year mine life

The coal price used was energy adjusted based on the forecast for benchmark thermal coal as developed by Wood Mackenzie coal consulting and published November 2013. A deduction of $33.69 was applied to the Export coal price for rail transport and port costs based on negotiated contracts and all coal is assumed to be sold into the international seaborne market. An adjustment to the selling price for each coal product was based on the actual calorific value from the mine model compared to the calorific value assumed by Wood Mackenzie for their benchmark price as illustrated below.

$$Forecast\ price\ \ Product\ 1 = \frac{Actual}{5800} \times Wood\ Mackenzie\ Price$$

$$Forecast\ price\ \ Product\ 2 = \frac{Actual}{5550} \times \text{Wood Mackenzie Price}$$

The capital and operating costs that had been derived by Coalspur consistent with the change in operating strategy were checked and validated and entered into the model. The average annual cash Flow forecast is shown in Table 22.1.

These NPV results are impaired relative to the 2012 economics largely due to the drop in coal price forecast. Coalspur has significantly reduced capital costs, and capital risk through solid contracts and have held benchmarkable operating costs while developing into largely a contractor operation.

Federal income taxes and Alberta income taxes were calculated at 15% and 10% of taxable income respectively. No inflation, interest or financing costs were applied to this analysis.

The economic modelling for this project was both deterministic, and based on a Monte Carlo approach used to evaluate the impact of variability in some of the key input parameters to the mine economics. Table 22.3 shows the results of the summary deterministic analysis.

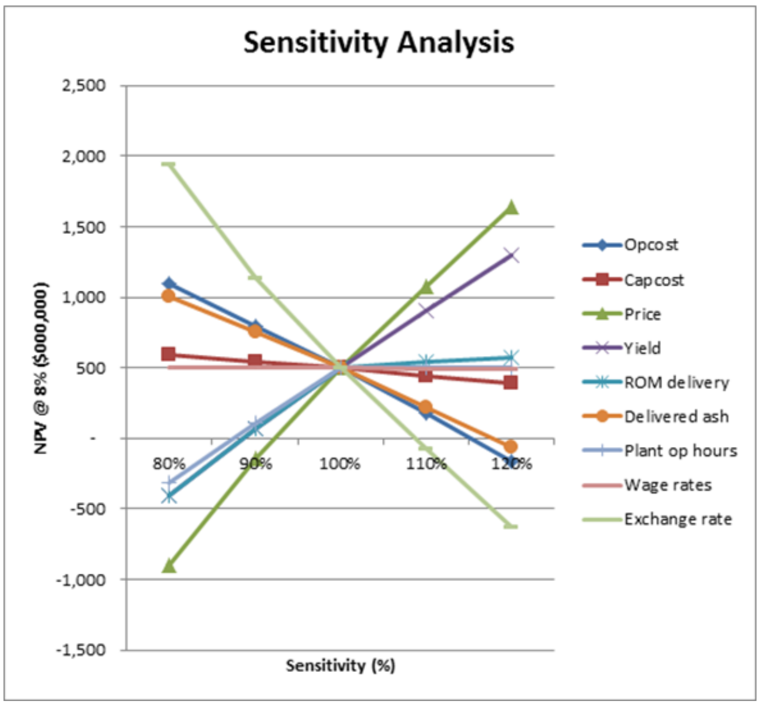
Table 1.3 Capital and Operating Costs

Economic value	Value
Average annual export coal sales (000 t)	10,324
Average annual revenue($000)	$766,929
Total 5 years capital ($000)	$758,000
Annual operating cost ($000)	$537,256
NPV @ 8% ($000)	$498,000
Internal rate of return	13.4%
Payback period	7.9 years

It is important to determine the sensitivity of the economic results to variations in input parameters in order to understand the conditions under which the project will not be economic. A deterministic sensitivity analysis was carried out by varying the input values and calculating a new net present value. The results of this analysis are shown in Figure 1.3.

It is seen from this analysis that the project economic results are very sensitive to changes in the operating cost, plant operating hours, coal price and the US$ exchange rate.

Figure 1.3 Economic Sensitivity Results



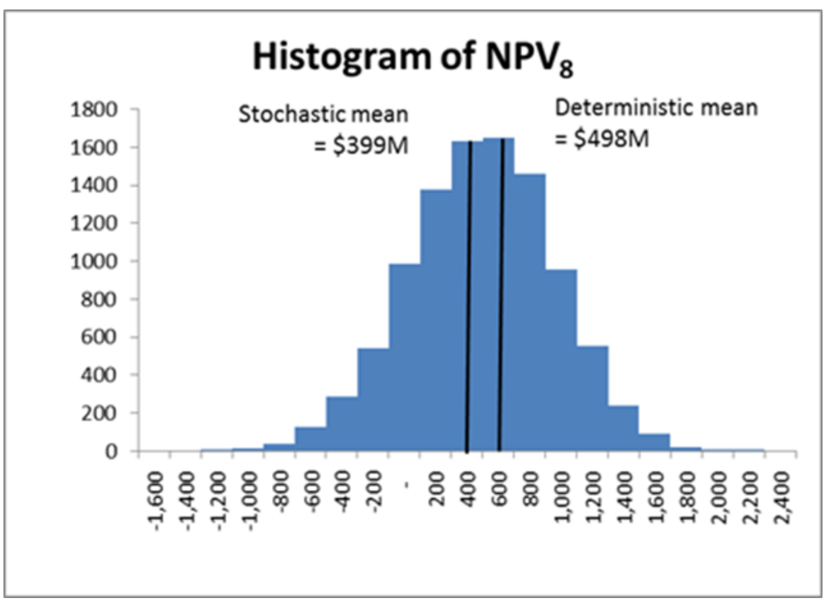
A Monte Carlo probabilistic assessment was made of the economic results to test the robustness of the project when key input variables are allowed to change simultaneously. Each of the selected input variables shown in Table 1.4 was defined by a triangular frequency distribution whose values were determined during an all-party discussion at a three day project workshop held during the Feasibility Study period.

Table 1.4 Monte Carlo Factors

Input Factor	Basis	Probability that real value is less than…		
		10%	50%	90%
Opcost sensitivity	times base case	0.80	0.90	1.00
Capcost sensitivity	times base case	0.90	1.00	1.50
Price sensitivity	times base case	0.85	1.00	1.10
Yield sensitivity	times base case	0.85	1.00	1.05
ROM delivery	times base case	1.10	0.98	0.85
Loss/dilution	times base case	1.10	1.12	1.15
Delivered ash	times base case	0.97	1.00	1.09
Exchange rate	times base case	0.90	1.00	1.06
Plant Production	Mtpa	11.5	11.0	10.0
Plant operating hours	times base case	1.06	1.00	0.985
Wage rates	times base case	0.90	1.00	1.15
Thickener underflow	solids % density	0.40	0.35	0.25
Return water	% of available	0.35	0.40	0.50
Clean coal conveyor	Mtpa	15	13	11

The Monte Carlo results are shown in Figure 1.4

Figure 1.4 Monte Carlo Results



From this analysis it can be seen that, on a risked basis, the median project NPV_8 drops from $498 million to $399 million and there is a 21% probability that the project will earn a negative net present value (rate of return is less than 8%).

1.12 Conclusions

On the basis of the results of the feasibility study and this review of the additional work completed to date it is concluded that:

- The Vista Coal Project has sufficient (quantity and quality) open pit Coal Resources to yield 11.5 Mtpa of saleable thermal coal products to the international coal market at full production, with a mine life of 30 years.
- There are sufficient *Proven* Coal Reserves to cover the capital investment payout period of 7.9 years.
- The project, with all related infrastructure requirements included, is technically and economically feasible.
- Sensitivities to the project design assumptions indicate that the project economics are robust.
- The revised operating and contracting strategy has significantly de risked the project to capital and operating cost exposure.

1.13 Recommendations

Based on the work undertaken to-date and to further optimize and refine during detailed design and construct, it is recommended that Coalspur considers the following additional work programmes:

It is recommended that:

- a comprehensive plan to address the AER recommendations and conditions is formulated
- a more detailed mine plan be completed to evaluate alternative mining systems to draglines that may potentially allow more rapid reclamation, smaller out of pit waste dumps, more flexible mining for product optimisation, and reduce mining costs
- belt press filters be progressed to reduce or eliminate the need for tailings ponds
- the down dip seam quality data trending from drilling carried out in 2011 be confirmed and incorporated in modelling
- further fines flotation tests are carried out to support the decision not to install a flotation circuit
- further work to characterize the properties of the processed fines for the Vista Mine should be undertaken
- a groundwater management plan should be instituted prior to construction to understand and design the system
- evaluation of additional clean coal storage facility be continued as contingency

2 Introduction

This Independent Technical Report ("ITR") has been prepared by Snowden Mining Industry Consultants Inc ("Snowden") for Coalspur Mines Limited ("Coalspur"), in compliance with the disclosure requirements of the Canadian National Instrument 43-101 ("NI43-101") and JORC Code 2004.

2.1 Terms of Reference

The trigger for preparation of this report is the filing of the Annual Information Form for the year ended December 31, 2013.

This report largely summarises the body of work completed by others in progressing the Coalspur Vista project. Snowden has adopted the approach that the diligence and qualified sign off throughout previous reports in areas that have been substantially unchanged is sufficient to provide the basis for this ITR.

This ITR contemplates and summarises material changes to the cost structure of the project, namely the change from owner operations to contractor operations, a reduction in capital required, and improvement in capital efficiency through process design and contracting strategy. There are many minor improvements and refinements to the project and at this time Coalspur are continuing to improve and optimize such that future enhancements to the project can be expected. The changes incorporated in this report relative to the preceding NI43-101 technical report, are indicated in Table 2.1.

Table 2.1 Material change elements from preceding NI43-101 technical report

Item	2012 FS	Current 2014 NI 43-101
Coal Price	$125	$92
Mine Capex	Owner fleet	Contractor fleet
Mine Opex	Owner operated	Contractor operated
Plant Capex	QCC/CWA	Forge EPC
Plant Opex	QCC/CWA	Forge / Taggart
Thermal dryers	In design	Removed, no value seen
Infrastructure	CWA	Forge EPC
Tailings	Tailings pond	Filters and co-disposal

Another significant new item is the approval of the project by the Alberta Energy Regulator (AER) body. This milestone event has reduced the risks regarding obtaining permits. The approval comes with certain recommendations and conditions of which two are noteworthy as far as the longer term operations are concerned. The permit limits the tailings pond height and thus capacity to approximately 5 years' worth of production and the permit expires after 10 years of operation. Therefore within the 10 year time frame, ongoing amendments and extensions to the permits will be required.

2.2 Sources of Information and Data

Unless otherwise stated, all information and data contained in this ITR and used in its preparation has have been supplied to Snowden by Coalspur, and where applicable, accessed from public domain sources *e.g.* SEDAR.

Several previously published NI43-101 reports have formed the primary basis for this current ITR, namely:

- Moose Mountain Technical Services, 2010: *Resource Estimate for the Vista Coal Property, West Central Alberta*
- Snowden Mining Industry Consultants, 2012: *Coalspur Mines Limited: Feasibility Study of the Vista Coal Project, Hinton, Alberta*
- Golder Associates, 2012: *Coalspur Mines Limited: Updated Resource Statement for the Vista Coal Project – Hinton, Alberta, Canada*

Various independent reports have prepared and published previously related to the Vista Coal Project. This ITR compiles all relevant data and information from the previous reports and studies to present a consolidated update and summary for the Vista Coal Project.

2.3 Current Personal Inspections

The Qualified Persons responsible for preparation of the report are David Lawrence, Grant van Heerden, Ross Broadley and Paul Franklin, none of whom have previously or recently made a personal inspection of the site.

The project site has been the focus of exploration drilling and feasibility level studies recently with all work being completed in 2012. Snowden prepared a Technical Report on behalf of the issuer in January 2012. The Snowden-prepared ITR has been released in the public domain where necessary disclosure has been made by the relevant Qualified Persons responsible for the work. Included in that disclosure were references to the then current personal inspections carried out. Given that no work has been conducted on the project site since then, Snowden has not considered it pertinent to visit the site as part of the preparation of this ITR.

The responsibilities of each author are provided in Table 2.2.

Table 2.2 Responsibilities of each Co-author

Author	Responsible for section/s
David Lawrence, MAusIMM	Supervising preparation of complete ITR
Grant van Heerden, Pr.Sci.Nat.	1 through 14 inclusive, 23 through 27 inclusive
Ross Broadley, MAusIMM	15 through 22 inclusive, 25 & 26.
Paul Fraknlin, Pr. Eng, / P. Mgr	Sections 21 & 22

3 Reliance on Other Experts

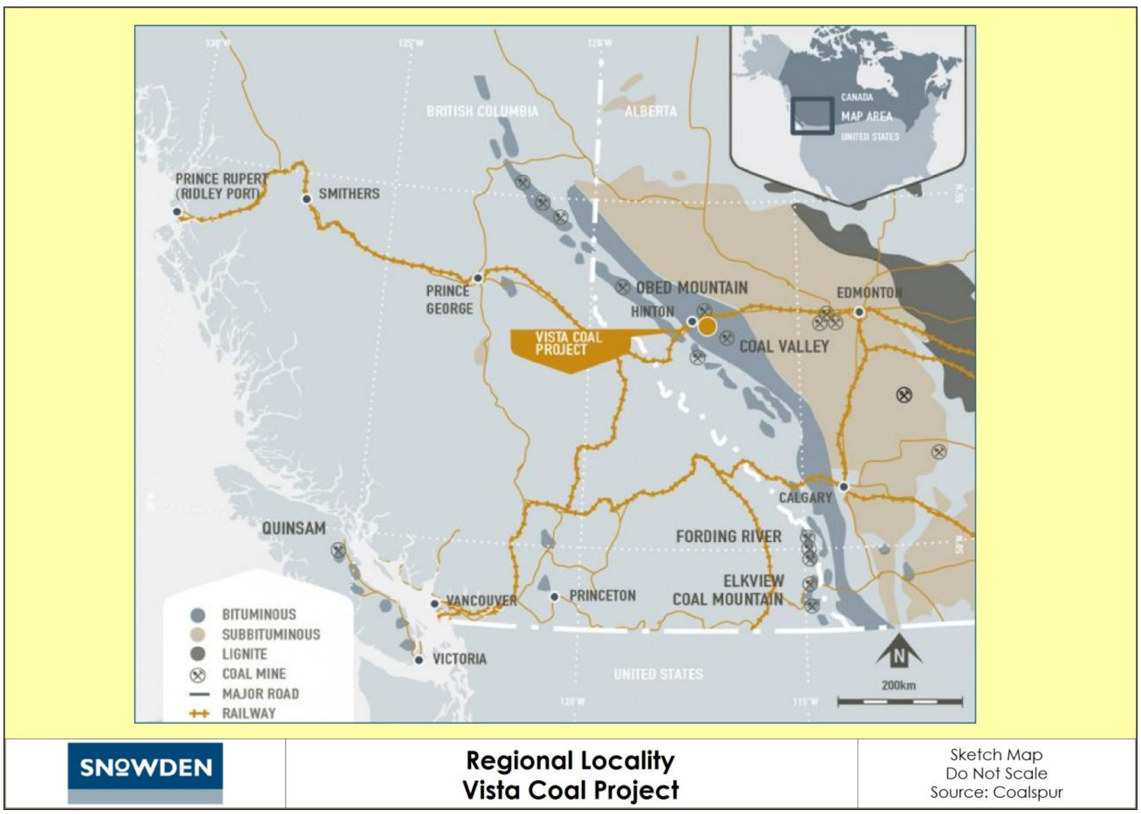
Snowden has relied upon data and information provided by different companies who are not Qualified Persons. Snowden has no reason to doubt the veracity and reliability of the information and data. Results of the work completed by these companies are estimates based on the data and information as stated in the report.

4 Property Description and Location

The Vista Coal Project is located east of the town of Hinton in west central Alberta, Canada (Figure 4.1). Primary road access to the general area is via the Yellowhead Highway (Highway 16), which is a major all-weather divided, paved highway, which connects Hinton with Edson, Alberta, 85 km to the east, and Edmonton, Alberta, 280 km to the east. The Athabasca River flows parallel to and north of the Highway 16 and the town of Hinton. Highway 40 runs north from Highway 16, approximately 7 km southwest of Hinton and connects to Grande Cache, 138 km to the northwest.

The CNR's main rail line runs parallel to the Athabasca River and Highway 16, approximately 8 km north of the Vista Coal Project. The railway provides direct access for coal delivery to the Port of Vancouver and to the Ridley Island Terminal at Prince Rupert.

Figure 4.1 Project Location Map



The coal leases are located south of Highway 16, the CNR rail line and the Athabasca River, all of which run parallel (SW-NE) to each other in the area along the northwestern margin of the Vista Coal Project. The project lies approximately 4 km east of the town of Hinton, 60 km southwest of the town of Edson and 40 km northeast of the Jasper Park boundary on Highway 16. The project is centred on approximately 5,915,000 North and 476,000 East (UTM11N, NAD83) and consists of several tracts of land extending over 22 km eastward from Hinton to the McLeod River.

Coalspur currently holds 58 individual coal lease agreements and three applications in the Hinton area[3,4]. Within this, the Vista Coal Project consists of 22 contiguous leases comprising the Hinton West, Z Block, Hinton East, Other Vista Project and McLeod River North Coal Resource Blocks. All of these leases are held directly, or in escrow, by Coalspur. The locations of these properties are shown on Figure 4.2, Figure 4.3,Figure 4.4,Figure 4.5.

Coalspur purchased the five Hinton East and Hinton West coal leases from Tanager on February 19, 2009. The Tanager leases, held in escrow, are subject to a final payment of C$10 million on the earlier of February 19, 2016, or coal production from the Tanager Leases reaching 90,000 tpm over a three month period, and an ongoing 1% gross revenue royalty for coal sold from those leases only. Coalspur executed an option to purchase agreement with Mancal Coal Inc. to purchase a 100% interest in the McLeod River North and Z Block leases in October, 2010.

The total area of the combined leases is approximately 9984 ha. Coalspur holds fourteen (14) tenured coal leases and three (3) coal leases under application. Tanager holds five (5) tenured coal leases[3,4]. Alberta Crown Coal Leases are granted for a term of 15 years and are renewable for additional terms on application. The Vista Coal Project leases are listed in Table 4.1.

[3] *Information sourced from the Alberta Government's online interactive map (**https://gis.energy.gov.ab.ca/Geoview/Viewer.aspx?Viewer=StandaloneCoalSLExt**)*

[4] *This information is current as at the Effective Date of this ITR, sourced from the Government of Alberta Energy website, **www.energy.gov.ab.ca***

Figure 4.2 Individual Coal Lease Agreements comprising the Vista Coal Project

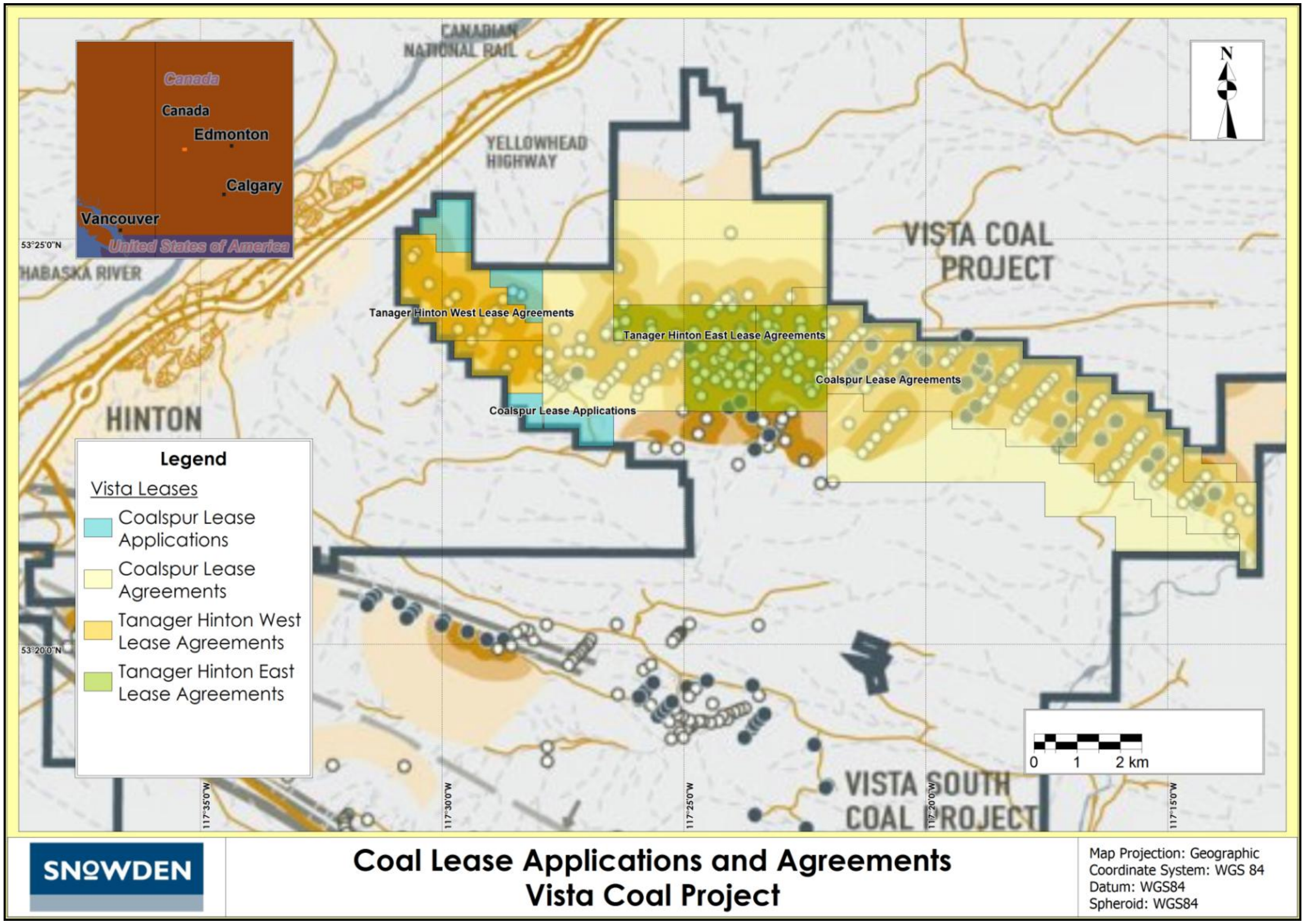


Figure 4.3 Key Resource Block Nomenclature for the Vista Coal Project

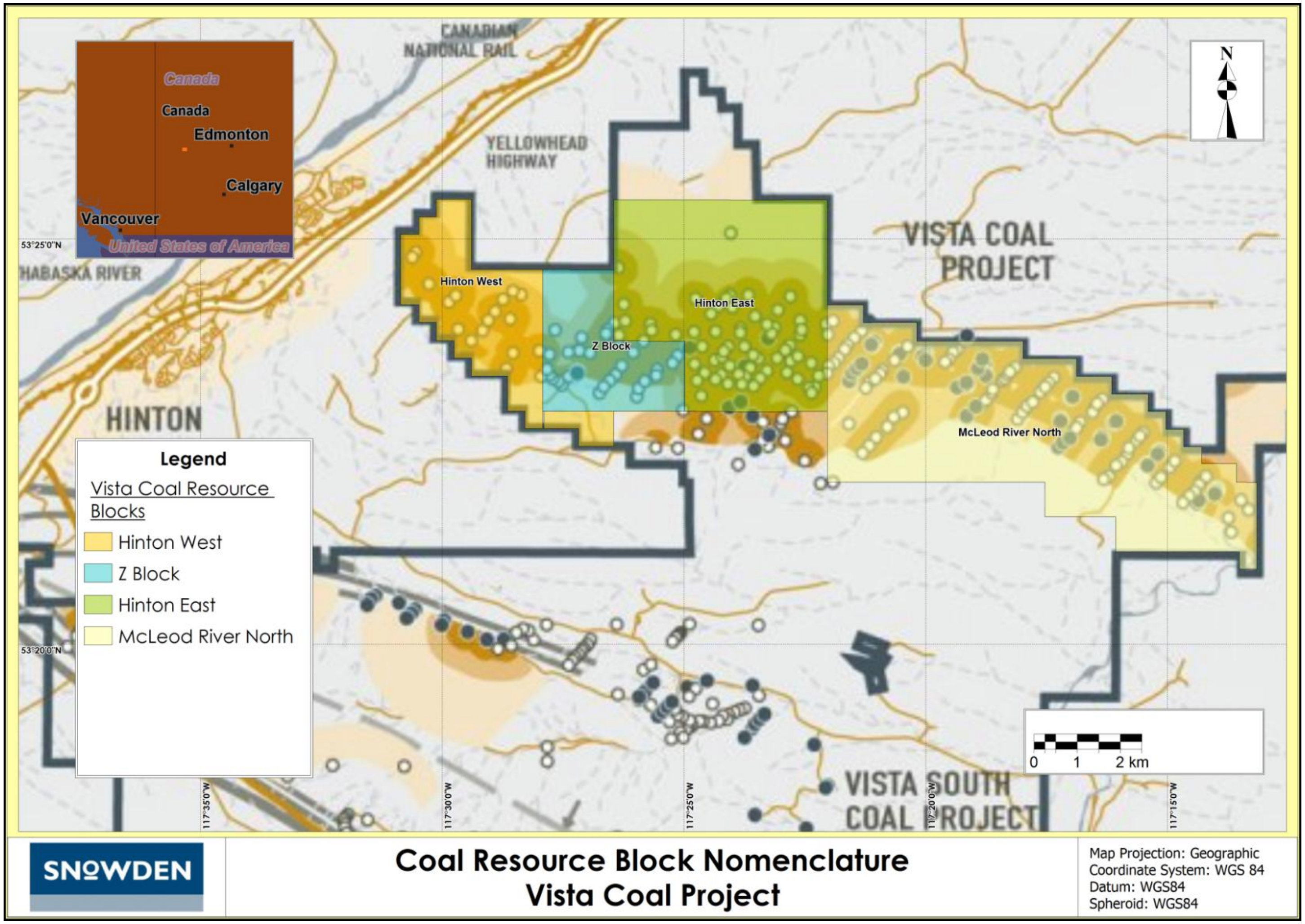


Figure 4.4 Vista Coal Project Leases (source Alberta Government's online interactive map3)

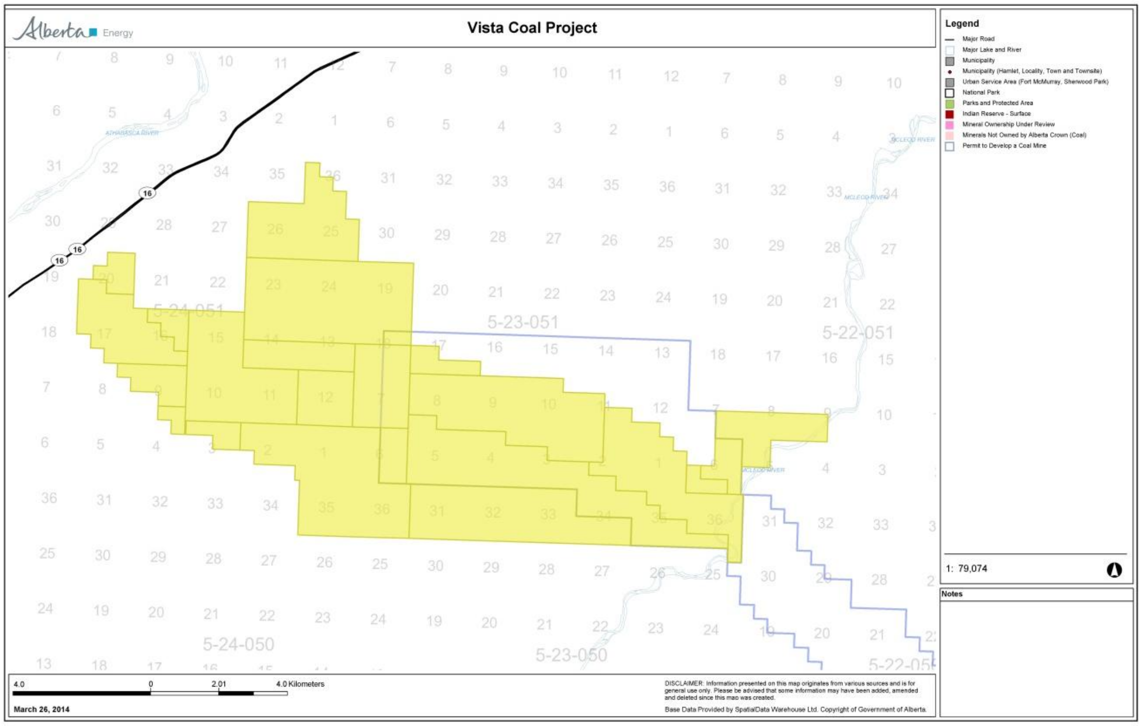


Figure 4.5 Zoom on Lease Map with Lease numbers (last 3 digits). **Not to scale.**

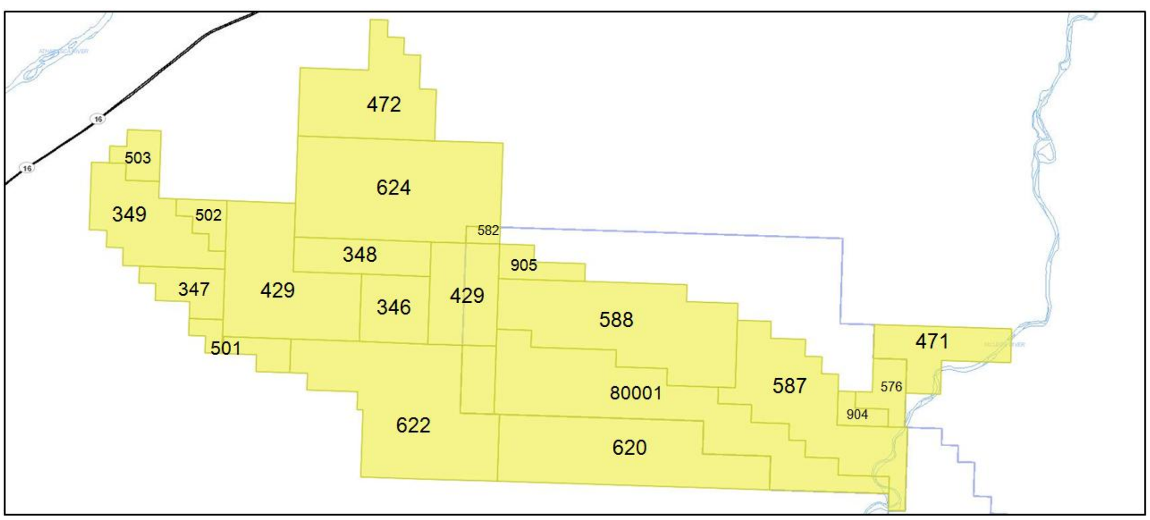


Table 4.1 Vista Mine Project Coal Tenures (source Government of Alberta Energy website[3,4])

Resource Block	Lease Number	Holder	Status	Area (ha)
Hinton East	1308020345	Consolidated Tanager Ltd.	Coal Lease	384
	1308020346	Consolidated Tanager Ltd.	Coal Lease	256
	1308020348	Consolidated Tanager Ltd.	Coal Lease	256
	1308120620	Coalspur Mines (Operations) Ltd.	Coal Lease	896
	1308120622	Coalspur Mines (Operations) Ltd.	Coal Lease	1,072
	1308120624	Coalspur Mines (Operations) Ltd.	Coal Lease	1,120
Hinton West	1308020347	Consolidated Tanager Ltd.	Coal Lease	176
	1308020349	Consolidated Tanager Ltd.	Coal Lease	464
	80368501	Application	Application	144
	80368502	Application	Application	96
	80368503	Application	Application	112
McLeod River North	1307070587	Coalspur Mines (Operations) Ltd.	Coal Lease	768
	1307070588	Coalspur Mines (Operations) Ltd.	Coal Lease	992
	1399080001	Coalspur Mines (Operations) Ltd.	Coal Lease	1,104
	1308050904	Coalspur Mines (Operations) Ltd.	Coal Lease	64
	1308050905	Coalspur Mines (Operations) Ltd.	Coal Lease	112
Other Vista Project	1311040471	Coalspur Mines (Operations) Ltd.	Coal Lease	320
	1311040472	Coalspur Mines (Operations) Ltd.	Coal Lease	592
	1311050576	Coalspur Mines (Operations) Ltd.	Coal Lease	128
	1311050581	Coalspur Mines (Operations) Ltd.	Coal Lease	128
	1311050582	Coalspur Mines (Operations) Ltd.	Coal Lease	32
Z Block	1307060429	Coalspur Mines (Operations) Ltd.	Coal Lease	768
Total for 22 Leases				9984

Surface rights are held by the Alberta Government, and logging and timber management are granted to West Fraser Mills Ltd under a Forest Management Area agreement. Tourmaline Oil Corporation has three natural gas wells (two of which are active) in the phase 1 mine permit area, and associated pipeline infrastructure. As per Coalspur's news release dated December 9, 2013[5], Tourmaline and Coalspur have made an agreement on developing their respective mineral interests and Tourmaline's wells pose no undue impediment to Coalspur's mine project. There are no private land owners on the properties.

Certain types of exploration activity require a Coal Exploration Permit ("CEP"), issued by the Alberta Government, prior to conducting the work on Crown land within a coal property. The current or future operations of Coalspur, including development and commencement of production activities on this property require other permits and approvals governed by laws and regulations pertaining to development, mining, production, taxes, labour standards, occupational health, waste disposal, toxic substances, land use, environmental protection, mine safety and other matters, under the jurisdiction of the Government of Alberta and/or the federal government of Canada.

The Alberta Energy Regulator has recently approved the Vista Coal Project on 27 February 2014. This approval includes various requirements or conditions relating to the coal processing plant, mine plan and end-pit lake, geotechnical investigations, fines management, surface water quality, wetlands, wildlife, and noise mitigation.

Parts of this report, relating to the legal aspects of the ownership of the mineral claims, rights granted by the Government of Alberta and environmental and political issues, have been prepared or arranged by Coalspur and its environmental consultants. While the contents of those parts have been generally reviewed for reasonableness by the authors of this ITR, for inclusion into this ITR, the information, data, and reports on which they are based have not been fully audited by Snowden.

Snowden is not aware, following reasonable discussions with Coalspur senior management, of any material legal, social, environmental or technical threats to the successful development of the Vista Coal Project.

[5] *Coalspur News Release; December 9, 2013; "Coalspur Reaches Agreement with Tourmaline Oil Corp Ahead of Alberta Energy Regulator Hearing".*

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1 Access

The Vista coal property is accessible from Hinton via the McPherson Creek logging road (owned and maintained by West Fraser Mills Limited). This all-weather gravel road, which is open year round, bisects the Z Block, then runs through the Hinton East Block, and then runs southeast along the northern boundary of the McLeod River North property to the McLeod River (Figure 5.1).

5.2 Topography, Elevation and Vegetation

The property is situated in the northwest trending outer foothills physiographic region of the Rocky Mountains which is characterized by relatively low, rounded hills with local muskeg in low lying areas. The highest elevation in the area is 1,440 metres above sea level (“masl”), and the average elevation of the valley floors is approximately 1,195 masl (Figure 5.2).

The property is generally covered with second growth forests with pine and mixes of white spruce and poplar on the hillsides and ridges; alders, willows and black spruce occur in low lying areas. The region is part of the West Fraser Forest Management Area (“FMA”), which is actively being logged and contains large areas that have been commercially logged and re-planted in the past.

5.3 Climate

The local climate is typical for the region and has little to no material impact on mining operations with other nearby mines operating year round. Minor delays are, however, experienced but these are typically of short duration, particularly in the winter months. Key components temperature and precipitation are covered in more detail in this section.

5.3.1 Regional Temperatures

Alberta has a dry continental climate with warm summers and cold winters. The province is open to cold arctic weather systems from the north, which often produces extremely cold conditions in winter. As the fronts between the air masses shift north and south across Alberta, temperature can change rapidly. Arctic air masses in the winter produce extreme minimum temperatures varying from −54°C in northern Alberta to −46°C in southern Alberta. In the summer, continental air masses produce maximum temperatures from 32°C in the mountains to 40°C in southern Alberta.

Mean annual temperature in the project area is 2.8°C with a maximum daily average of 14°C in July/August and a minimum daily average of -11.0°C in January. Extreme temperatures have been recorded ranging from a maximum of 35°C to a minimum of minus 42°C. Table 5.1 shows the mean monthly temperatures prevalent at the project area compared to the national averages.

Figure 5.1 Primary Access Routes into the Vista Coal Project

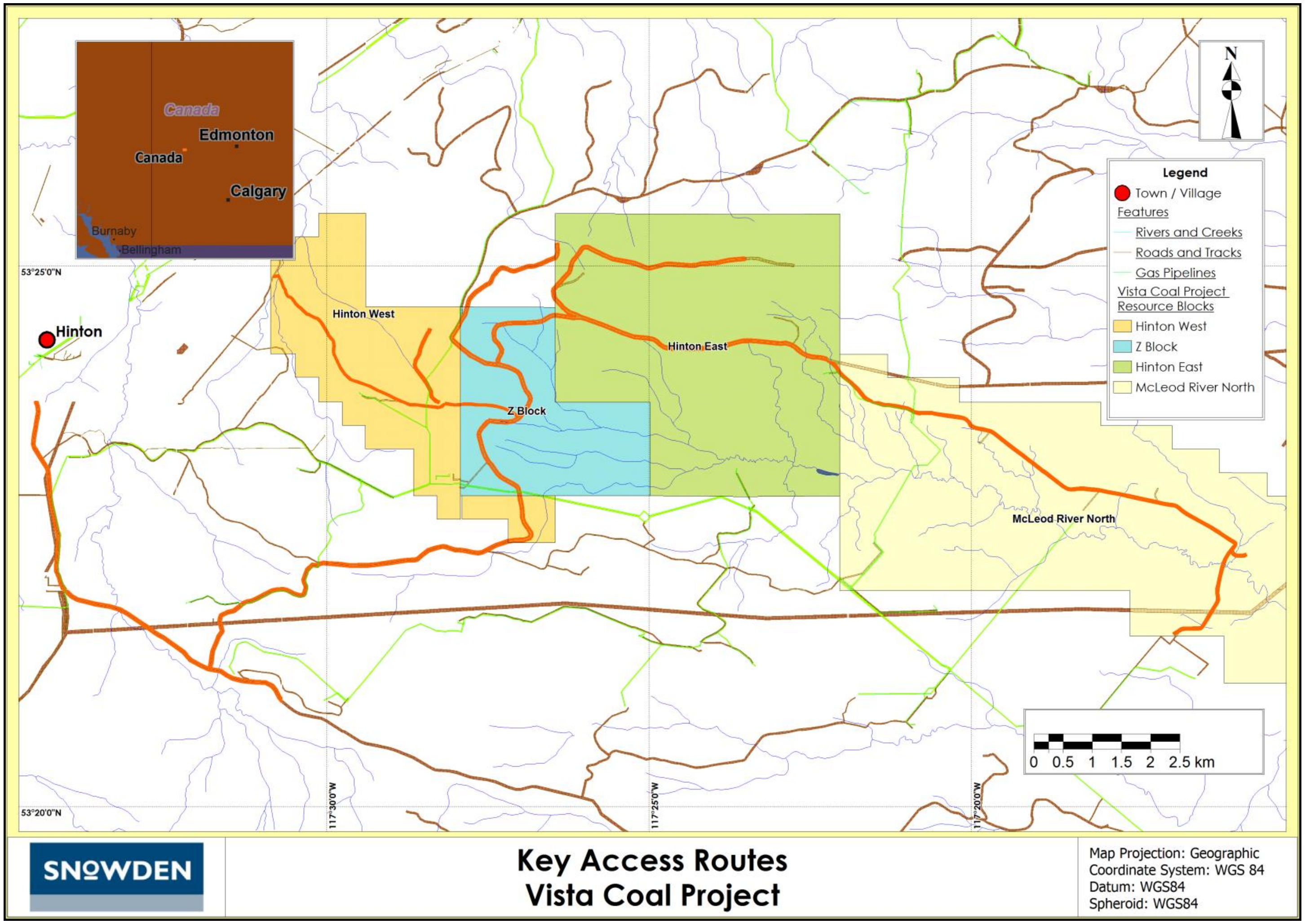


Figure 5.2 Topography over the Vista Coal Project

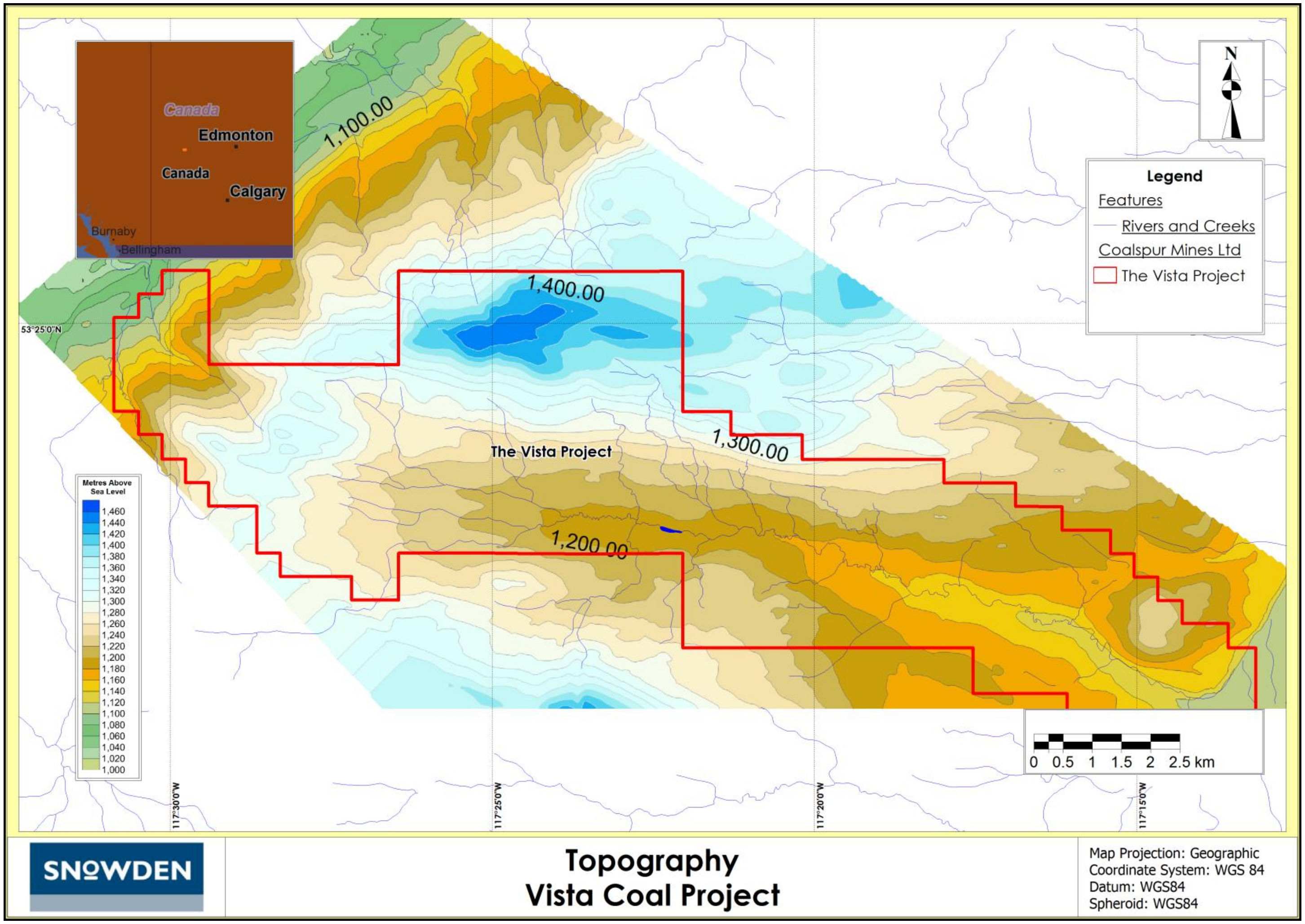


Table 5.1 Monthly Temperatures

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Avg (°C)	-11	-7	-2	4	9	12	14	14	9	4	-4	-8
Daily Max (°C)	-5	0	5	11	16	20	22	21	17	11	1	-2
Daily Min (°C)	-17	-14	-10	-4	1	5	6	6	1	-2	-10	-13
Canada Daily Avg (°C)	**-10**	**-8**	**-3**	**4**	**11**	**15**	**18**	**17**	**12**	**6**	**-1**	**-8**

5.3.2 Regional Precipitation

The Rocky Mountains cast a “rain shadow” over much of Alberta. As the moist air from the Pacific Ocean rises to pass over the mountains on its way to Alberta, it is cooled, and rain or snow fall on the Pacific side of the mountains. As the air descends on Alberta, it gains heat and produces warm, dry winds. The driest weather is in December and February when an average of 15-17 mm of snowfall is typically recorded. The wettest weather is from June to August, when an average of 81 mm of precipitation (snow and rain) is typical. The average annual relative humidity is 66.3% and average monthly relative humidity ranges from 50% in May to 84% in January and December.

Precipitation in Alberta ranges from 30 cm in the southeast to 45 cm in the north, except from the foothills region, where accumulations can reach up to 60 cm annually. The eastern slopes of the Rocky Mountains (where the project area is located) receive considerably less annual rainfall. Table 5.2 presents monthly averages for recorded precipitation.

Table 5.2 Monthly Preceipitation

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	1	0	1	14	61	78	93	72	46	16	2	0
Snowfall (mm)	29	15	21	8	4	0	0	0	3	12	20	17
Total (mm)	**30**	**15**	**22**	**22**	**65**	**78**	**93**	**72**	**49**	**28**	**22**	**17**

5.4 Local Resources and Infrastructure

The town of Hinton lies immediately west of the Vista Coal Project. The town is home to approximately 10,000 inhabitants. The vast majority of the labour force is employed, predominantly in the trades associated with the agriculture industry[6].

The CNR main railway line runs parallel to the Athabasca River and Highway 16, approximately 8 km north of the Vista Coal Project. The railway provides direct access for coal delivery to the Port of Vancouver and to the Ridley Island Terminal at Prince Rupert.

Paved landing strips are available at both Hinton and Edson for light aircraft.

Transmission lines (138 kV) to supply electrical power to the area are located along Highway 16 and along the southern boundary of the Vista Coal Project.

[6] http://www.citystats.ca/city/Alberta/Hinton.html

6 History

The first geological investigations in the region were undertaken by the Geological Survey of Canada. Rutherford (1923, 1924) carried out reconnaissance mapping of the Embarras, McLeod and Athabasca Rivers. Later, Lang (1944) and Irish (1945) published more detailed maps of the Entrance and Pedley areas.

In the late 1920s, a small scale mining operation began at Drinnan, immediately west of the Hinton West property, by Jasper Coal Ltd. Underground mining took place periodically from that time to the mid-1940s when the operation was abandoned due to declining demand for domestic coal.

The exploration and development of the areas currently underlying the Vista Coal Project has been carried out by a number of separate companies, including more recently, Coalspur directly.

6.1 Consolidated Tanager Limited

In 1963-64, Imperial Oil Ltd. drilled 60 test holes in the area. However, these holes were not properly surveyed, the geophysical logs were of poor quality and most of the original data is poorly documented.

In 1971, Associated Porcupine Mines Ltd (“APM”) acquired the coal rights to the areas that are now Hinton East and Hinton West. In partnership with Granby Mining Co. Ltd. (“Granby”), APM carried out exploration on their Hinton properties from 1972-1974. Exploration consisted of geological mapping, prospecting of the cuttings from seismic boreholes, an induced polarization survey, shallow backhoe trenching and two drilling programmes. Seven rotary holes (594 m) in the eastern part of the Hinton East block were drilled in 1972. Eight diamond holes (661 m) in the Hinton West block were drilled in 1974. All drill holes were geophysically logged with a density, gamma ray and neutron suite. However, none of the drill holes or trenches were surveyed. Only two trenches located bedrock and none of the recovered core was kept or photographed. Granby subsequently relinquished their interest in the properties.

In 1981, Esso Minerals Canada (“Esso”) signed an agreement with APM whereby Esso would earn an interest in the property.

In 1981, Esso drilled nine rotary holes (2,782 m) and one cored drill hole (400 m) on the Hinton East property. All drill holes were geophysically logged and sampling and analyses were carried out on the core. New aerial photography was also undertaken to construct high quality topographic maps of the area.

In 1982, 44 rotary holes (6,126 m) and 10 cored drill holes (1,222 m) were drilled and geophysically logged on Hinton East. Three of the drill holes were also geotechnically logged.

In 1983, 13 rotary holes (1,305 m) were drilled and geophysically logged on Hinton East. A geological model based on work from 1981-1983 was generated for Hinton East and West that correlated the seams from both areas. An application was made to the Alberta government to reclassify 922 ha of Hinton West from Category I, which prohibits exploration, to Category II.

The Alberta government reclassified the 922 ha of Hinton West into Category II in 1984 (Category II allows for limited exploration under strict control but commercial development by surface mining will not normally be considered). Exploration in 1984 concentrated on Hinton West and consisted of nine rotary holes (1,272 m). The holes were geophysically logged and drill cuttings were analysed.

The 1985 exploration program consisted of four cored drill holes (469 m) and four rotary holes (567 m). All holes were geophysically logged and the cored drill holes were geotechnically logged. The coal core was sampled and analysed in detail.

In 1983 a Coal Resource for Hinton East was estimated at 438 Mt of which 90 Mt were considered surface resources and 348 Mt were classified as underground resources. A Coal Resource was estimated for Hinton West in 1985 at 47 Mt clean coal at a 12:1 stripping ratio. These resources for Hinton are considered historic in nature.

During their four year option period, Esso completed, in addition to its exploration programmes, an Engineering Feasibility Study and submitted a Preliminary Application for a Mine Permit to the Alberta government.

Esso terminated their option agreement in 1985 and the property reverted to APM.

In early 1989, Consolidated Tanager Limited ("Tanager") was formed by APM to hold the coal leases. In 1989, Tanager hired LAS Energy Associates Limited ("LAS") to do a thorough evaluation of the Hinton properties in order to determine an optimum development strategy. With selective mining of the coal at moderate stripping ratios, LAS estimated a 46 Mt "reserve" (non-compliant to NI 43 101) of clean coal. The actual strip ratios were not provided although LAS states that the average ratio is 4.0:1 and the wash plant recovery is estimated at 55%. Many coal companies report strip ratios as bank cubic metres ("BCM") waste to clean tonnes of coal.

6.2 Manalta Coal Limited

Manalta Coal Limited ("Manalta") acquired the current McLeod River North and Z Block leases in 1971 and conducted a major coal exploration drilling programme on the McLeod River North property in 1981/82. A total of 148 rotary drill holes including 45 till holes (LOX[7] holes), and 17 cored drill holes were completed during this period along nine cross sectional access lines spaced between 800 m to 1,100 m apart. The drilling programme was designed to intersect the two major mineable coal zones (Val d'Or and McPherson) on the property and quantify resource estimates to a high degree of accuracy.

The core samples were analysed on individual coal seam plies to forecast *in situ* coal quality. Subsequent washability studies were undertaken to determine clean coal quality and product yield factors. Manalta extracted two 600 t bulk samples from the Val d'Or and McPherson zones for detailed washability studies and plant design purposes.

This work and subsequent mining, civil engineering and environmental studies were compiled and submitted as formal Mine Development application to the Government of Alberta in 1982.

The Alberta government issued a Mine Development Permit in early 1983.

[7] *LOX – Line of Oxidation. Drilling undertaken to determine depth of weathering / fresh rock interface*

The project remained dormant until 1992 when Manalta initiated a 17-hole exploration drilling programme on the Z Block lease. The purpose was to define mineable resources on this lease. Eight of the holes were cored to confirm coal quality.

All of the 1981/1982 and subsequent 1992 drilling was geophysically logged. HQ diameter core samples were obtained by continuous wire line methods with acceptable core recovery in the main coal sections. All of the sampling and analytical procedures were assessed to be in line with accepted industry practice.

Manalta proceeded with an updated Mine Feasibility Study which incorporated both the Z Block and McLeod River North leases. The study was completed in 1995 but Manalta decided not to proceed with development.

Manalta was converted into an Income Trust in 1997 and subsequently sold all of its operating assets in 1998. Some of the non-operating assets did not become part of the Manalta Income Trust and were retained by Mancal Coal Inc. ("Mancal") and its predecessor companies.

6.3 Coalspur Mines Limited

Coalspur purchased the Hinton East and Hinton West coal leases from Tanager on February 19, 2009. In February 2010, Coalspur conducted a core drilling programme (total 10 drill holes) on the property to validate coal quality and resource expectations. In February 2010, Coalspur published a scoping level Technical Report on the economics of mining the Hinton East and West properties, which showed positive returns.

In June 2010, Mancal and Coalspur entered into an option agreement for Coalspur to acquire 100% interest in the McLeod River North and Z Block leases. Final payment was made and the leases were transferred to Coalspur in October, 2010.

In September 2010 Coalspur started a major drilling programme on the property to infill between the historic Manalta holes for resource confirmation and collect coal quality samples for product washability studies.

The combination of the four properties Hinton East, Hinton West, McLeod River North, and Z Block were renamed the Vista Coal Project.

In January, 2012 Coalspur reported the results of a Feasibility Study for the Vista Coal Project, which showed positive returns.

From 2014 to present, Coalspur has been advancing the permitting and financing of the project along with further enhancements and optimisation initiatives. No further drilling, test work or other material changes affecting the data have taken place.

There has been no mine production from the Vista Coal Project.

7 Geological Setting and Mineralisation

7.1 Geological Setting

The coal deposit associated with the Vista Coal Project occurs along the eastern margin of the Rocky Mountain Foothills Disturbed Belt, southeast of the town of Hinton, Alberta. The coal-bearing horizons consist of continental clastic sediments of the Paskapoo and Coalspur Formations of Palaeocene Age. The most prominent structural feature is the Pedley Fault which trends northwest/southeast along the southwestern boundary of the Vista Coal Project and separates the faulted, steeply dipping strata in the west from the gently dipping, monoclinal strata that underlie the property (Figure 7.1).

Four stratigraphically continuous coal zones have been intersected on the property along a 22 km strike length from the Athabasca Valley (NW) to the McLeod River (SE). They are identified in descending order as the Val d'Or, McLeod, McPherson and Silkstone Zones. Each zone consists of multiple coal plies separated by clastic parting material of variable thickness. The aggregate total coal thickness of the combined zones averages 28 m over a 200 m stratigraphic interval.

The structural style is a simple monocline trending 300° and dipping gently at 6° northeast at the northern boundary of the property to a maximum 15° at the southern boundary on the McLeod River.

7.2 Regional Geology

The Vista Coal Project is located on the eastern margin of the outer foothills of the Rocky Mountain thrust belt. The rocks form part of a thick sequence of continental sediments from the Saunders Group that overlies the marine Wapiabi Formation of the Alberta Group. The Upper Cretaceous-Tertiary Saunders Group is over 3,600 m thick and is divisible into the Brazeau, Coalspur and Paskapoo Formations (Figure 7.2). Although all three units host carbonaceous members and thin coal seams, the major (potentially economic) coal deposits are restricted to the Coalspur and Paskapoo Formations.

Strata of the Saunders Group were deposited mainly within lacustrine and alluvial environments. The Brazeau and Coalspur Formations were deposited as a series of five cyclotherms, each consisting of a lower part that comprises mainly channel sandstones and an upper part, consisting mostly of mudstones with coaly shales and/or coal beds, and lacustrine rythmites (Jerzykiewicz and Sweet, 1988). The fifth cyclothem is the Coalspur Formation (Jerzykiewicz, 1985). The thickest coal beds are associated with alluvial deposits in the upper part. The Coalspur Formation is up to 600 m thick and includes seven major seams, which range up to 22 m in thickness (Engler, 1983; Jerzykiewicz and McLean, 1980). This formation contains the vast majority of identified Coal Resources in the outer foothills.

The Paskapoo Formation, which overlies the Coalspur Formation, is a continental alluvial plain deposit and includes thick successions of poorly indurated mudstones and sandstones. Economically important coals are restricted to the Paskapoo Formation north of Hinton, in the Obed Mountain Coalfield, where a coal-bearing interval about 140 m thick contains up to six seams of high volatile bituminous coal, with individual seams up to 5 m thick (Horachek, 1985).

7.3 Local Geology

7.3.1 Coalspur Formation

The coal bearing upper part of Coalspur Formation consists of approximately 300 m of interbedded sandstones, siltstones and carbonaceous to bentonitic mudstones, and several thick continuous coal zones. True bentonite and tuff layers are present, most commonly associated with the coal zones.

A distinct, resistive conglomerate, known as the Entrance Conglomerate, marks the base of the Coalspur Formation and is approximately 275 m below the lowermost coal zone. Thick cross bedded sandstones of the Tertiary (Cenozoic) Paskapoo Formation conformably overlie the Coalspur Formation throughout the region.

Six persistent and correlated coal zones have been identified in the Hinton region. In descending order they are identified as the Val d'Or, Arbour, McLeod, McPherson, Silkstone and Mynheer zones (Figure 7.3). These zones are typically multi-ply coal seams with interbedded mudstone/bentonite partings and can range in thickness from 1 m to up to 35 m. The most significant zones encountered at the Vista Coal Project are the Val d'Or, McLeod and McPherson zones.

7.3.2 Structural Geology

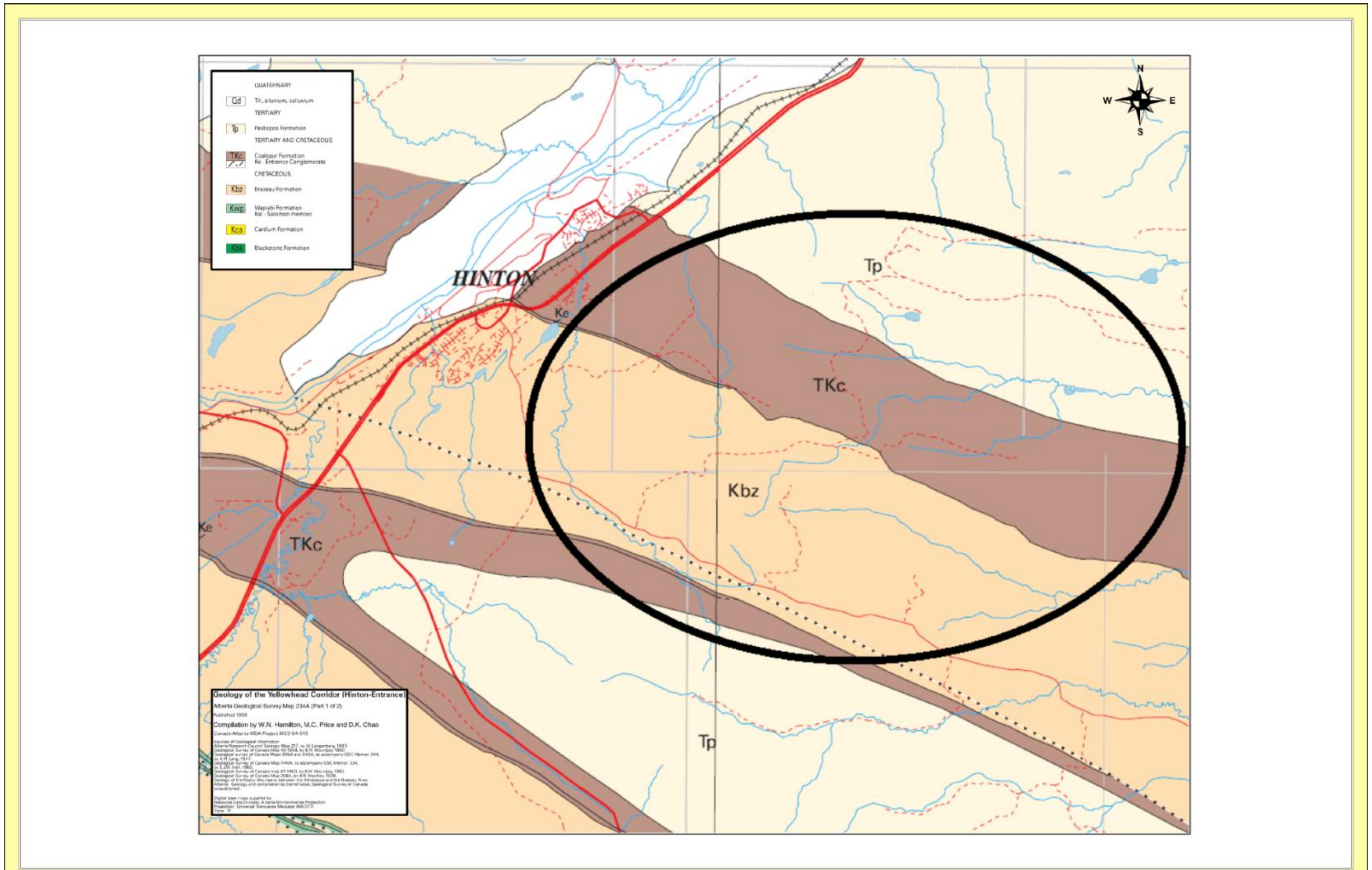
The Coalspur Formation at the Vista Coal Project is exposed in subcrop along the erosional eastern margin of the Prairie Creek Anticline. This margin area is bounded to the west by the Pedley Fault, a major reverse fault, which separates the folded and deformed strata of the Foothills Belt from the undeformed Alberta Syncline strata.

The structure is a simple monocline, trending 300° northwest/southeast. The beds dip gently northeast from 6° in the western part of the property up to 15° at the McLeod River on the eastern boundary.

No significant faulting has been identified on the property. Glacial ice deformation has been observed locally along the subcrop margins of the coal zones.

The property is overlain entirely by a mantle of glacial till and alluvium which varies from 5 m to 30 m in thickness. Consequently, all stratigraphic correlation and structural interpretation is based entirely on the geological modelling of drill hole data.

Figure 7.1 Local Geology of the Vista Coal Project



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Local Geology
Vista Coal Project

Sketch Map
Do Not Scale
Source: Alberta Geological Survey

Figure 7.2 Regional Stratigraphic Correlation across the Interior Plains

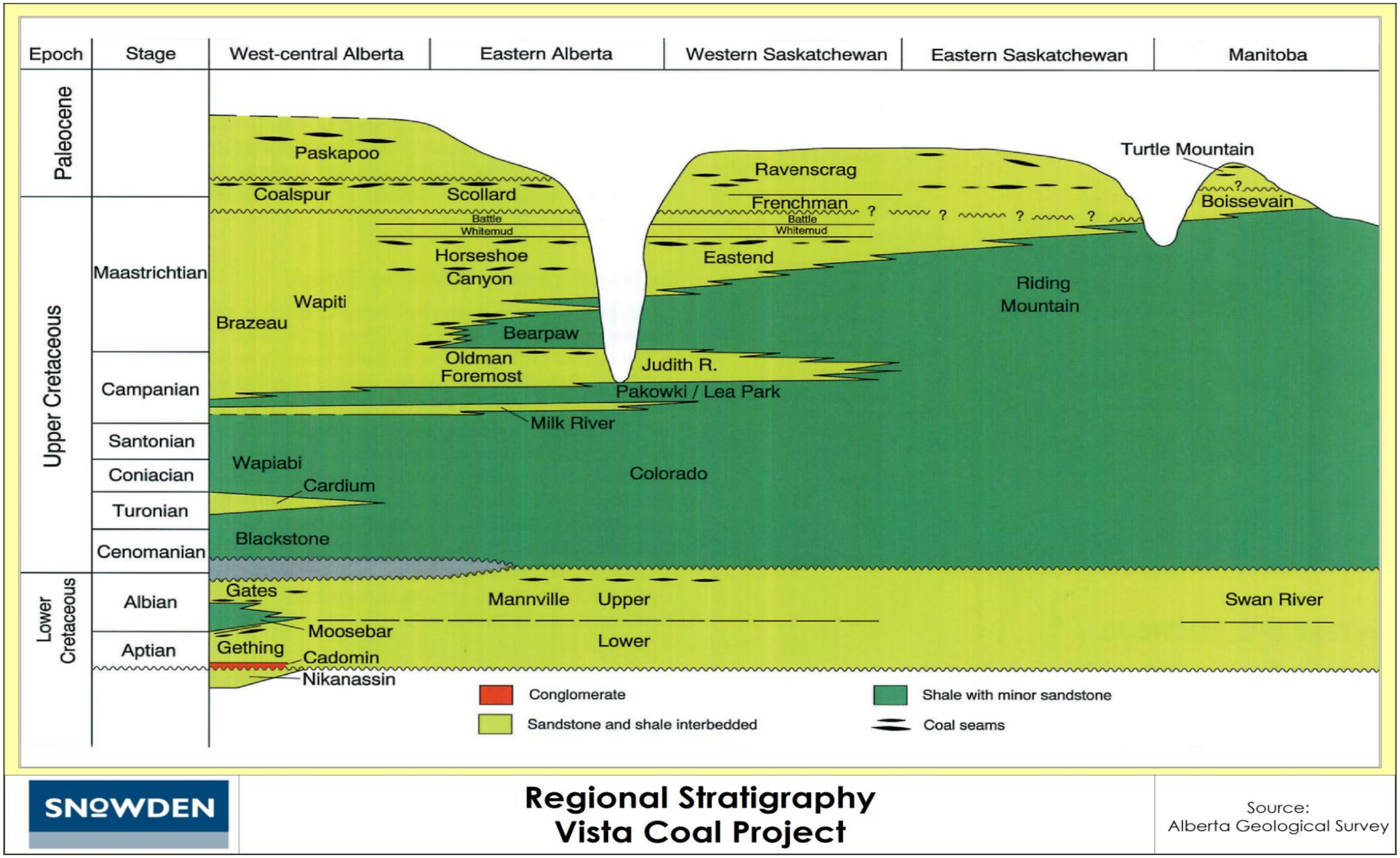
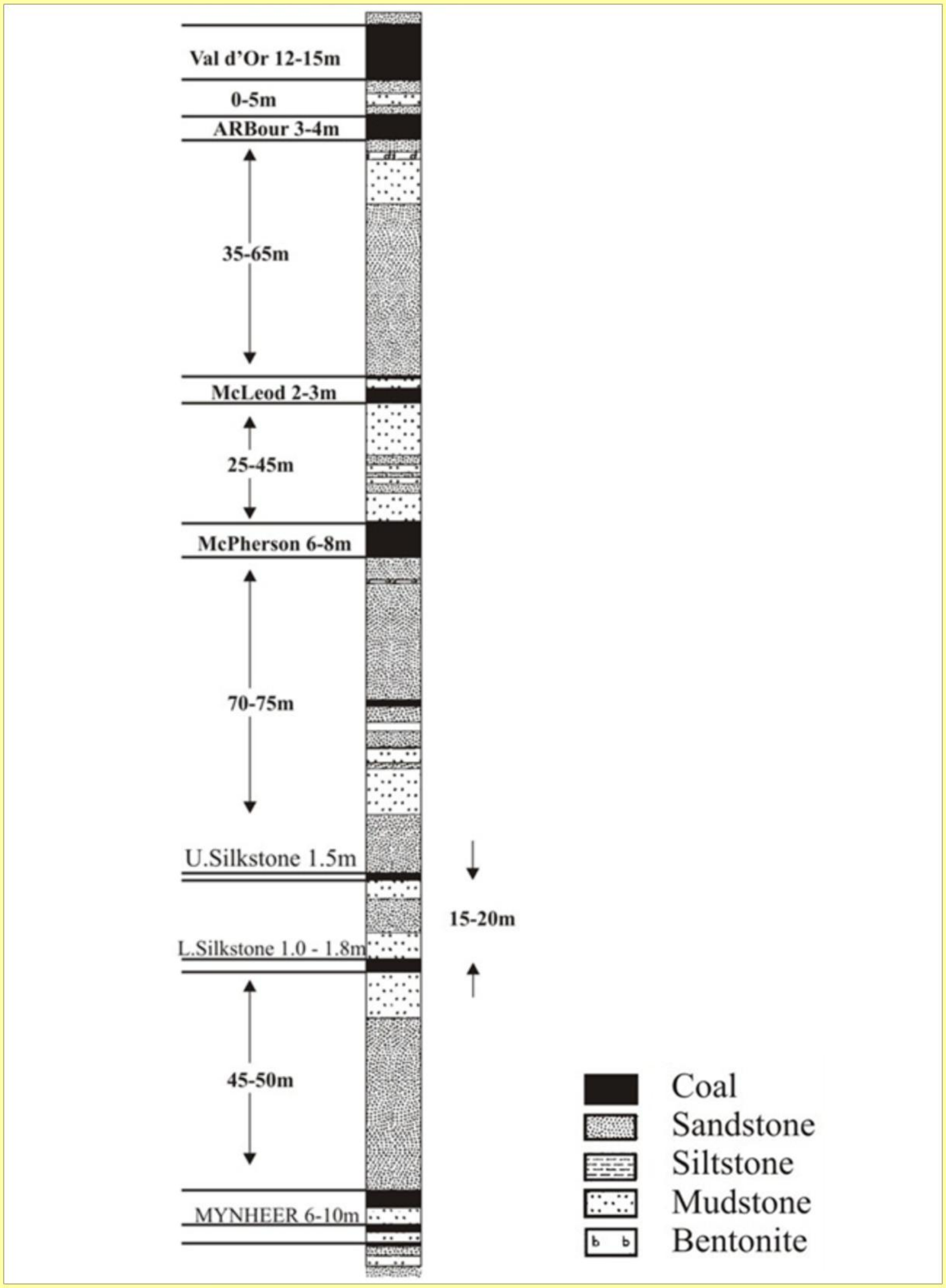


Figure 7.3 Generalised Stratigraphic Column of the Coalspur Formation at the Vista Coal Project



Generalised Stratigraphic Column
Vista Coal Project

Source: from MMTS (2010)

7.4 Mineralisation

The nomenclature used for identifying coal zones and individual seam plies has been adopted from Manalta. Esso applied a different nomenclature for the Hinton East and Hinton West coal deposits and this nomenclature been changed to correspond with that applied by Manalta.

Of the six recognised coal zones encountered within the Coalspur Formation, only the Val d'Or, McLeod, McPherson and Silkstone zones maintain a persistent mineable thickness throughout the Vista Coal Project lease areas and constitute the majority of the potentially mineable resource volume. The Arbour Zone is locally present only in the Hinton West Block, while the Mynheer Zone is usually too deep and too thin to be considered surface mineable.

The relative stratigraphic position and average thicknesses of the coal zones (seams/plies) are shown in Figure 7.4.

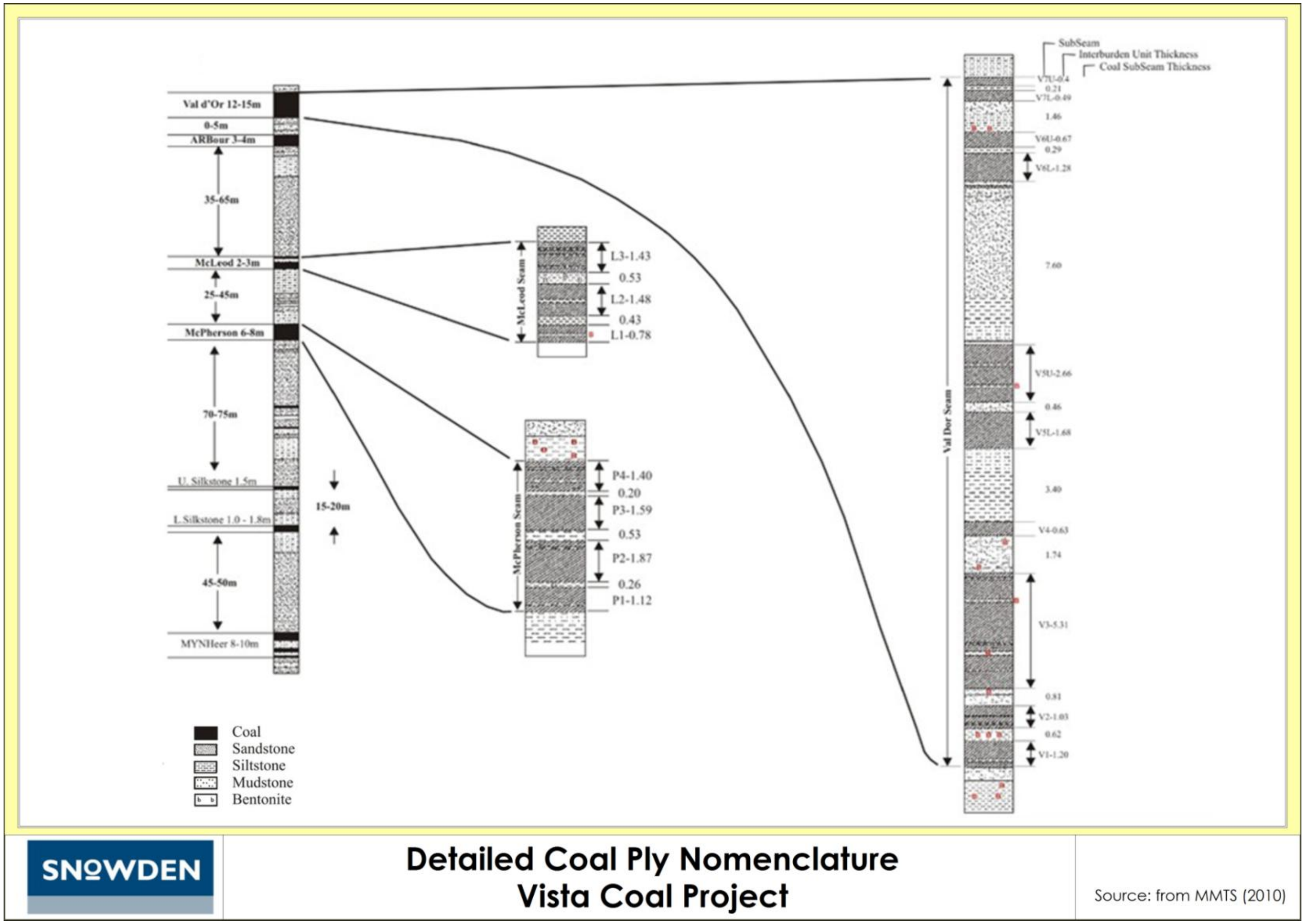
The Val d'Or Zone consists of seven correlated sub-seam plies numbered from the base up from V1 through V7 (see Figure 7.4). Some of these plies are further divided into lower and upper units by thin partings. The individual plies maintain relatively constant thickness over the strike length of the property, while most of the variation takes place in the interbedded clastic parting material. The average zone thickness is approximately 32 m, of which some 15 m is coal. The zone thickness increases from 20 m along the eastern boundary along the McLeod River to over 60 m in the Hinton West Block. This is almost entirely due to increases in the interbedded sandstone sequence in the upper part of the zone, as the total coal thickness remains relatively constant.

The McLeod Zone consists of three correlated plies, numbered from the base up L1 to L3. These plies are typically high ash coal. The zone has an average thickness of approximately 5 m, of which some 3.7 m is coal.

The McPherson Zone consists of four plies, identified, from the base up, as P1 through P4. The McPherson plies are the most consistent in terms of thickness and continuity. The average zone thickness is nearly 7 m, of which 6 m is coal.

The Silkstone Zone is located 70 m below the McPherson Zone and consists of two distinct coal seams: the Upper Silkstone and the Lower Silkstone seams. The Upper Silkstone Seam ranges in thickness from 0.3 m to 1.0 m, while the Lower Silkstone Seam, 10 m below, consists of two coal plies separated by a thin parting. This seam ranges in thickness from 3.0 m to 3.5 m.

Figure 7.4 Detailed Stratigraphic Column of the Target Coal Zones at the Vista Coal Project



8 Deposit Types

The type of coal deposit being explored and targeted for potential future exploitation can be described as being the thick interbedded type. In this type of coal deposit, thin coal accumulations are interbedded with clastic (non-coal) layers in sequences typically several, and often thicker, metres in thickness.

In the Vista Coal Project area, the coal zones occur at depths from sub-outcrop (below the base of the overlying till material, extending down dip to over 250 m deep. The targeted Coal Resources, in terms of deposit type, are defined as surface mineable.

Data acquired through standard coal exploration drilling methods and techniques are then collated and used to construct three dimensional computer generated geological models of structure and coal quality (grade).

In terms of structure, the target area can be described as being an area with low tectonic disturbance, the only main feature being the eastern monocline, resulting in strata dips of up to 10°. No major faults have been identified or interpreted within the project area. The geology type, as defined by geological complexity, is classed as moderate.

9 Exploration

The first geological investigations of the region were undertaken by the Geological Survey of Canada. Rutherford (1923, 1924) carried out reconnaissance mapping of the Embarrass, McLeod and Athabasca Rivers. Later, Lang (1944) and Irish (1945) published more detailed maps of the Entrance and Pedley map areas.

In the late 1920s, a small scale mining operation began at Drinnan, immediately west of the Hinton West property, by Jasper Coal Ltd. Underground mining periodically took place from that time to the mid-1940s, when the operation was abandoned due to a declining demand for domestic coal.

The entire Vista property is overlain with a blanket of glacial till and alluvium which varies from 5 m to 30 m in thickness, and as a consequence, all exploration has been conducted using primarily exploration drilling methods. There appears to be little in the way of exploration data derived from other methods *e.g.* airborne geophysical surveys, seismic surveys etc.

The exploration and development of the Vista Coal Project, as it is currently defined, was carried out by four separate companies: APM; Esso; Manalta; and most recently Coalspur.

10 Drilling

10.1 Hinton West and Hinton East

Associated Porcupine Mines Ltd carried out initial exploration between 1971 and 1974. A total of 15 drillholes, with downhole geophysical logging and minor sampling, were completed. Density, gamma ray and neutron logs were run on all holes and coal samples were taken from two holes.

Exploration by Esso on the Hinton properties was carried out continuously between 1981 and 1985. Their work included the drilling of 94 drill holes on the property for a total of 14,145.3 m. There were 182 core samples taken. Drill holes were geophysically logged with a full suite of geophysical logs, including gamma ray, calliper, long-spaced density, bed resolution density, focused beam electric, and sonic.

Coalspur conducted a drilling programme on the lease areas in February 2010 to collect samples for coal thickness and coal quality verification and validation. Five holes were drilled on Hinton West and seven holes were drilled on Hinton East. In the 2011/2012 season, Coalspur drilled a further four drill holes (three cored and one rotary) totalling 1,126 m. In total, Coalspur drilled 1,978.2 m.

Table 10.1 provides specific details regarding all drilling undertaken on the Hinton properties to date.

Table 10.1 Summary Drilling Statistics for Hinton (West and East)

Company	Year	Rotary Holes	Depth (m)	Core Holes	Depth (m)	Total Holes	Total Depth (m)
APM / Tanager	1972	7	594.0	0	0	7	594.0
APM / Tanager	1974	0	0	8	661.0	8	661.0
Esso	1981	9	2,782.2	1	400.0	10	3,182.2
Esso	1982	44	6,126.7	10	1,222.4	54	7,349.1
Esso	1983	13	1,305.0	0	0	13	1,305.0
Esso	1984	9	1,272.4	0	0	9	1,272.4
Esso	1985	4	567.0	4	469.6	8	1,036.6
Coalspur	2010-2012	1	341.0	15	1,637.2	16	1,978.2
Grand Total		**87**	**12,988.3**	**38**	**4,390.2**	**125**	**17,378.5**

10.2 McLeod River North and Z Block

Manalta initiated a major exploration programme on the McLeod River North property in 1980, and continued through calendar 1981. The programme was designed to define the surface mineable coal resources of the Val d'Or and McPherson zones within 100 m of the surface. A closely spaced drilling pattern was laid out on nine cross sectional drill access lines spaced between 800 m and 1,100 m apart along strike of the coal bearing zone. A total of 148 rotary drill holes (7,677 m), including 45 till holes, and 17 continuous wire line HQ cored drill holes (937 m) were completed and geophysically logged.

In addition, two 600 tonne bulk samples were extracted from the site in 1981 for pilot scale washability testing.

Manalta completed a 17 drill holes (1,505 m) on the Z Block lease in 1992 to define surface mineable Coal Resources. Eight of these holes were cored (702 m) to provide samples for coal quality analyses.

The drilling was undertaken with Mayhew 1000 and Failing 1250/1500 type rotary drills mounted on trucks or Nodwell tracked vehicles. These types of drills normally have a maximum drilling depth limitation of 120 m. The coring was conducted with a Cyclone TH100 truck mounted drill rig equipped with a 3 m Christensen triple tube core barrel. This allowed for continuous retrieval of a 6.99 cm diameter core inside a plastic liner. The reported core recovery ranged from 85% to 100% with an average value of 95%.

Coalspur conducted an extensive exploration drilling programme from September 2010 through February 2011 to verify coal quantity and quality expectations, and to infill between the historic Manalta drill lines for detailed resource definition. Three cored drill holes were completed on the Z Block and 55 rotary plus 26 core holes on the McLeod North zone for a total of 84 holes and 8,127 m. Table 10.2 summarises the drilling on the McLeod and Z Block leases.

The equipment used consisted of two Ingersoll Rand TH60 truck mounted drill rigs. Coring was performed with a Christensen wireline system using a split inner barrel to facilitate on site sampling. Both 7.62 cm and 15.6 cm core was cut; the larger diameter specifically for attrition testing (drop shatter) to model washability performance.

All holes were geophysically logged running a full suite of gamma, density, single point resistance and calliper. Core recovery was excellent, averaging over 90% for the 7.62 cm core and 100% for the larger 15.6 cm core. In addition, ten closely spaced 15.6 cm cores were collected from a single drill site from the Val d'Or Seam to provide enough volume for bulk sample washability testing and follow up combustion tests.

Table 10.2 Summary Drilling Statistics for McLeod River North and Z Block

Company	Year	Rotary Holes	Depth (m)	Core Holes	Depth (m)	Total Holes	Total Depth (m)
McLeod River North							
Manalta	1980	31	1,984.0	7	310.0	38	2,294.0
Manalta	1981	72	5,050.0	10	627.0	82	5,677.0
Manalta	Till holes	45	643.0	0	0	45	643.0
Coalspur	2010/2011	55	4,948.0	26	2,867.0	81	7,815.0
Sub-total		***203***	***12,625.0***	***43***	***3,804.0***	***246***	***16,429.0***
Z Block							
Manalta	1992	9	803.0	8	701.5	17	1,504.5
Coalspur	2011	0	0	3	312.1	3	312.1
Sub-total		***9***	***803.0***	***11***	***1,013.6***	***20***	***1,816.6***
Grand Total		**212**	**13,428.0**	**54**	**4,817.3**	**266**	**18,245.6**

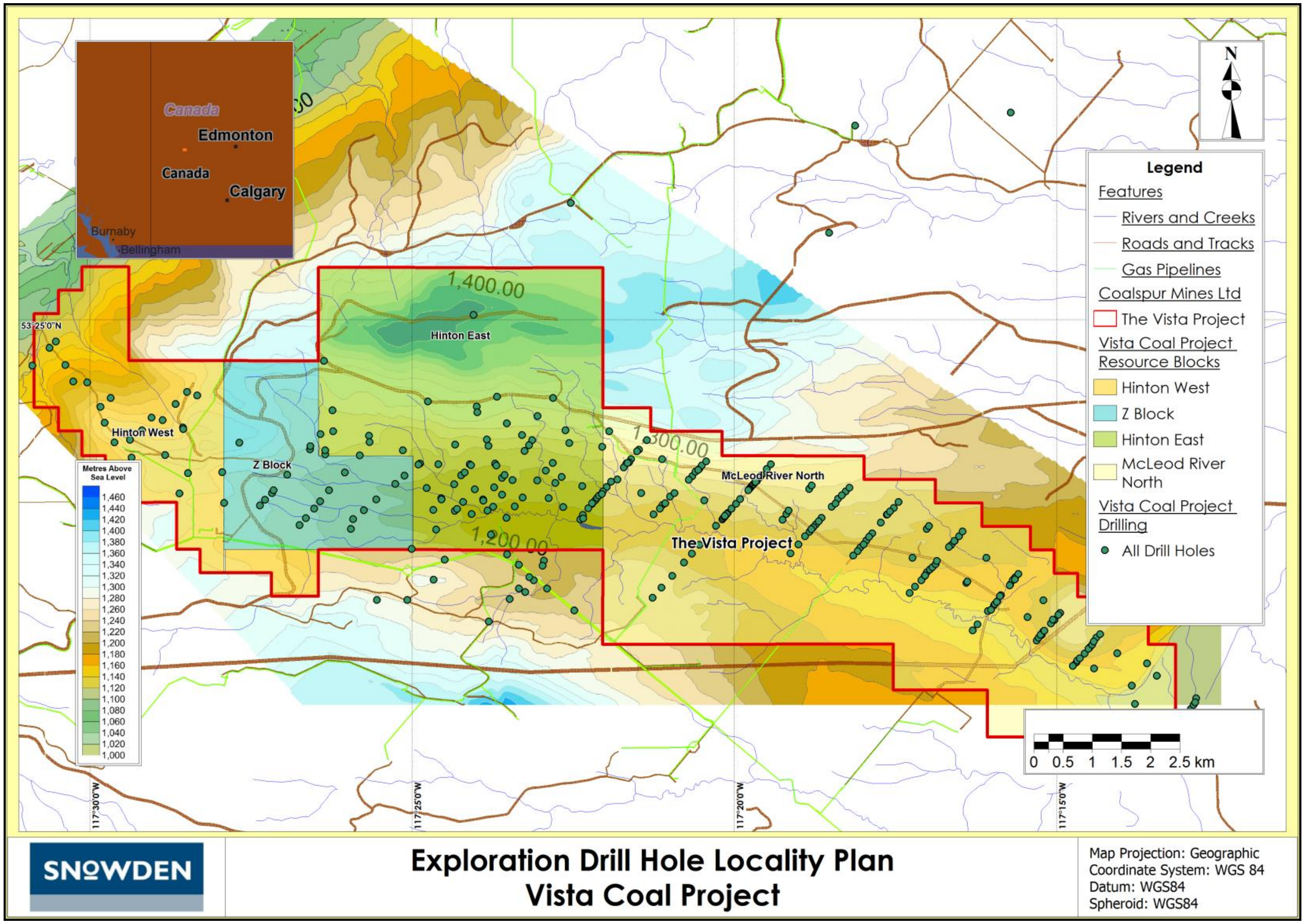
All of the available survey, lithological and geophysical log, and core sample data (including laboratory analytical data) from all of these programmes has been reviewed and compiled by Moose Mountain Technical Services ("MMTS"). The validated information has formed the basis of the geological models used in subsequent Coal Resource and Coal Reserve estimation exercises. Table 10.3 summarises the drilling undertaken on all of the Vista Coal Project leases to date.

Table 10.3 Summary of Drilling at the Vista Coal Project (as at March 2014)

Company	Year	Rotary Holes	Depth (m)	Core Holes	Depth (m)	Total Holes	Total Depth (m)
APM / Tanager	1972	7	594.0	0	0	7	594.0
APM / Tanager	1974	0	0	8	661.0	8	661.0
Manalta	1980	31	1,984.0	7	310.0	38	2,294.0
Esso	1981	9	2,782.2	1	400.0	10	3,182.2
Manalta	1981	117	5,693.0	10	627.0	127	6,320.0
Esso	1982	44	6,126.7	10	1,222.4	54	7,349.1
Esso	1983	13	1,305.0	0	0	13	1,305.0
Esso	1984	9	1,272.4	0	0	9	1,272.4
Esso	1985	4	567.0	4	469.6	8	1,036.6
Manalta	1992	9	803.0	8	701.5	17	1,504.5
Coalspur	2011	56	5,289.0	44	4,816.3	100	10,105.3
Grand Total		**299**	**26,416.3**	**92**	**9,207.8**	**391**	**35,624.1**

Figure 10.1 shows the positions of all drilled holes over the Vista Coal Project.

Figure 10.1 Drill Hole Locality Plan



10.3 Core Recovery, Handling, and Sampling

Snowden has not been directly involved in any of the exploration and drilling programmes undertaken to date. MMTS, however, have been directly involved in the recent Coalspur exploration drilling programmes and have previously signed off as Qualified Persons (Snowden, 2012 and Golder 2012) for Item 4 through Item 12 (inclusive). For the purposes of this ITR, Snowden accepts responsibility for the data and information previously reported by MMTS for Item 10.

MMTS was not involved in the historical work undertaken by Esso and Manalta, though all of this work was reportedly completed (and later verified by MMTS) under the direct supervision of an experienced geologist.

The sampling procedures used by Manalta for sampling coal in core included:

- surveying of drill hole locations (X, Y, and Z)
- systematic sampling of coal by collecting the entire coal interval (ply sampling)
- systematic core logging and down hole geophysics completed to better define coal intersections
- sealing coal samples in plastic bags and shipping them to a certified laboratory for analysis
- archiving analysis certificates for future inspection.

Core recovery was aided with a plastic liner inside a split barrel of an HQ wireline core barrel system. Once filled, the core tubes were capped, labelled and set in snow to freeze. Down hole geophysics was completed on all holes. Coal core tubes were then sent to Birtley Laboratories in Calgary. The core tubes remained frozen until they were sampled in individual plies. All coal plies greater than 0.2 m were sampled. Parting material less than 0.2 m was included with the coal samples. Partings from 0.2 m to 0.5 m were analysed. Partings greater than 0.5 m were not sampled.

Work conducted by Esso at Hinton West and Hinton East used the same wireline coring methodology and system. All coal plies greater than 0.3 m were sampled. Parting material less than 1.0 m was included with the coal samples. Partings from 0.3 m to 1.0 m were analysed. Partings greater than 1.0 m were not sampled.

After logging, geophysical logs were compared to obtain final depths and thicknesses of coal seams. Sample plies were then chosen, bagged and sent for analysis.

Core recovery was generally excellent to good, ranging from 80% to 100% and averaging 95%.

In MMTS's opinion, both Esso and Manalta exercised great care and diligence to maintain sample integrity.

The core logging and sampling procedures applied by MMTS during the Coalspur exploration programmes followed closely the ASTM Standard, D5192, 'Standard Practice for Collection of Coal Samples from Core'. The collection of coal samples from recovered core was handled according to the following procedures:

- To identify the coal intervals and their host rock material, each completed core hole was geophysically logged using a four function downhole tool recording borehole diameter, rock density, natural gamma, and resistivity of the formation.
- The coal cores, retrieved from the 3 m long split barrel, were first cleaned of any mud or contaminants, marked with the top and bottom run intervals, and then photographed for permanent visual identification.
- The top and bottom depths of the cored interval, as recorded by the driller, were then compared to the measured recovered core interval to determine overall recovery. Using the geophysical log record, the recovered coal intervals were also compared to the true in situ coal thickness. In drill holes where any recovered coal core thicknesses were less than 85% of in situ thicknesses, the drill hole was re-drilled to obtain a better recovery. If after several attempts the recovery remained less than 85%, the recovered coal core with the best recovery was used for sample analysis.
- Using the best-recovered coal core interval, the core was then subdivided into separate lithologic units. These were then measured and described using standard geological terms to identify and record amongst others, lithology, colour, hardness, grain size, contacts, and contamination, as well as to record core loss and any coal sample intervals extracted for analysis.

Samples taken for analysis were extracted according to the following procedures:

- The minimum thickness for a coal sample interval was 60 cm (2.0 ft.).
- Intra-seam partings, up to a maximum thickness of 15 cm (6 in.) were included in the sampled coal intervals.
- Where the intra-seam parting is less than the maximum parting thickness i.e. <15 cm, the adjacent coal beds must individually be at least 2 times the parting thickness to allow the coal and parting material to be sampled together. The total sample thickness must be greater than the minimum thickness for a coal sample interval i.e. >60 cm.
- Carbonaceous shale, bone (impure coal) and rock partings greater than 15 cm were sampled separately to determine their dilution effect. If the carbonaceous material, when combined with the coal, meets the minimum requirements for coal quality, they may be included with the overall coal sample interval.
- A 15 cm roof and floor sample was taken from each major coal zone.

The samples collected from core were then placed in individual plastic bags marked on the outside with the drill hole number and sample number, and then carefully sealed to prevent excessive moisture loss. The samples were then placed together in one larger collecting bag and marked on the outside with the drill hole number.

11 Sample Preparation, Analyses, and Security

Snowden has not been directly involved in any of the sampling activities and analytical programmes undertaken to date. MMTS, however, have been directly involved in the recent Coalspur exploration drilling programmes and have previously signed off as Qualified Persons (Snowden, 2012 and Golder 2012) for Item 4 through Item 12 (inclusive). For the purposes of this ITR, Snowden accepts responsibility for the data and information previously reported by MMTS for Item 11.

MMTS was not involved in the historical work undertaken by Esso and Manalta, though all of this work was reportedly completed (and later verified by MMTS) under the direct supervision of an experienced geologist.

All exploration work conducted by Coalspur was under the direct supervision of MMTS.

11.1 Esso Sampling and Analysis

The Esso sampling protocol for cores collected in 1981, 1982, and 1985 was developed by Esso/DB Engineering to isolate individual coal and rock parting plies within each of the six seams for proximate analysis and washability (float/sink) testing. The plies could then be recombined into logical mining units and washability performance could be modelled.

Continuous 7 cm diameter core intervals were collected inside PVC plastic core liners in 3 m intervals. The liner ends were sealed and the sequenced core was sent to Calgary for logging and sampling. The cores were correlated to the geophysical log record for each hole to determine recovery and identify any lost core sections. Generally, all coal plies greater than 0.3 m were sampled. Parting material less than 1.0 m thick was included with the adjacent coal samples as it was deemed not feasible to selectively mine by surface mining methods. Partings greater than 1.0 m thick were not sampled as they were considered to be able to be selectively mined by surface mining methods. . In total, 135 plies were sampled from 11 cored drill holes in the 1981-83 programme and an additional 47 plies were sampled from four cored drill holes in the 1985 programme.

Birtley Coal and Minerals Testing (Calgary) conducted standard proximate analysis (moisture, ash content, volatile matter) and sulphur on each of the 182 individual ply samples. The samples were tumbled and screened at 19 mm x 6 mm, 6 mm x 0.5 mm, and 0.5 mm x 0 mm size fractions. The 19 mm x 6 mm and 6 mm x 0.5 mm fractions were floated at relative densities of 1.4, 1.5, 1.6, and 1.7, with proximate analysis performed on each float and the final sink fraction.

11.2 Manalta Sampling and Analysis

The Manalta sampling protocol for cores collected in 1980, 1981, and 1992 was developed by Manalta to isolate individual coal and rock parting plies within each of the three main coal zones (Val d'Or, McLeod, and McPherson) for proximate analysis and washability (float/sink) testing. The plies could then be recombined into logical mining units and washability performance could be modelled.

Continuous 7 cm diameter core intervals were collected in 3 m intervals in PVC liners. The liner ends were sealed and the sequenced core was sent to Calgary for logging and sampling. The cores were correlated to the geophysical log record for each hole to determine recovery and identify any lost core sections. Generally, all coal plies greater than 0.2 m were sampled. Parting material less than 0.2 m thick was included with the adjacent coal samples as it was deemed not to be selectively mineable by surface mining methods. Partings greater than 0.5 m thick were not sampled as they were deemed selectively mineable by surface mining methods..

Coal ply samples with less than 90% recovery were rejected from the analytical programme.

Birtley Coal and Minerals Testing (Calgary) conducted limited proximate analysis (moisture and ash content), calorific value, equilibrium moisture, and specific gravity on each of the individual ply samples. Manalta combined these individual plies into logical mining units. The samples were crushed and screened at 9.5 mm x 0.5 mm, and 0.5 mm x 0 mm size fractions. The 9.5 mm x 0.5 mm fractions were floated at relative densities 1.4, 1.5, 1.6, and 1.8, with proximate analysis performed on each float and the final sink fraction. The 0.5 mm x 0 mm was not processed.

11.3 MMTS Sampling and Analysis

The MMTS sampling and analytical programme was developed by Bob Leach Pty Ltd. Individual coal seam and rock ply core samples were shipped to ALS Laboratories in Vancouver with a corresponding sample manifest to insure receipt.

On the 7.62 cm diameter core samples the following protocol was followed:

- Each sample was weighed and Apparent Relative Density (“ARD”) tests were undertaken prior to sample crushing. Instructions were provided to composite ply samples into logical mining units (coal and non-removable parting material). Each ply was crushed to -19 mm and combined on the basis of ARD and thickness.
- One quarter of the combined sample was tested for Proximate Analysis, Calorific Value, Total Sulphur, Chlorine and Specific Gravity.
- The remaining three quarters of the composite samples was screened at 0.5 mm. The minus 0.5 mm fraction was analysed for Proximate Analysis and Calorific Value.
- The +0.5 mm material was subjected to washability testing at relative densities of 1.4, 1.5, 1.6, 1.7, 1.8 and 2.0. Proximate Analysis and Calorific Value were performed on all floats and the final sink fraction.
- Instructions were provided to create further clean coal composites.

On the 15.6 cm large diameter core, the following protocol was followed to generate attrition data for wash plant design:

- Each sample was weighed and ARD determined prior to sample crushing. Instructions were provided to composite individual ply samples into logical mining units (coal and non-removable parting material).
- The combined sample was subjected to a Drop Shatter Test. The sample was dropped twenty times from 2 m and screened at -50 mm. Any oversize was hand-knapped to pass 50 mm. The broken sample was dry sized at 32, 16, 8, 4, and 2 mm. The dry size distribution and any coal losses were calculated for material reporting below 2 mm.
- A wet tumble sample was prepared according to instructions. The sample was wet tumbled for 5 minutes with cubes. Wet sizing was performed at 32, 16, 8, 2, 1, 0.25 and 0.125 mm fractions.
- Float/sink samples of +16 mm, 16 mm x 4 mm, 4 mm x 2 mm, and 2 mm x 0.25 mm were prepared. Each increment was washed at relative densities 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70, 1.80 and 2.0. Each float and the final sink fraction was analysed for Proximate Analysis and Calorific Value.
- The 0.25 mm x 0.125 mm and -0.125 mm fractions were analysed for Proximate Analysis.
- Clean composite samples from both sets of core data were further analysed for Ash Chemistry, Ash Fusion and Petrographic Analysis.

12 Data Verification

12.1 MMTS Verification

MMTS completed numerous levels of verification, including but not limited to:

- geological interpretation of all available drill holes and geophysical logs;
- database construction and entry of sample intervals, individual ply analysis and composite assays; and
- checking drill hole collar coordinates against topography to eliminate any obvious errors in location.

MMTS constructed all drillhole data lithology and coal quality database files, which were in turn uploaded into MineSight® software to create a 3D resource block model for three dimensional verification. MMTS believes that the database files are accurate and presents no major threat to the resource estimate.

While it is not possible to physically verify the historical sampling procedures and analytical processes, it is MMTS's opinion that the sampling and analytical protocols were sound and the reported results appear reasonable based on knowledge of similar coal mining operations nearby.

12.2 Snowden Validation

Snowden undertook to perform certain validation exercises on the data as supplied to Snowden by Coalspur.

Essentially two main data sets were received by Snowden:

- Drill Hole Data
  - Collar positions
  - Basic lithology
  - Ply-by-ply proximate coal qualities
- MineSight Block Model
  - Various grid files exported in ASCII (CSV) format from the Coalspur block model
  - Grids include surfaces of roof and floor (depth and elevation), as well as unit thickness, for various lithological interfaces and units (coal, overburden, till etc.), and a range of coal quality parameters (proximate analyses)

These data sets have been reviewed and interrogated in specialised software appropriate to each data type. Drill hole data has been assessed in Supervisor (geostatistical software) while block model data has been assessed in Vulcan (3D geological modelling software). The exported block model grids have also been compared with the drill hole data in Supervisor.

12.2.1 Exploration and Drill Hole Data

The drill hole database (in spreadsheet format) named '*Coalspur Mine Plan_RAWdb_20110502-old.xls*' was interrogated in the geostatistical software programme Supervisor.

A number of edits were made prior to processing in Supervisor, including but not limited to:

- Ply recorrelation:
  - Plies named "Unknown" in the spreadsheet received were recoded to the Ply Name (coal ply or stone ply) deemed most appropriate based on the reported air dry ash content and stratigraphic position. An example is presented in Figure 12.1.
  - Obvious errors were identified and corrected as appropriate. An example is presented in Figure 12.2.
- Relative Density ("RD") calculations:
  - Where air dry RD values were absent in the original data, an RD was previously calculated using the Moose Mountain Technical Services (MMTS, 2010) formula based on the air dry ash content. The formula is:

$$RD\ ad\ = 1.26 + \frac{(1.75 - 1.30) * 50}{Ash\%\ (ad)}$$

Snowden is of the opinion that the formula is appropriate for the rank and type of coal.

  - Snowden undertook several correlation exercises to validate the MMTS formula and is comfortable that the MMTS formula produces reliable results.

In Figure 12.1 the upper Unknown Ply has a similar ash content to the Val d'Or 3 Upper ("V3U") Ply immediately above the 0.09 m Stone Ply separating the two, therefore it was recoded to V3U. The lower Unknown Ply has a much lower ash content and is separated from the upper coal ply by a stone parting of 0.25 m, therefore is was recoded to Val d'Or 3 Lower ("V3L").

Figure 12.1 Recorrelation of plies based on stratigraphy and ash content

From	To	Thick	Seam	Ply	M% ad	Ash% ad
57.58	57.61	0.03	Val D'Or	Stone	0.80	86.83
57.61	57.76	0.15	Val D'Or	V3U	3.54	9.14
57.76	57.96	0.20	Val D'Or	V3U	2.52	42.97
57.96	58.05	0.09	Val D'Or	Stone	1.39	91.45
59.56	59.70	0.14	Val D'Or	Unknown	2.60	49.20
59.70	59.95	0.25	Val D'Or	Stone	0.73	92.36
59.95	60.24	0.29	Val D'Or	Unknown	3.70	16.78
60.24	60.59	0.35	Val D'Or	Stone	1.26	91.83

From	To	Thick	Seam	Ply	M% ad	Ash% ad
57.58	57.61	0.03	Val DOr	Stone	0.80	86.83
57.61	57.76	0.15	Val DOr	V3U	3.54	9.14
57.76	57.96	0.20	Val DOr	V3U	2.52	42.97
57.96	58.05	0.09	Val DOr	Stone	1.39	91.45
59.56	59.70	0.14	Val DOr	V3U	2.60	49.20
59.70	59.95	0.25	Val DOr	Stone	0.73	92.36
59.95	60.24	0.29	Val DOr	V3L	3.70	16.78
60.24	60.59	0.35	Val DOr	Stone	1.26	91.83

SNOWDEN

Database Correlation Corrections
Vista Coal Project

Figure 12.2 Data entry error correction

From	To	Thick	Seam	Ply
51.31	54.20	2.89	Val D'Or	V1_V2
100.60	104.80	4.20	McLeod	Stone
129.15	136.05	6.90	McP1_2_3_4	Unknown

From	To	Thick	Seam	Ply
51.31	54.20	2.89	Val DOr	V1_V2
100.60	104.80	4.20	McLeod	Stone
129.15	136.05	6.90	McPherson	McP1_2_3_4

SNOWDEN

Database Correlation Corrections
Vista Coal Project

It is clear in Figure 12.2 that the Seam and Ply entry for the McPherson Seam was initially entered incorrectly. The code “McP1_2_3_4” is a Ply Code and was initially entered into the Seam field, with “Unknown” then being captured as the Ply Code. The correction as shown was made.

The data were then interrogated and basic statistics and correlations were determined for certain coal quality parameters. The key coal quality parameters are considered to be:

- Air Dry Moisture Content (M_{ad})
- Air Dry Relative Density (RD_{ad})
- Air Dry Ash Content (Ash_{ad})
- Air Dry Calorific Value (CV_{ad})

It is from these qualities that the *in situ* values are calculated using basic formulae. The only parameter that is assumed is *In Situ* Moisture (“M_{is}”). Although both Total Moisture (“TM”) and Equilibrium Moisture (“EQM”) tests have been conducted on a range of samples collected during the various phases of exploration, M_{is} has been assumed to be one percentage point greater than the assumed EQM, which is fixed for each ply dependent on the geographic location of the sample *i.e.* all coal plies from East Block are assigned an EQM of 10.0%, and therefore a M_{is} of 11.0%.

Equilibrium and *In Situ* Moisture

Snowden has assessed the analysed results for TM and EQM, and is comfortable that the assumptions regarding M_{is} as applied are reasonable. Figure 12.3 to Figure 12.5 present comparatives between the assumed regional EQM and the laboratory determined EQM from actual samples.

Figure 12.3 Regional EQM for West Block Coal (assumed left, laboratory right)

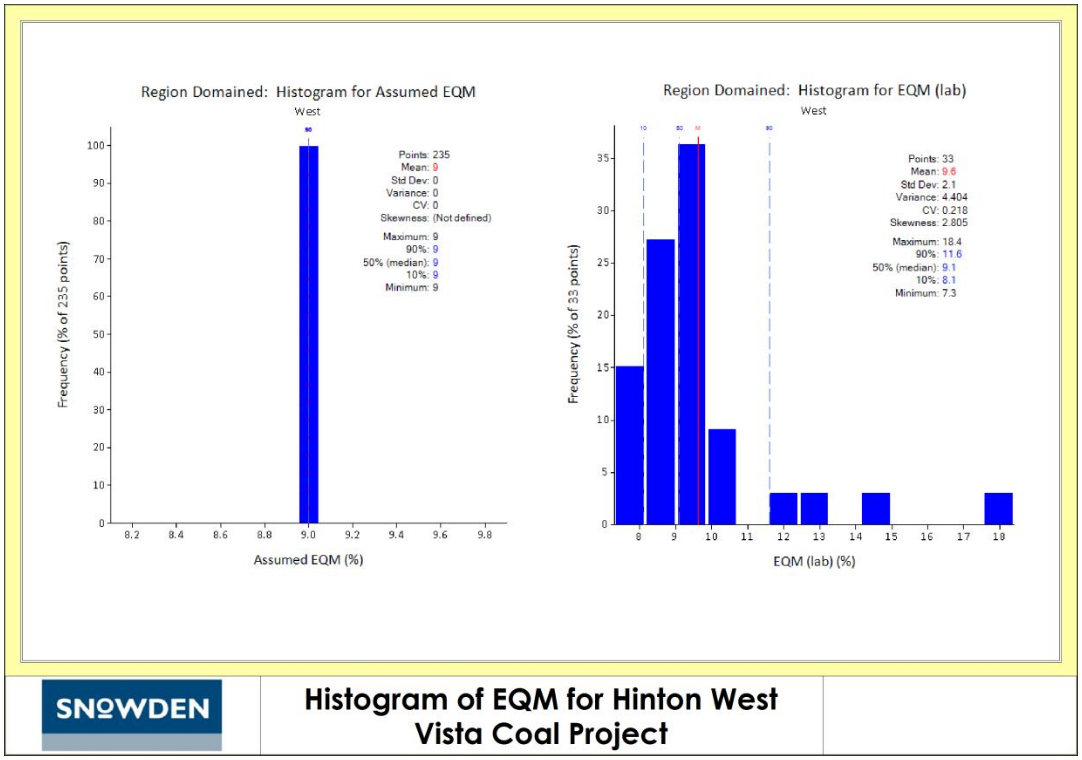


Figure 12.4 Regional EQM for East Block Coal (assumed left, laboratory right)

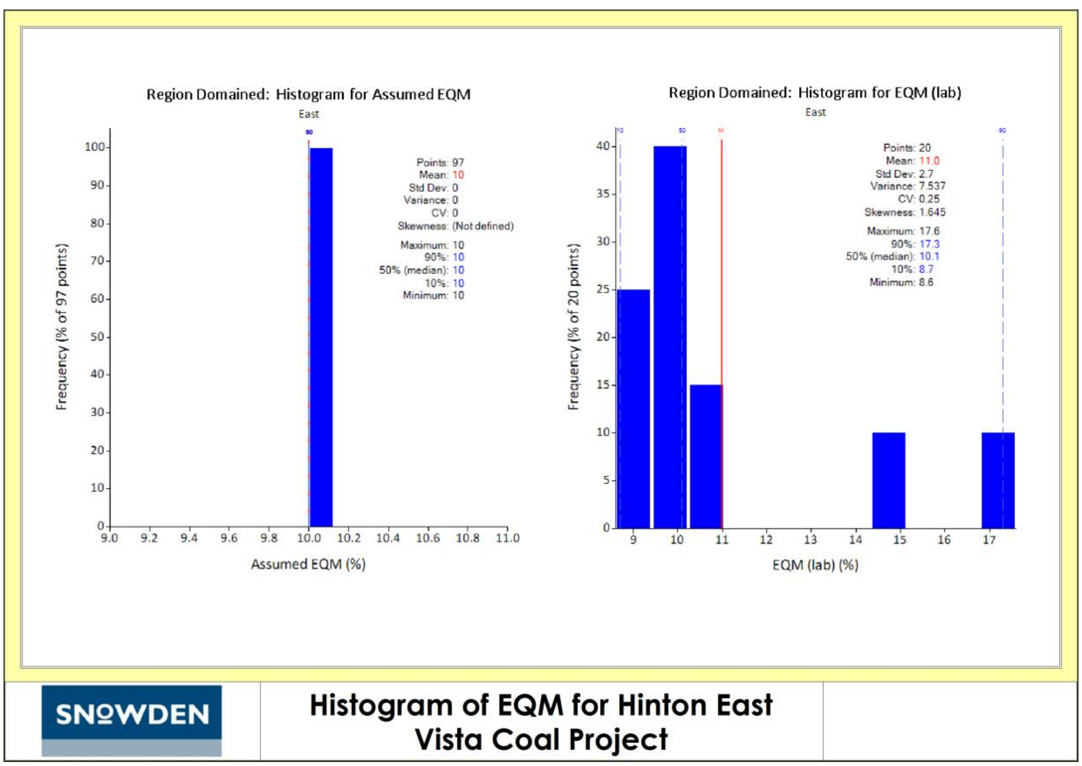
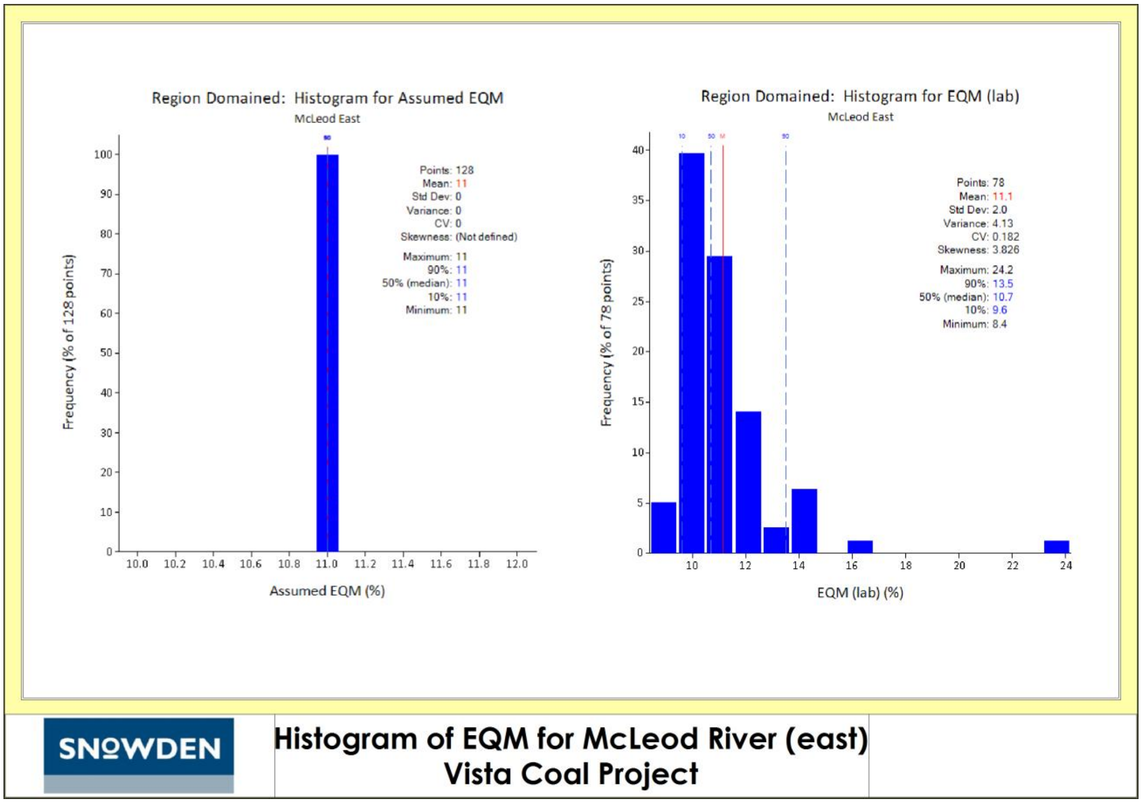


Figure 12.5 Regional EQM for McLeod (east) Coal (assumed left, laboratory right)



The addition of one percentage point to the EQM to estimate the regional *in situ* moisture is in line with previous studies for northern hemisphere coals that suggest that EQM slightly underestimates M_{is} *e.g.* Selvig and Ode (1953), Ode and Gibson (1960), and Luppens and Hoeft (1991) in Fletcher and Sanders (2003).

Air Dry Moisture, M_{ad}

Distributions for M_{ad} are presented in Figure 12.6 and Figure 12.7 (coal only and non-coal respectively). The distributions are log normal, indicating a slight positive skew resulting from several anomalous high moisture values recorded for the Val d'Or Seam (coal and non-coal samples) in the McLeod East region for borehole MR81-17C.

Figure 12.6 Distribution of M_{ad} for coal samples across the Vista Coal Project

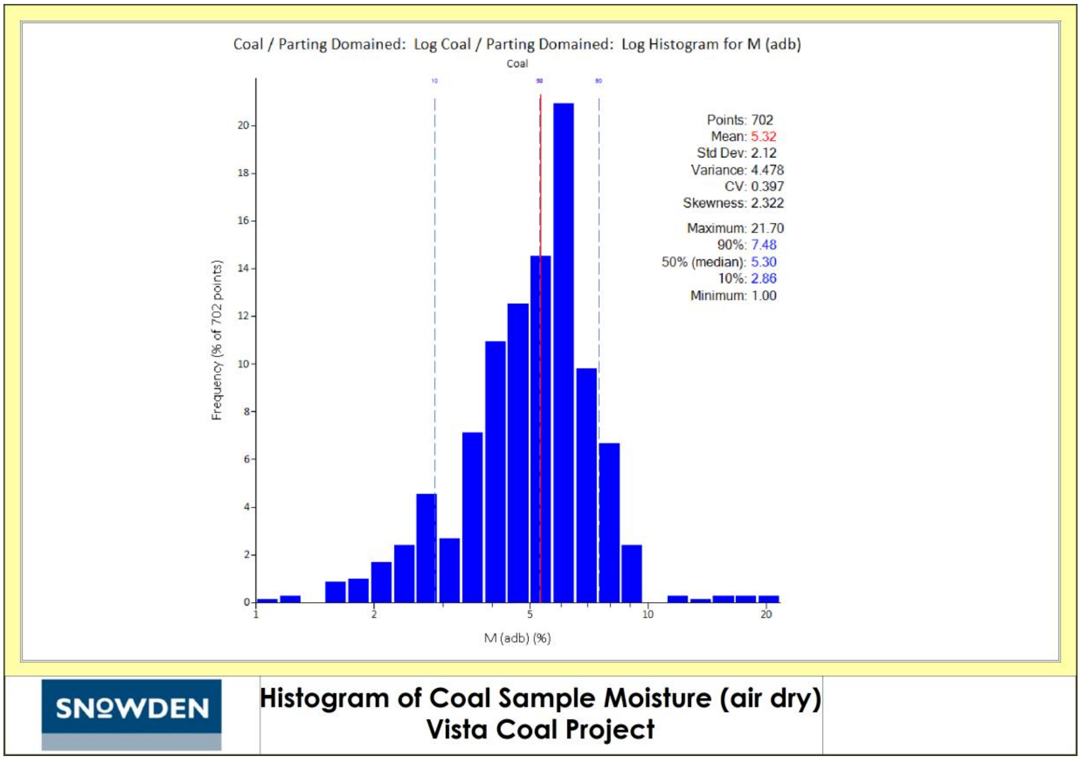
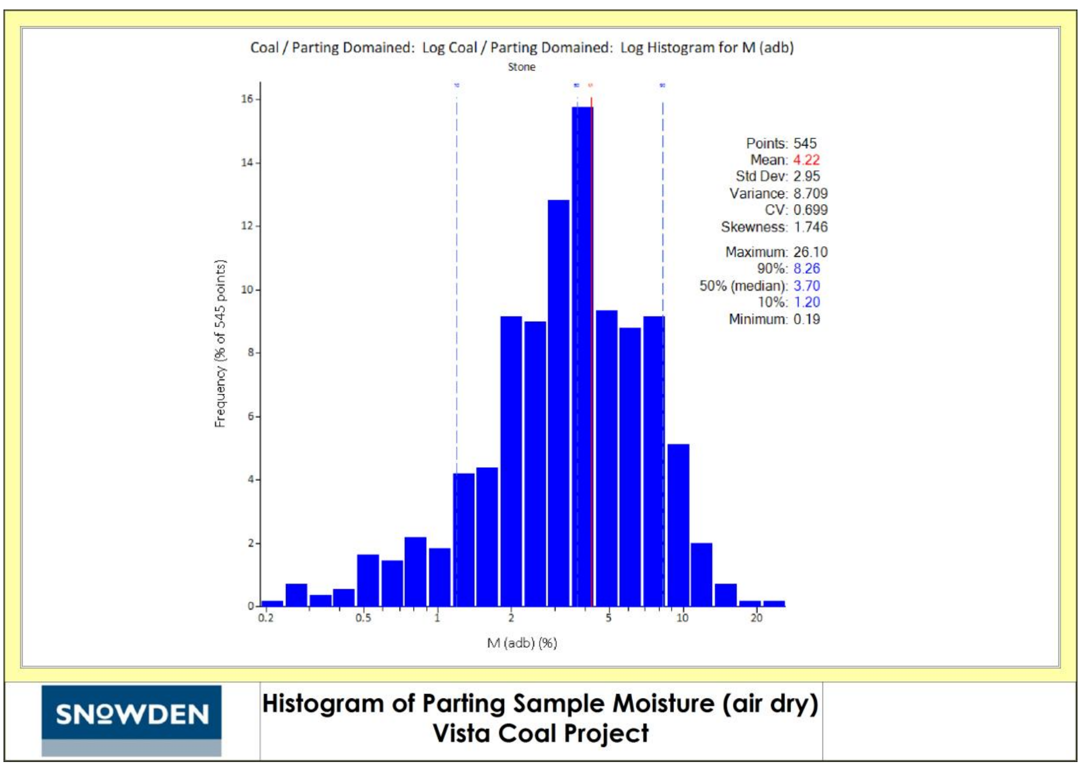
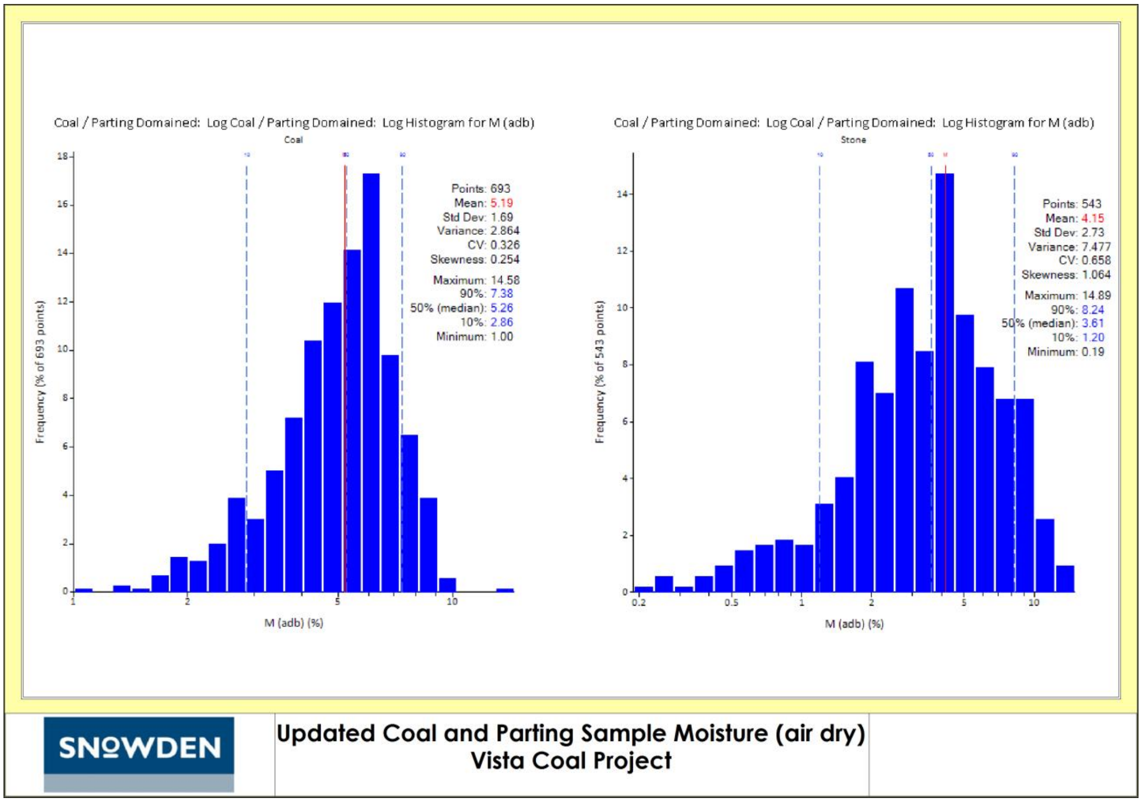


Figure 12.7 Distribution of M_{ad} for parting samples across the Vista Coal Project



Given that all the anomalously high M_{ad} values are derived from only one borehole, Snowden has assumed these values to be incorrect and deleted them from the edited data set. The updated distributions are presented in Figure 12.8 (coal left, non-coal right).

Figure 12.8 Edited and updated distribution of M_{ad} for coal and parting samples across the Vista Coal Project

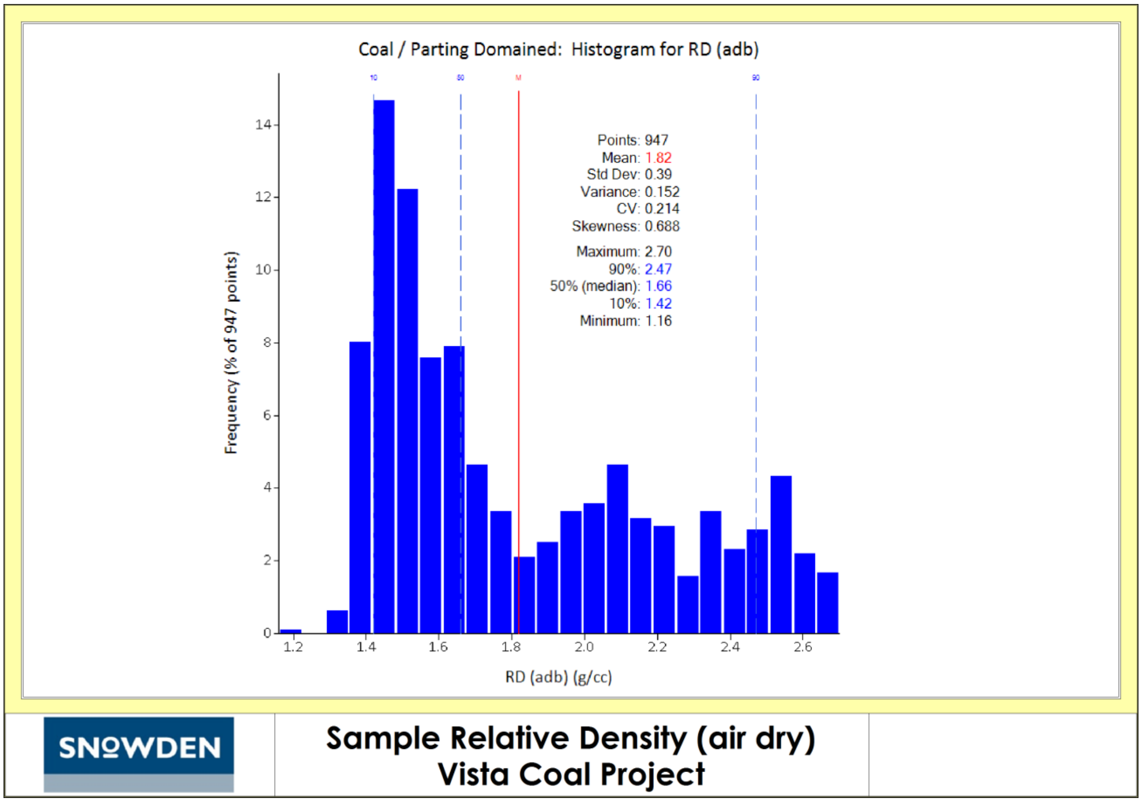


Although visually the distributions do not look materially different, the skewness has decreased, especially for the coal only distribution. The coal only distribution is now practically a normal distribution with a skewness of less than one.

Air Dry Relative Density, RD_{ad}

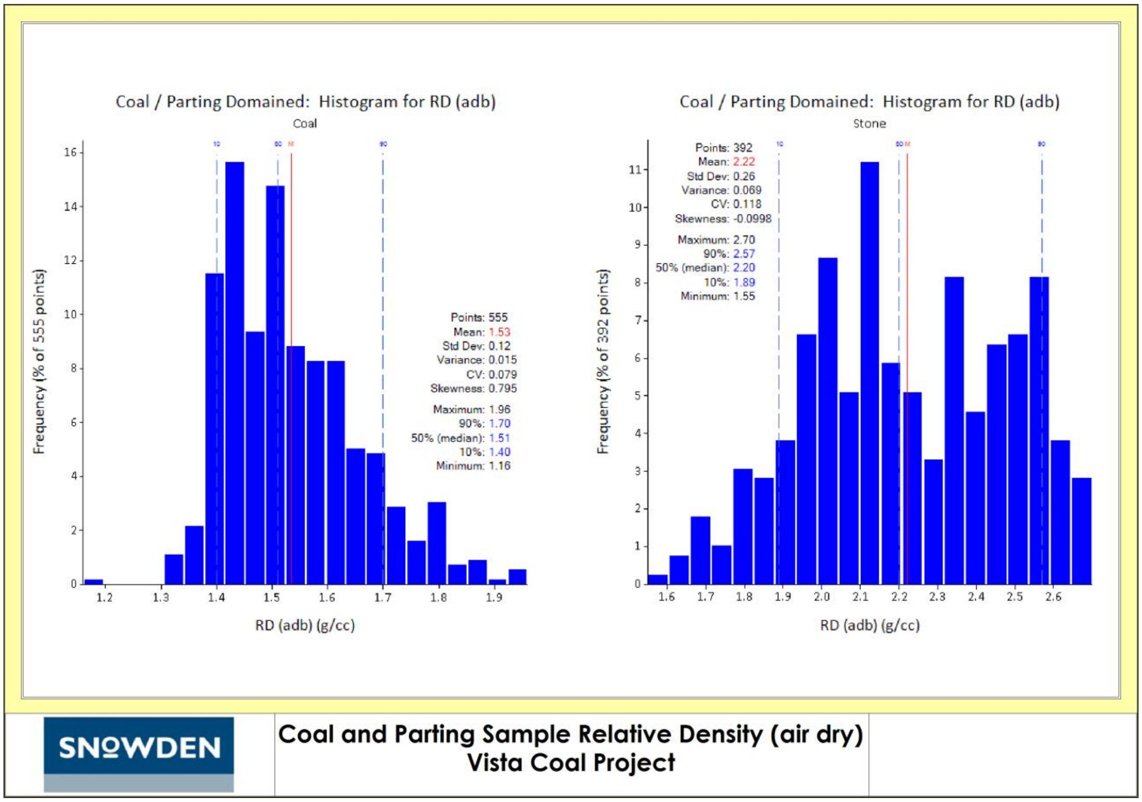
The global RD_{ad} distribution for the Vista Project is presented in Figure 12.9. It is clear that at least two distinct populations exist in the data, and this stands to reason as the coal (RD<1.8) and non-coal (RD>1.8) ply samples were sampled together as part of the parent seam.

Figure 12.9 Distribution of RD_{ad} for all samples across the Vista Coal Project



Once domained, the RD_{ad} distributions for coal and non-coal can be properly assessed. Figure 12.10 presents the domained distributions for coal (left) and non-coal (right). These distributions are what could reasonably be expected for thick interbedded coal seams as encountered at the Vista Project. In fact, the non-coal RD_{ad} distribution shows potentially two populations: this may be a function of the non-coal ply lithologies being undifferentiated between carbonaceous mudstones (lower density range) and truly clastic partings (higher density range).

Figure 12.10 Distribution of RD_{ad} for coal and parting samples across the Vista Coal Project



Air Dry Ash, Ash_{ad}

It is well understood that RD and Ash are well correlated in coal seams, with RD being the dependent (y) variable while Ash is the independent (x) variable. Therefore, as expected, the global Ash distribution shows at least two populations across the Vista Project samples (Figure 12.11). Once domained according to sampled lithology ply *i.e.* coal or non-coal (parting), the distributions appear as single populations with close to normal distributions (Figure 12.12).

A measure of the veracity of proximate analytical data is the correlation between Ash_{ad} and RD_{ad}. Figure 12.13 shows the correlation scatter plot for the mixed data set. It is clear that two regressions are presented: one for Ash_{ad} between ±10% and ±55%; and one for Ash_{ad} between ±55% and ±95%. The domained regression cross plots are presented in Figure 12.14 and Figure 12.15.

Figure 12.11 Distribution of Ash_{ad} for coal and parting samples across the Vista Coal Project

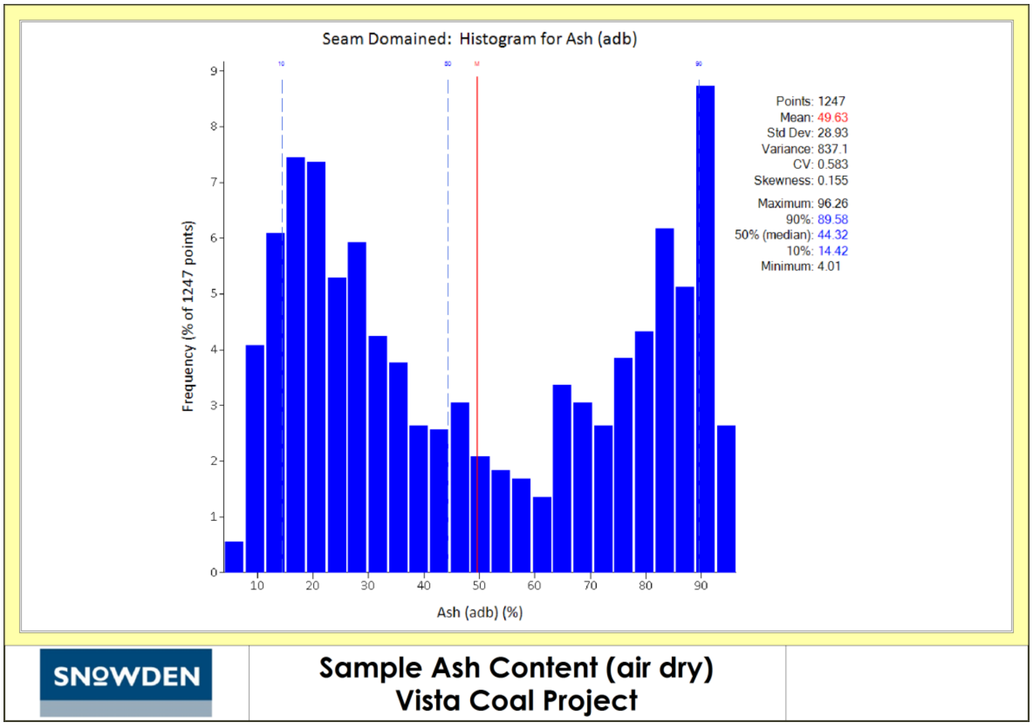


Figure 12.12 Coal / Parting domained distribution of Ash_{ad} for samples across the Vista Coal Project

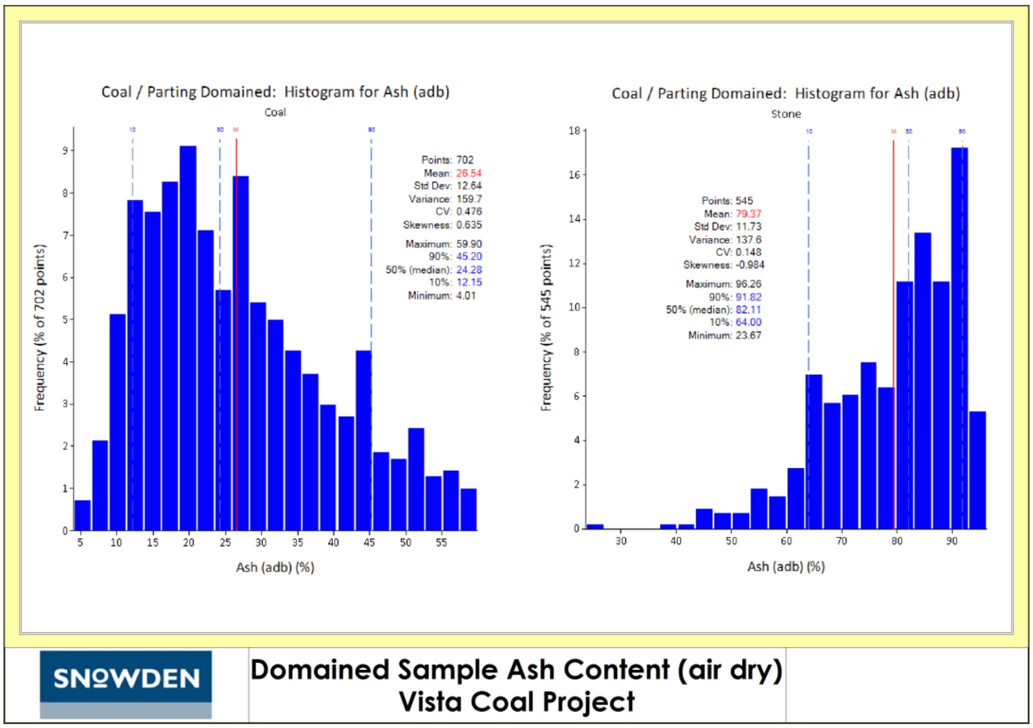


Figure 12.13 Coal / Parting correlation of Ash_{ad} and RD_{ad} for samples across the Vista Coal Project

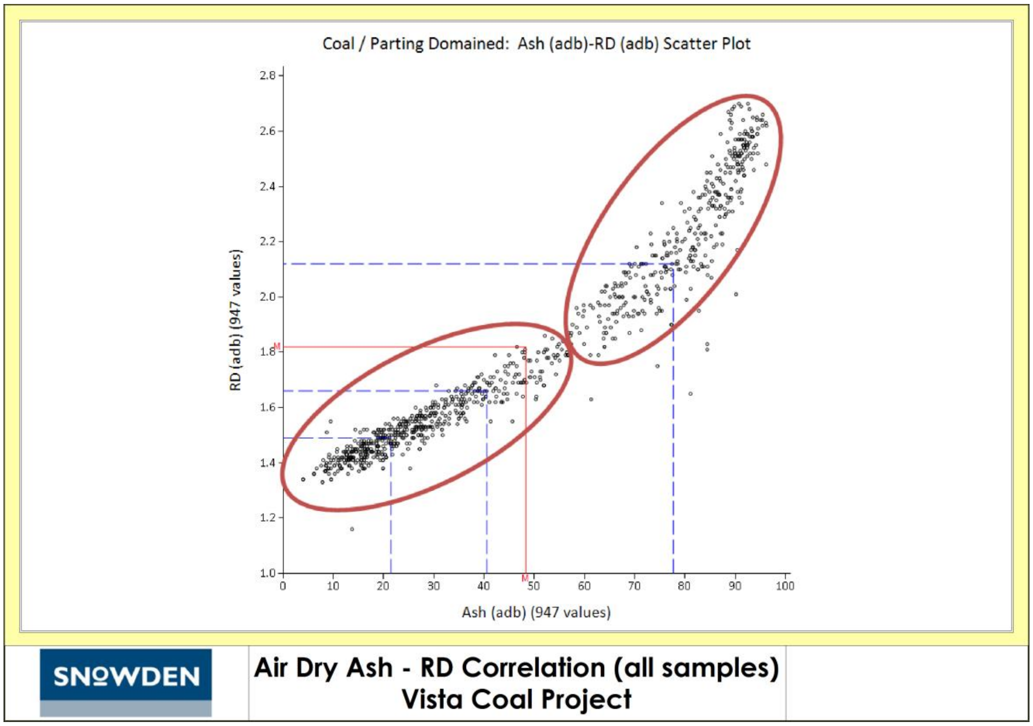


Figure 12.14 Ash_{ad} – RD_{ad} for coal samples across the Vista Coal Project

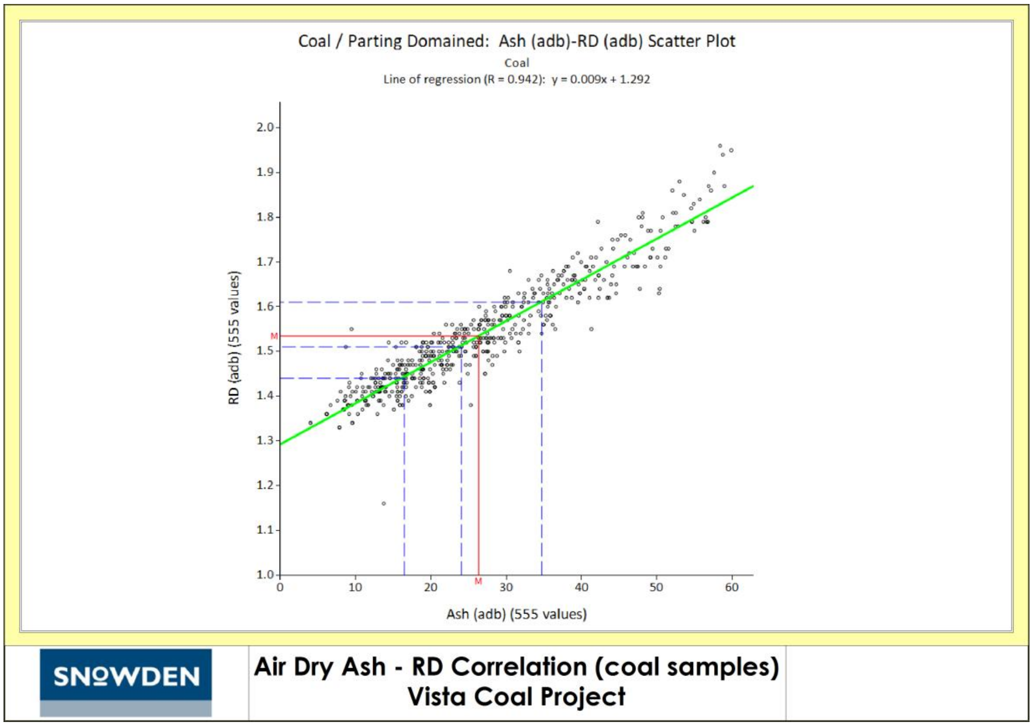
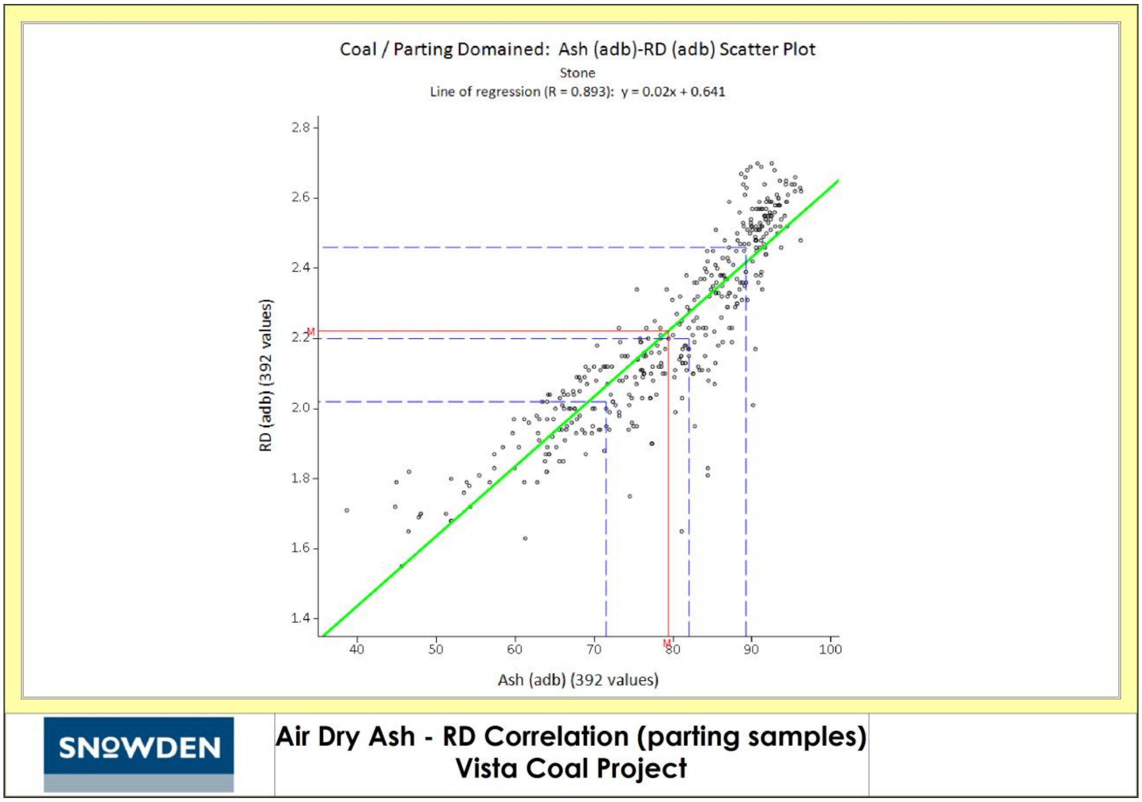


Figure 12.15 Ash$_{ad}$ – RD$_{ad}$ for parting samples across the Vista Coal Project

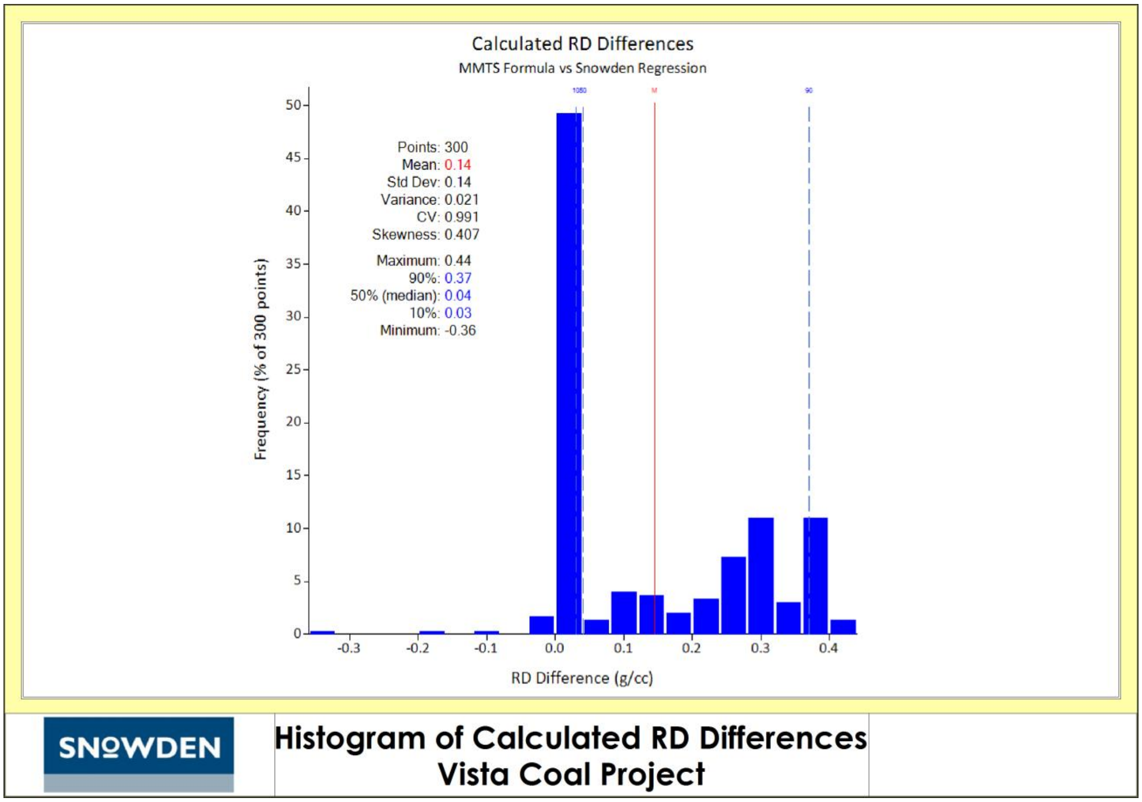


As can be expected, the regression is very good with correlation coefficient, R, approaching unity (0.942). The non-coal correlation is slightly weaker with an R-value of 0.893. However, this is still a strong enough correlation indicating robust sample and analytical data.

It will be noticed that the total number of RD analyses (947) is significantly less than the total number of Ash analyses (1,247). RD analyses are often not performed on all samples. In this case, a sufficient number of results for RD$_{ad}$ are available to produce reliable correlation cross plots to allow for the determination of missing RD values for both coal and non-coal samples.

The final correlation formula for coal is compared with the formula applied by MMTS by evaluating the differences in calculated RD values (Figure 12.16). Snowden is comfortable that both formulae are applicable for the Vista Project, and Snowden is satisfied that the MMTS formula is reliable.

Figure 12.16 Differences in calculated RD (MMTS vs Snowden regression)

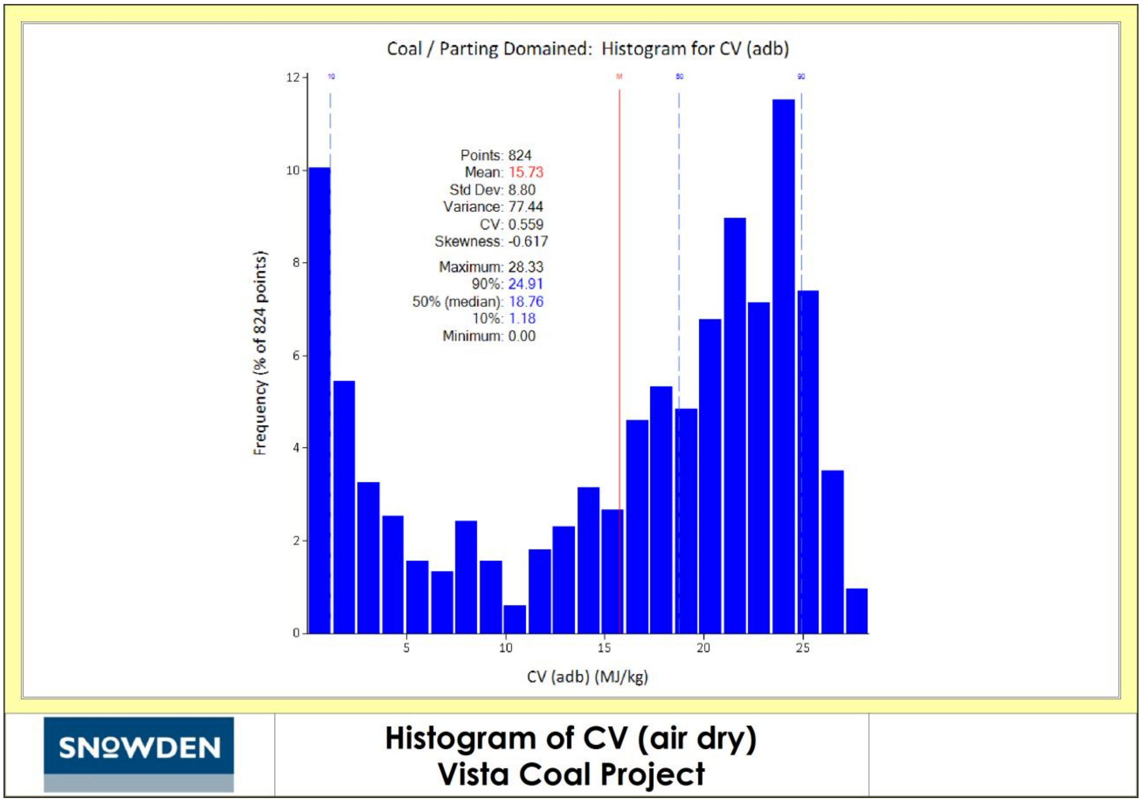


The Snowden-derived regression formula (Figure 12.14) calculates a higher RD than the MMTS formula. The significant differences are due to the underestimation of RD for true clastic parting using the MMTS formula as compared to the Snowden-derived non-coal correlation formula. This is to be expected as the MMTS formula is only valid for material with a real RD of less than 1.75 g/cc (MMTS, 2010).

Air Dry Calorific Value, CV_{ad}

The global distribution of CV_{ad} across the Vista Project is presented in Figure 12.17. Similar to RD_{ad}, CV_{ad} is strongly correlated to Ash_{ad}, albeit negatively, and clearly two populations are present: coal; and non-coal.

Figure 12.17 Global distribution of CV_{ad} across the Vista Coal Project



Appropriately domained, the distributions are presented in Figure 12.18. The distributions show opposite skews (coal negative and non-coal positive). This implies certain level of misclassification of coal into non-coal plies and vice-versa. This is also apparent in the Ash_{ad} distributions. The degree of misclassification is not considered to be material as, in the case of the non-coal (stone) distribution, less than 10% of the samples have a CV_{ad} of greater than *ca.* 9.5 MJ/kg

Coal and non-coal correlations are presented in Figure 12.19. Where missing CV_{ad} values are encountered in the data received, Snowden have calculated the appropriate CV_{ad} based on the particular regression formula as a function of the coded ply *i.e.* either coal or non-coal (stone).

Summary

A detailed statistical review has been undertaken for the drill hole data received, in particular the proximate analytical data have been investigated.

The as-received drill hole data (physicals and coal qualities) are suitable for the current Coal Resource estimate exercise and level of mining study being undertaken.

The current review has highlighted the opportunity to interrogate the data set and improve its overall integrity through re-correlation and application of appropriate regression formulae.

Figure 12.18 Coal and parting domained CV_{ad} distributions for theVista Coal Project

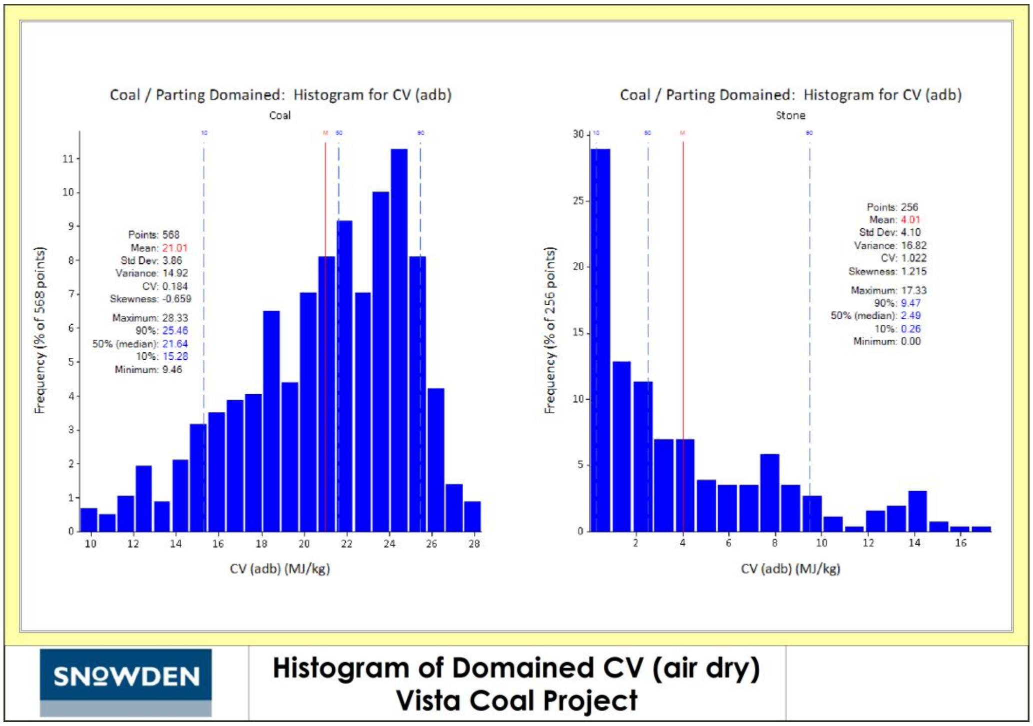
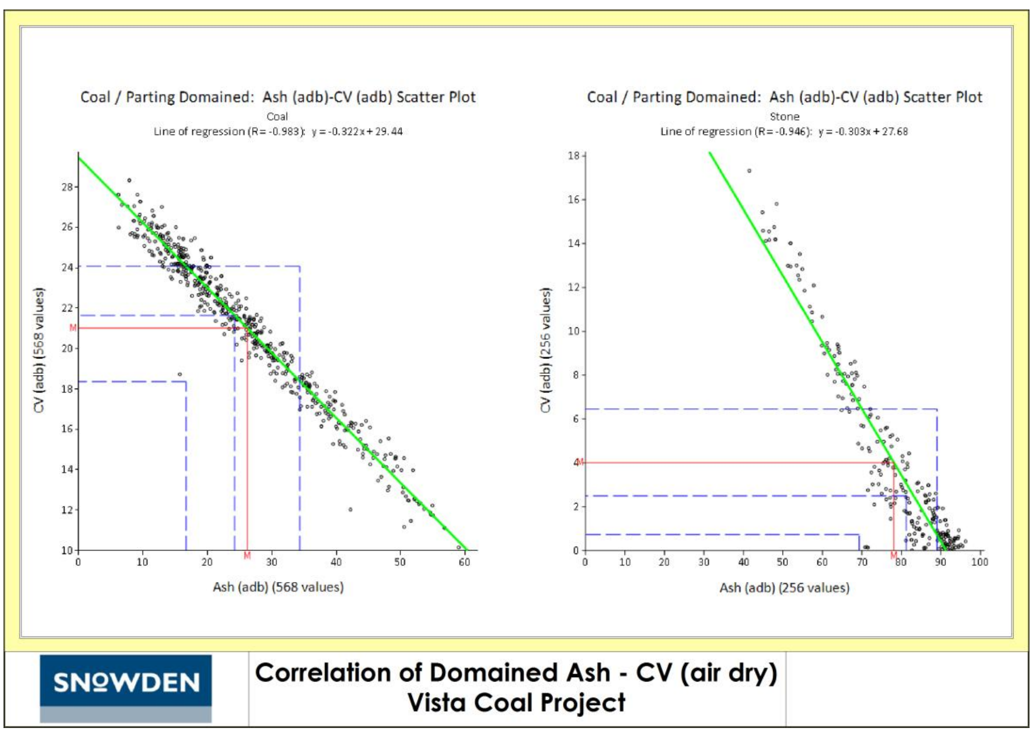


Figure 12.19 Domained Ash_{ad} – CV_{ad} correlation cross plots for the Vista Coal Project



12.2.2 Resource Model

The Coal Resource block model, developed by Coalspur using MineSight geological modelling software, has been supplied to Snowden in ASCII text format.

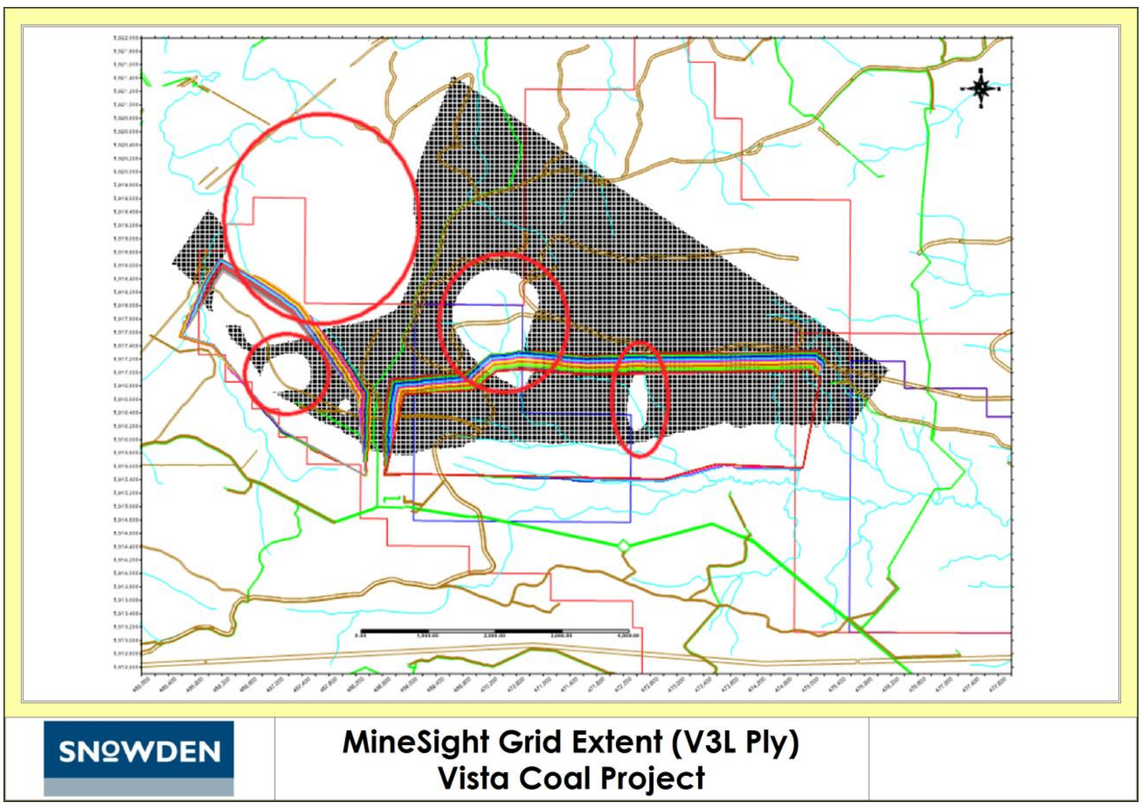
The grids of ply physical (from, to, thickness) and coal quality (proximate analyses) data have been assessed.

Grid Validation

Initially, the grids were loaded into Snowden's preferred coal geological modelling software, Vulcan, and displayed for visual interrogation.

Certain anomalies have been identified in the grid files as received. The primary anomaly is that certain grids have 'holes' in them *i.e.* the grids does not extend continuously across the modelled area. Figure 12.20 shows the distribution of grid points for the floor elevation (structure floor grid, SFG) for the Val d'Or 3 Lower ply.

Figure 12.20 Grid extent of the Val d'Or 3 Lower ply highlighting data gaps (holes)



Basic statistics were determined from the various grids, particularly from grids with and without gaps for the same parameters. Figure 12.21 shows the comparison of the Ash grids in term of spatial coverage, while Figure 12.22 presents the distribution histograms of Ash values within the individual grids.

Figure 12.21 Comparison of grid coverage (Ash) for the V3L ply

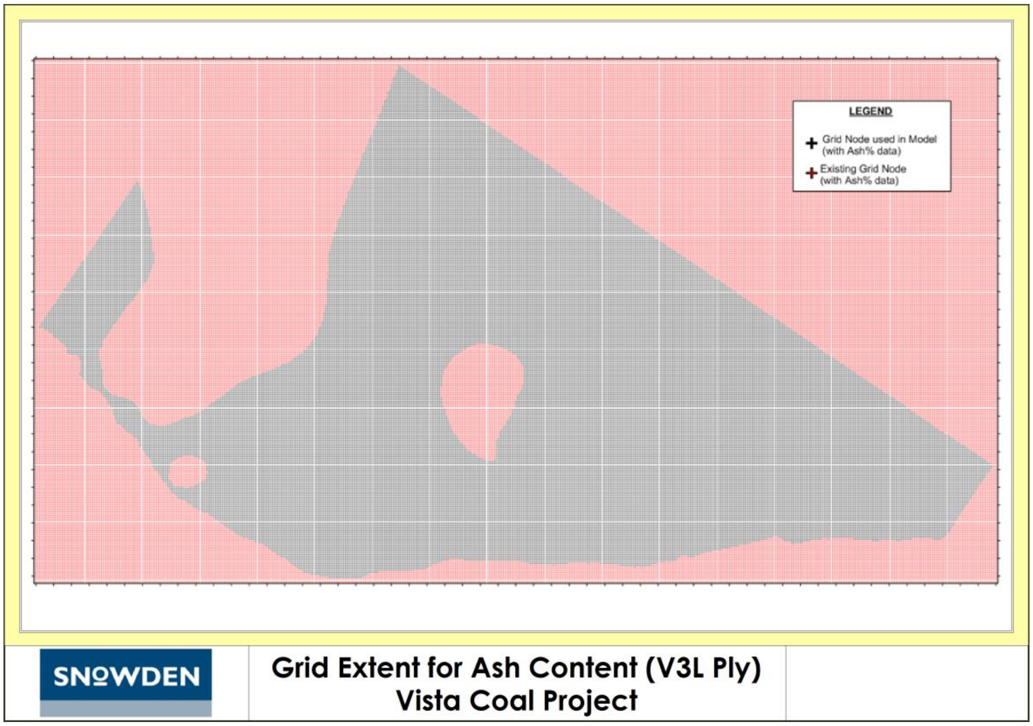
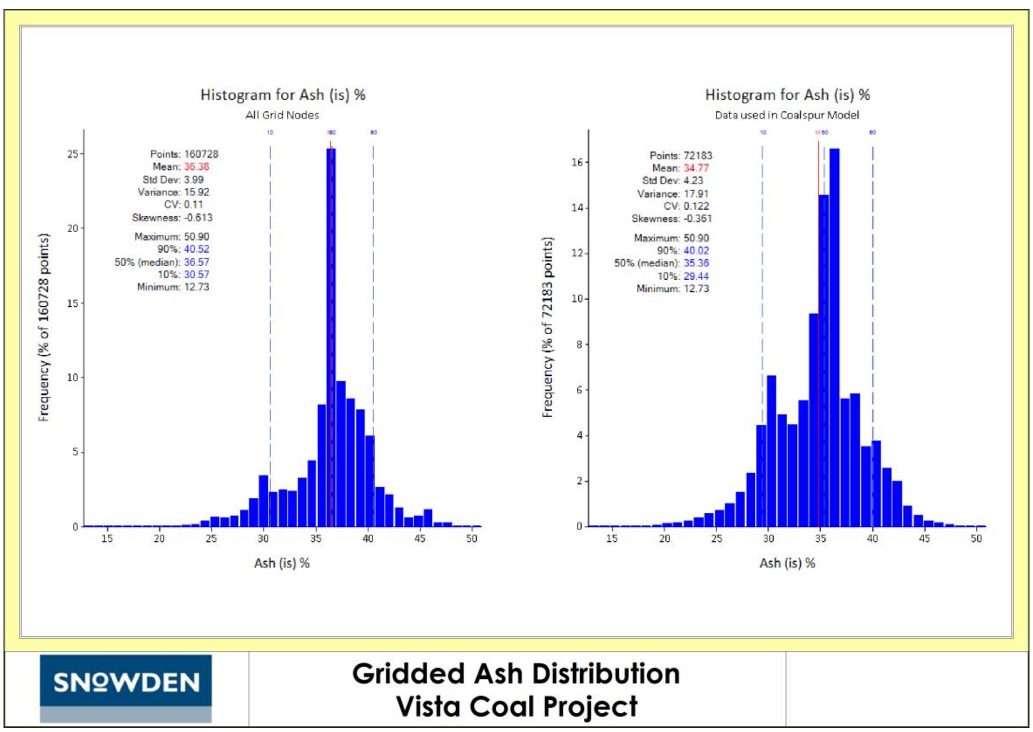
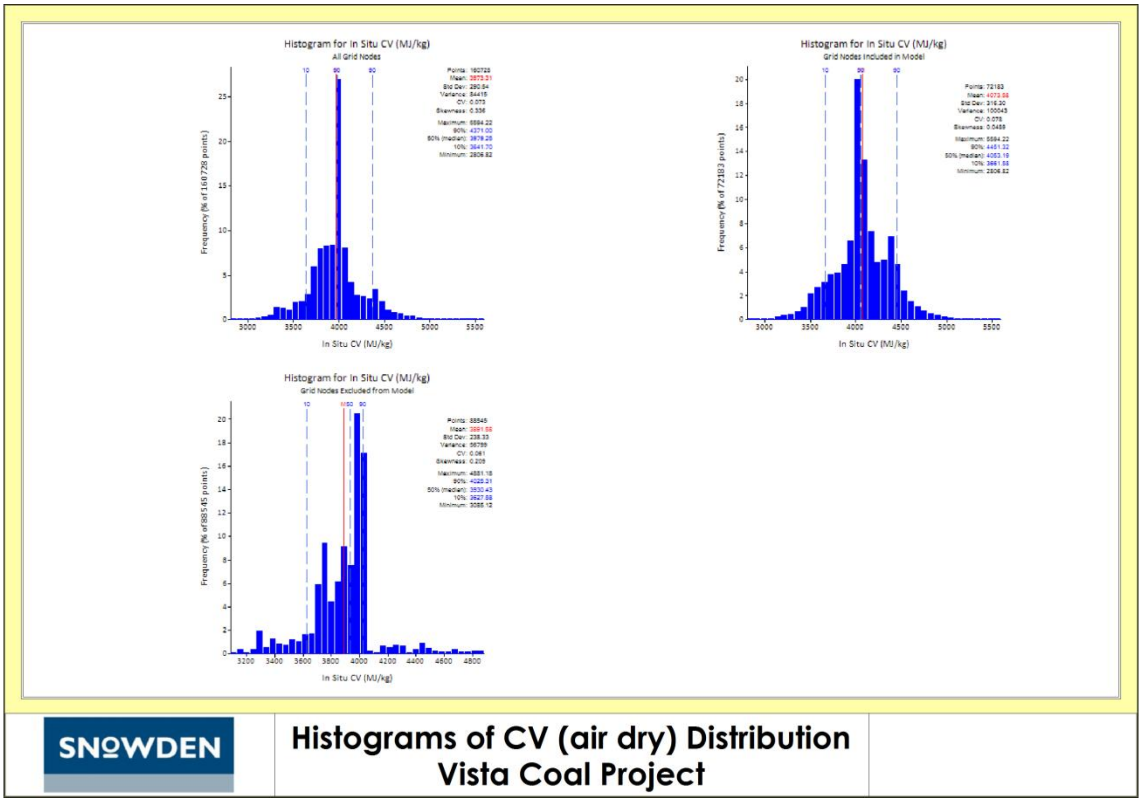


Figure 12.22 Histogam of Ash distribution for grids received



It is clear in the example presented that there is little difference in ash distribution between the two grids in terms of minima, maxima, and nature of distribution (normal). A similar comparison was performed for the Calorific Value and the distribution histograms are presented in Figure 12.23.

Figure 12.23 Comparison of CV distribution between grids received for V3L



Although the general trends for the histograms for 'All Grid Nodes' and "Grid Nodes Included in Model' do not appear too dissimilar, the histogram for the 'Grid Nodes Excluded from Model' clearly shows a bias to the lower energy nodes. The implication is that the data used in the model will be slightly biased to the higher energy end of the data range. This is supported by the slightly higher data average for the 'Grid Nodes Included in Model' data set compared to the 'All Grid Nodes' data average.

Summary

Although Snowden did not set out to validate the Coal Resource estimates by way of reengineering the MineSight block model to a Vulcan grid model, Snowden did review the resultant model grids and is comfortable that they are suitable for the purposes of volumetric estimation and for transferring to a mining model for coal seam aggregation and mine planning at this level of study.

The full extent and reasons for the gaps in the supplied grids has not been fully investigated but Snowden does not expect these to impact materially on either Coal Resource or Coal Reserve estimates but does suggest the gaps are rectified in future studies.

13 Mineral Processing and Metallurgical Testing

13.1 Disclosure

This section has previously been reported by Snowden (2012) and is reproduced here on the understanding that there have been no changes to the data and no additional data generated that may influence the discussions and interpretations presented previously. Snowden now takes responsibility for the information and interpretations now presented in this ITR.

13.2 Core Quality Testing Programme

13.2.1 Background

The coal-bearing strata at the Project are part of the upper Saunders Group within the Coalspur Formation. The two major mineable seams present are the Val d'Or and the McPherson seams, though one other seam, the McLeod Seam, is also targeted for mining.

The coal is moderately low rank bituminous suited to thermal coal production targeting CV in the range of 5,700 kcal/kg to 5,800 kcal/kg GAR.

A preliminary coal quality evaluation on the Hinton West and East blocks, 'Coal Quality Report: Vista Coal Project East and West Blocks' (2010 Vista Coal Quality Report), was completed in July 2010. A second report, 'Coal Quality Report: Vista Coal Project Feasibility Study' was completed in September 2011.

The Feasibility Study assessment on coal quality has been completed on a series of exploration programmes undertaken to date, in addition to historical information retrieved from Esso's programmes in the Hinton West and East blocks, and Manalta's work in the Z Block and McLeod River North Block. The results were transcribed into raw coal, washability, clean coal, and yield databases for use in the Feasibility Study.

The databases consist of:

- ±1,200 raw coal entries encompassing all regional areas in the Project
- detailed washability reporting yield, ash and CV by density on 300 working sections
- detailed clean coal analysis on 200 working section simulated product samples; and
- 200 attrition tests (drop shatter and wet tumble) on both coal and stone samples to support CPP design studies.

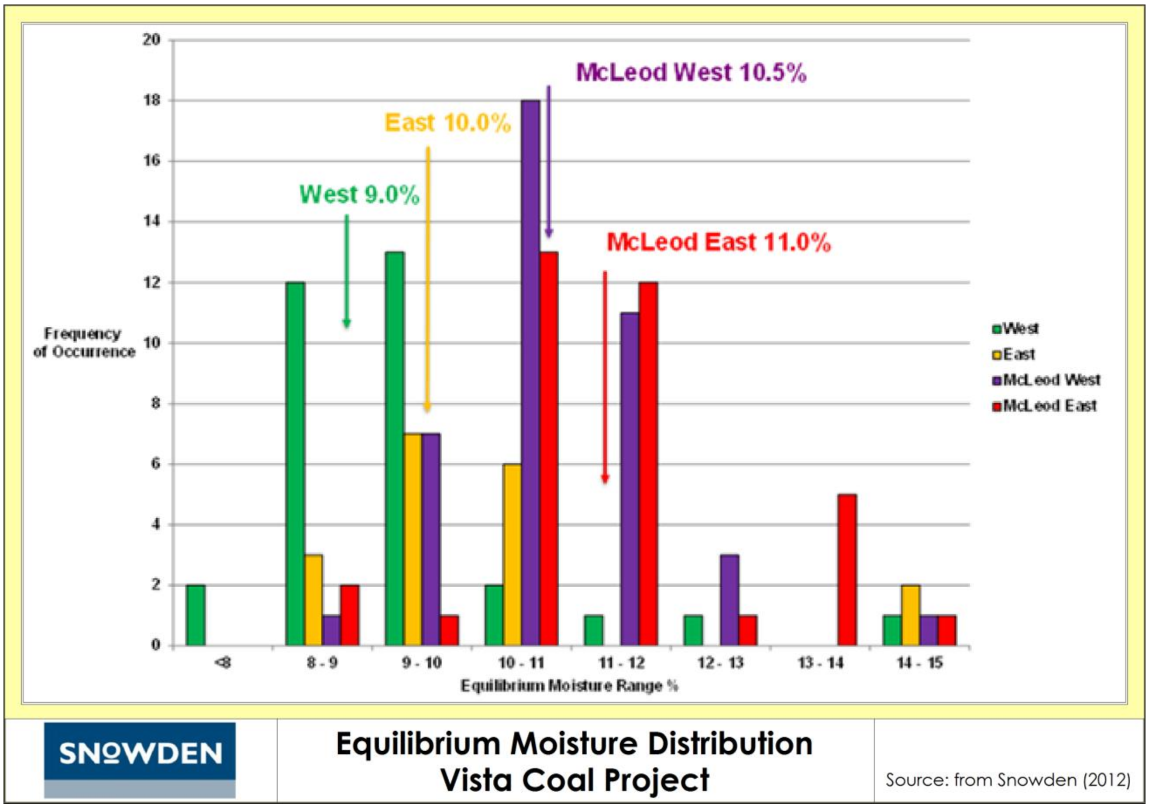
The work conducted to date has established clear trends in rank, moisture, energy and yield across the deposit and is of sufficient quality and quantity for Coal Resource estimation and for mining studies as contemplated in this ITR.

13.2.2 Coal Quality

Moisture

Based on equilibrium moisture, EQM, results, which range from 9% in the west to 11% in the far eastern extent of the McLeod River North Block (designated as McLeod East here), the *in situ* moisture, M_{is}, will range from 10% in the west to 12% in the east (Figure 13.1).

Figure 13.1 EQM distribution across the Vista Coal Project



13.2.3 Calorific Value

Dry ash free calorific value, CV_{daf}, ranges from approximately 7,600 kcal/kg in the west (McPherson Seam) to slightly less than 7,350 kcal/kg in the east (Val d'Or Seam). Table 13.1 shows the average heat content for the various seams per resource block.

Table 13.1 Dry Ash Free CV per Seam across the Vista Coal Project (after Snowden, 2012)

Block	CV_{daf} (kcal/kg)				
	Val d'Or	Arbour	McLeod	McPherson	Silkstone
Hinton West	7,514	7,514	7,534	7,581	
Z Block	7,477		7,530	7,593	
Hinton East	7,431		7,500	7,518	
McLeod West	7,383		7,444	7,430	7,503
McLeod East	7,327		7,392	7,362	

Combined, the EQM and CV_{daf} results confirm there is a rank decrease from west to east in the deposit and stratigraphically from the upper Val d'Or Seam to the lower Silkstone Seam.

13.2.4 Ash and Sulphur

Raw ash varies considerably between the various seams and plies due to the presence of occasional thin stone bands (intra-seam partings). All seams are low to moderate in total sulphur content.

Table 13.2 Air Dry Coal Qualities per Seam and Ply (after Snowden, 2012)

Val d'Or Seam			
Ply	Thick (m)	Ash% (ad)	TS% (ad)
V7	0.7	29.0	0.60
V6U	0.6	10.0	0.60
V6L	1.5	16.0	0.45
V5U	3.0	28.0	0.35
V5L	2.0	13.0	0.25
V3	0.6	17.0	0.30
V3U	2.0	24.0	0.20
V3L	1.0	34.0	0.30
V2	1.0	33.0	0.30
V1	1.2	30.0	0.25

Arbour Seam			
Ply	Thick (m)	Ash% (ad)	TS% (ad)
A1	1.0	35.0	0.25

McPherson Seam			
Ply	Thick (m)	Ash% (ad)	TS% (ad)
P4	1.0	27.0	0.30
P3	2.0	22.0	0.20
P2	2.5	27.0	.25.3
P1	1.0	24.0	

McLeod Seam			
Ply	Thick (m)	Ash% (ad)	TS% (ad)
L3	1.0	36.0	0.30
L2	1.5	30.0	0.25
L1	0.8	36.0	0.25

Silkstone Seam			
Ply	Thick (m)	Ash% (ad)	TS% (ad)
SK2U	0.6	40.0	0.45
SK2L	0.7	38.0	0.35
SK1	1.5	22.0	0.25

Val d'Or Seam

The Val d'Or Seam (primary economic interest) varies in thickness from approximately 8 m in the west to over 16 m in the east. The seam generally presents as seven plies (V7 to V1) of quite variable thickness. Often, the plies contain intra-seam partings which split the plies into upper and lower sub plies *e.g.* V5U and V5L. In the west, the upper plies, V7 to V4, tend to thin out, reducing the total seam thickness. Most of the plies are moderate in ash though some sub-plies (V6U, V5L and V4) are quite low in ash. All plies would be classed as low to moderate in total sulphur, though there is a tendency for the upper plies to have moderate results.

Arbour Seam

The Arbour Seam is present in the west only. It has moderate to high raw ash and low sulphur.

McLeod Seam

The McLeod Seam generally presents as three plies with a total coal thickness up to 4 m. All of the plies are moderate to high in raw ash. Total sulphur is low.

McPherson Seam

The McPherson Seam is the second seam of economic interest and generally presents with a total seam thickness of 6 m to 7 m throughout the deposit. The four coal plies comprising the seam are moderate in ash and low in sulphur.

Silkstone Seam

Little is known of the quality in the Silkstone Seam due to a lack of reliable intersections and analytical data. Based on the scant results, it presents as three sub-plies, of which the upper two are high in ash. The seam has low to moderate total sulphur.

13.2.5 Clean Coal Yield, Product Ash, Moisture, and Calorific Value

The Val d'Or and McPherson seams constitute the majority of the mineable resource. Both will contribute to producing an export quality product with a gross calorific value, GCV[8], in the range of 5,700 kcal/kg to 5,800 kcal/kg, depending upon the washing cut-point density. Due to the rank decrease to the east, the most easterly regions of the deposit will likely realise 100-200 kcal/kg lower GCV than the more central or western regions. However, while there is a rank decrease to the east, the eastern coals tends to wash to lower product ash, particularly the Val d'Or Seam.

[8] *GCV is the equivalent of GAR*

The following conditions have been assumed in assessing yield, product ash, and product CV:

- ROM feed moisture has been assessed to be identical to the estimated *in situ* moisture on a regional basis:
  - West = 10.0%
  - Z = 10.5%
  - East = 11.0%
  - McLeod West = 11.5%
  - McLeod East = 12.0%
- Base CV data for product energy calculations have been derived from the washability result averages and applied on a regional and seam basis.
- Projected product moisture during washing has been assessed from non-centrifuge moistures studies:
  - +16 mm product ex centrifuge = *In Situ* Moisture
  - -16+2 mm product ex centrifuge = *In Situ* Moisture + 1%
  - -2+0.25 mm product ex centrifuge = *In Situ* Moisture + 7%
- A dense medium cyclone / hindered bed spirals combination for the CPP configuration has been assumed, similar to the feasibility design concept. The simulation design assumed a crushed coal top size of 50 mm.

Excluding the impacts of coal loss and dilution, the seams have the potential to realise 56-69% wet yield at a cut-point density of 1.55. The McLeod Seam will realise a lower quality product of approximately 5,400 kcal/kg GCV with yield of 40- 50%. Table 13.3 and Table 13.4 present simulated product qualities for the Val d'Or and McPherson seams.

Table 13.3 Val d'Or Seam Product Qualities at Cut Point RD 1.50 (after Snowden, 2012)

Block	Seam	ROM Ash %	ex-Centrifuges			
			Yield %	TM %	Ash %	CV kcal/kg
West	Val d'Or	30.3	58.0	11.9	11.3	5,768
Z		24.9	67.6	12.4	9.2	5,861
East		26.1	61.7	12.9	9.3	5,784
McLeod West		21.6	70.3	13.4	9.1	5,723
McLeod East		21.9	69.4	14.0	9.6	5,597

Table 13.4 McPherson Seam Product Qualities at Cut Point RD 1.50 (after Snowden, 2012)

Block	Seam	ROM Ash %	ex-Centrifuges			
			Yield %	TM %	Ash %	CV kcal/kg
West	McPherson	26.9	61.9	11.9	12.2	5,750
Z		26.0	65.6	12.6	11.8	5,736
East		26.8	57.3	12.9	11.6	5,677
McLeod West		23.5	67.7	13.4	12.3	5,517
McLeod East		24.0	66.7	14.1	11.3	5,494

13.2.6 Target Energy Specifications

The projected yield (no coal loss or contamination) at a CV_{GAR} of 5,800 kcal/kg is approximately 60% at a wash RD in the order of 1.55 for a blend of Val d'Or and McPherson coals (excluding lower rank coal from the most easterly portion of the deposit). The Val d'Or Seam outperforms the McPherson Seam, due mainly to lower product ash in the Val d'Or.

Up to a 7% improvement on gross yield may be obtained if an average gross energy specification of 5,700 kcal/kg was accepted in comparison to 5,800 kcal/kg. The lower energy scenario would increase the washing density from approximately 1.55 to approximately 1.60 to 1.65.

13.2.7 Life of Mine Plan

The LOM Plan, which considered the impacts of coal loss and contamination on yield within the pit shell, was completed as a collaborative effort between Bob Leach and Golder, who designed the pit shell for the Vista Project. Golder assigned dilution and coal loss criteria to each working section within each core with coal quality data, generally 10 cm to 15 cm floor dilution, and a coal loss of 15 cm from the roof in each working section.

Following completion of the yield simulations under the proposed mining conditions, Golder assigned the coal quality outputs to its LOM Plan (run of mine basis), forecasting tonnage, yield, product ash, and product CV for the mine plan (Table 13.5).

The combined production from the pit shell realised 313 Mt of product at an average yield of 55.3% with a CV_{GAR} of 5,723 kcal/kg. Coal from the blended Val d'Or and McPherson seams averaged 57.7% yield at an average CV_{GAR} of 5,767 kcal/kg. The poorer quality McLeod Seam averaged 42.5% yield at a CV_{GAR} 5,410 kcal/kg.

Table 13.5 Life of Mine Tonnage and Grade Forecast (after Snowden, 2012)

Coal Ply	ROM Coal			Product Coal				
	Tonnes	Ash_{ad} %	ISM %	Tonnes	Yield %	Ash_{ad} %	CV_{GAR} kcal/kg	Prod.Moist %
V6U	4,907	18.6	11.0	3,355	68.4	5.9	6,051	12.1
V6L	18,560	25.1	10.7	12,142	65.4	7.4	5,974	11.9
V5U	37,073	30.6	10.8	21,992	59.3	9.5	5,818	11.9
V5L	25,464	26.4	10.5	17,804	69.9	8.6	5,881	11.9
V4	10,586	35.3	9.8	5,629	53.2	6.8	6,022	11.9
V3U	95,889	28.4	10.4	59,432	62.0	10.4	5,794	11.7
V3L	30,012	48.6	9.6	13,773	45.9	10.9	5,744	11.8
V2	27,581	39.6	10.1	13,352	48.4	11.8	5,678	11.9
V1	31,108	33.7	10.3	17,638	56.7	11.7	5,694	11.8
L3	20,806	47.3	10.3	7,884	37.9	15.7	5,407	12
L2	44,961	40.9	10.4	21,482	47.6	15.9	5,409	11.9
L1	24,682	47.4	10.0	9,031	36.6	15.8	5,415	11.9
P4	26,653	34.7	10.5	14,150	53.1	13.5	5,578	11.9
P3	61,277	31.4	10.3	36,674	59.9	11.5	5,761	11.7
P2	65,303	32.5	10.5	36,863	56.5	12.6	5,666	11.8
P1	41,414	34.5	10.2	22,562	54.5	11.6	5,753	11.7
TOTAL	566,274	34.4	10.4	313,764	55.4	11.4	5,723	11.8
Val d'Or / McPherson Blend	475,824	32.5	10.4	275,367	57.9	10.8	5,767	11.8
McLeod Seam	90,450	44.2	10.3	37,397	42.5	15.8	5,410	11.9

13.2.8 Clean Coal Properties and Potential Product Quality Ranges

Aside from a GCV of between 5,700 kcal/kg and 5,800 kcal/kg, the clean coal product from the combined Val d'Or and McPherson seams will be of low total sulphur content (average 0.35% ad) and moderate to low nitrogen (average 1.1% daf). The product is relatively hard (HGI 40-41) and occasional samples reported initial deformation ash fusion temperatures slightly below 1,200°C. Combustion tests however, have indicated that the coal has excellent combustion properties. The McLeod Seam will produce a secondary product with a CV_{GAR} of between 5,300 kcal/kg and 5,450 kcal/kg. Other clean coal products will be similar to the Val d'Or / McPherson blend. Table 13.6 provides the predicted clean coal product specifications.

Table 13.6 Clean Coal Product Specifications (after Snowden, 2012)

Product Summary	Val d'Or / McPherson Blend	McLeod Seam
Total Moisture %	11.5 - 12.5	11.5 - 12.5
Ash %	9 - 11	15 - 17
CV_{GAR} kcal/kg	5,700 - 5,800	5,250 - 5,350
CV_{DAF} kcal/kg	7,400 - 7,500	7,400 - 7,500
Proximates % ad		
Moisture	6 - 7	6.5 - 7.5
Ash	10 - 12	16 - 18
Vols	32 - 35	30 - 33
$Vols_{DAF}$	39 - 42	38 - 41
TS	0.35 - 0.45	0.35 - 0.45
AFT		
Initial	1,180 - 1,250	1,180 - 1,240
Flow	1,400 - 1,500	1,440 - 1,500
Ultimates % daf		
C	77 - 79	77 - 79
H	4.8 - 5.2	4.8 - 5.2
N	1.05 - 1.15	1.05 - 1.15
O	14.0 - 15.5	14.0 - 15.5
S	0.35 - 0.45	0.35 - 0.45
Ash Oxides % dry		
Silicon	55 - 62	60 - 67
Aluminium	18 - 21	15 - 20
Iron	3 - 6	3 - 6
Calcium	6 - 9	4 - 8
Sodium	1.9 - 2.5	1.9 - 2.5
Specials		
HGI	40 - 41	38 - 39

14 Mineral Resource Estimates

14.1 Summary

Coal Resource estimates are currently reported for the Vista Coal Project (Table 14.1).

Table 14.1 March 2014 Coal Resources for the Vista Coal Project

Description	Resource Category		
	Measured	Indicated	Inferred
In Situ Coal Resources (tonnes 000s)	688,000	342,900	290,700

14.2 Disclosure

Coal Resources reported in this ITR were prepared by Mr Jim McQuaid, P.Eng., of Golder Associates, and reviewed by Mr Grant van Heerden, Pr.Sci.Nat., a full time employee of Snowden Mr van Heerden takes full responsibility for the estimates presented here.

Mr van Heerden is a Qualified Person as defined in NI43-101 (June, 2011). Snowden is independent of Coalspur Mines Ltd.

Coal Resources that are not Coal Reserves do not have demonstrated economic viability.

14.2.1 Known Issues that Materially Affect Coal Resources

Snowden is unaware of any issues that may materially affect the Coal Resources in a detrimental sense. The preceding statement is based on the following:

- The recently completed and reported 'Feasibility Study of the Vista Coal Project, Hinton, Alberta', Snowden (2012) did not highlight any potential issues.
  - Given that there has been no material change to available information since 2012 it is reasonable to assume that there remain no known issues that could potentially have a material detrimental impact on the project.
- Coalspur continues to hold valid Coal Leases and Coal Lease Agreements covering the Vista Coal Project.
  - Coalspur also holds Mine Permit C2011-5 and Coal Processing Plant Approval C2011-3, as amended in February 2014 under AER decision 2014 ABAER 004
- Coalspur has represented that there are no outstanding legal issues; no legal actions, and injunctions pending against the Project.
- There are no known marketing, political, or taxation issues.
- Coalspur has represented that the Project has local community support.
- There are no known infrastructure impediments.

14.3 Assumptions, Methods and Parameters – Snowden Resource Estimates

The basis of the Coal Resource estimates for the Vista Coal Project is discussed in this section and is based on the following:

- Data Verification and Validation –undertaken by MMTS, reviewed by Snowden (Item 12)
- Data sources and databases – undertaken by Golder, reviewed by Snowden
- Geological interpretation and modelling – undertaken by Golder, reviewed by Snowden
- Establishment of block/grid models – undertaken by Golder, reviewed by Snowden
- Compositing of sample intervals (working section analysis) – undertaken by Golder, reviewed by Snowden
- Classification of estimates with respect to confidence limits – undertaken by Golder, reviewed by Snowden
- Resource tabulation and reporting – undertaken by Golder, reviewed by Snowden.

14.3.1 Data Sources and Databases

Golder (2012) prepared stratigraphic and coal quality models for the project based on information provided by Coalspur. The data included the results of modelling completed by Coalspur during previous estimations. The models were updated to include additional exploration and analytic results from 2010/2011 drilling programmes.

All data used in the preparation of the structural and coal quality models were provided by Coalspur.

The following data were supplied in digital formats:

- Areal (maps and plans) data in CAD (DWG or DXF) format
- Lithology log and analytical records in ASCII or spreadsheet format.

Topography data were obtained from a triangulation export from Coalspur's MineSight block model. The triangulation was based on data points with a nominal spacing of about 12 m, with gaps in the data where lakes were encountered.

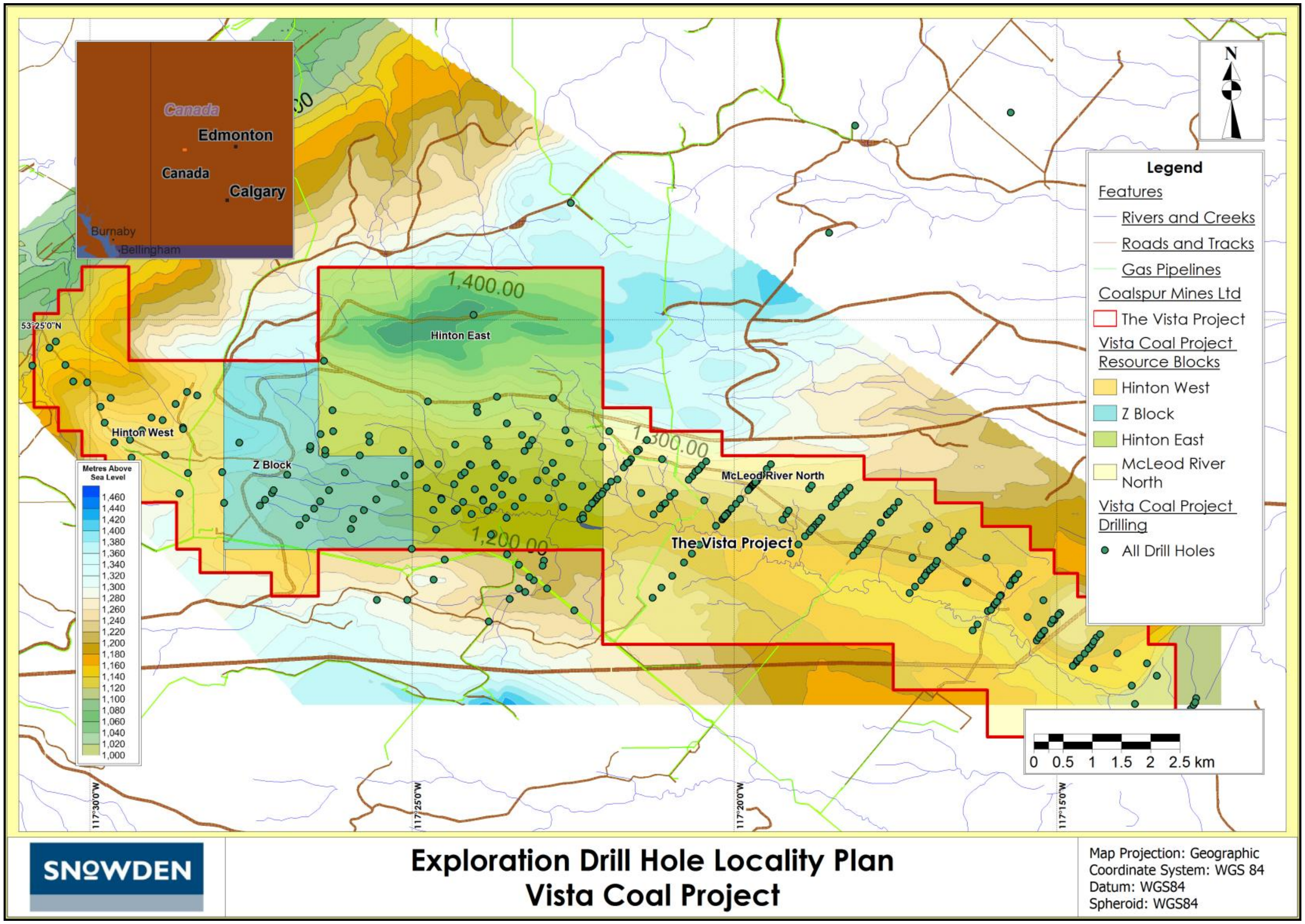
Planimetric data, or feature data, were obtained from CAD drawing files. These files included property boundaries, roads, rights-of-way, drainages etc. The Coalspur property lies within the bounds of the NAD83 geographic 2D coordinate reference system, UTM Zone 11N (Transverse Mercator) projection.

Drill hole data were obtained from two sources. The majority of the holes were provided by Coalspur in two comma-separated-value (CSV) files, created from data exports from a MineSight model. Drill hole collar survey data for 331 locations were contained in the file '*dhcol.csv*', while a total of 8,609 records of depth and lithology information from 326 holes were provided in '*dhlith-110324.csv*'.

Coal quality data were provided by Coalspur in the file '*Coalspur Mine Plan _RAWdb_20110502-old.xls*'. The file contained 1,247 proximate analysis results from 66 drill holes.

Figure 14.1 shows the relative positions of all categorised drill holes in the various databases received.

Figure 14.1 Plan of Drill Holes used in the Vista Coal Project Geological Models



14.3.2 Geological Modelling and Interpretation

Golder (2012) prepared stratigraphic and coal quality grid models for the Project based on the survey, lithology and coal quality data sets in tandem with the topographic digital terrain model ("DTM"). Base data included digital topographic triangulation data, drill hole survey and lithology records and coal quality ply sample data. The models generated consisted of regular arrays of data, or grids, distributed over the project area.

Base data for the generation of the topography model consisted of digital triangulation segments exported from a previous model of the area. The grid surface for the topography was created using a regular 10-m grid cell interval.

In the January 2011 Technical Report, Wardrop states that "drillhole collars were adjusted to fit the topography." A comparison of drill hole collar elevations to projected elevations from the topography grid confirms this, as the differences are typically within 0.25 m. This type of "draping" of drill holes on topography is typically done when collar survey elevations are questionable; and it is recommended that the databases for the project include original collar survey data as well as adjusted data, to provide a complete data set.

The stratigraphic model for the area was created by Golder (2012) using MineScape Stratmodel software. The initial step in the process was the definition of the coal seams to be modelled and the modelling parameters within the project "schema". The schema defines the interpolators, modelling limits and the coal seams included in the geologic reserve model. Drill hole data were imported to MineScape to create a database of graphical drill hole objects. Utilizing the drill hole objects and topography model as base data, the stratigraphic model was created according to the modelling parameters and seams defined in the schema. The coal seam horizons included in the stratigraphic model are shown in Table 14.2.

The primary seam groups include the Val d'Or, McLeod and McPherson plies. Coalspur requested that the V7 ply of the Val d'Or Group and 4 additional minor seams (A, SLK2, SLK1 and MYN) be included with the models. Table 14.2 includes information regarding the inclusion of estimated tonnages from each seam or ply in the mine development plan.

Base data for the model included 315 drill holes (66 core holes) along 17 major drill lines, containing data for 23 component seam splits, as well as 2 parent seam intervals. Two modelling horizons (TILL and TREND) were included to establish a till floor boundary and to control structural trends, respectively. Database statistics for the drill holes used for the Vista model are shown Table 14.3.

During modelling, the coal seams logged in the drill hole data are used to build roof, floor, seam thickness and interburden thickness surfaces for each coal seam defined in the schema. All of the coal seams in the model were limited by a surface representing the bottom of the till material. The resultant three-dimensional representation of the Vista Coal Project coal measures contains all the coal seams defined in the schema modelled to show the effects of the regional structural trends and the effects of clipping by the base of till material.

Table 14.2 Vista Coal Project stratigraphic model horizons

Elemental Seam	Compound Seam	Seam Group	Included in Mine Plan?
V7U	V7	Val d'Or	No
V7L			No
V6U			Yes
V6L			Yes
V5U			Yes
V5L			Yes
V4			Yes
V3U			Yes
V3L			Yes
V2			Yes
V1			Yes
A1		Arbour	No
L3		McLeod	Yes
L2			Yes
L1			Yes
P4		McPherson	Yes
P3			Yes
P2			Yes
P1			Yes
SLK2U	SLK2	Silkstone	No
SLK2L			No
SLK1			No
MYN			No

The stratigraphic model was reviewed by visual examination of cross sections and plan mapping created from the model. Cross sections were created between drill holes along and between each drill line. Coal structure contours and isopach maps were created for each coal seam defined in the schema. The cross sections and maps were compared to the drill hole data and visually analysed for continuity and logical interpolations and extrapolations. Inconsistencies between modelled surfaces and surrounding drill hole data were reviewed. Modifications to either the drill hole correlations or modelling parameters were made where necessary. The stratigraphic model and the model graphics were recreated for subsequent review. This process was repeated until the final version of the model was developed.

Table 14.3 Summary of Vista Coal Project drill hole lithology database statistics

Seam	# Intercepts	Average Thickness (m)	Minimum		Maximum		Standard Deviation (m)
			Hole	Thickness (m)	Hole	Thickness (m)	
V7U	19	0.38	MR80-20	0.20	MT81-7	0.60	0.09
V7L	43	0.64	MR80-20	0.20	MR81-17C	1.05	0.21
V6U	83	0.70	81-02	0.30	MR81-17C	2.55	0.30
V6L	95	1.28	MR80-20	0.30	MR81-17C	3.42	0.47
V5U	105	2.48	CO8106	0.19	MT81-4	4.00	0.76
V5L	103	1.65	SO83-61	0.10	CO8106	3.72	0.48
V4	111	0.64	CO81-05	0.35	CO7802	1.37	0.14
V3U	126	4.28	CO8106	1.43	CPW10-03	6.15	0.76
V3L	119	1.24	MT81-2	0.25	84-79	4.10	0.78
V2	127	1.07	10-34-51-23	0.30	CPE10-01	2.80	0.34
V1	128	1.31	CPE10-01	0.25	CPW10-02	3.20	0.36
A1	35	1.42	MN92-08	0.18	CPW10-01	4.35	1.17
L3	90	0.85	10-34-51-23	0.22	CPZ10-02C	2.19	0.35
L2	91	1.65	MN92-15C	0.53	82-47A	2.20	0.33
L1	92	0.81	MN92-03	0.26	CPM10-17A	1.80	0.26
P4	128	1.19	84-75	0.20	MR82-35	2.05	0.42
P3	134	1.78	84-77	0.63	82-54	2.80	0.35
P2	135	2.06	82-35	0.90	CPE10-04	3.60	0.49
P1	136	1.10	TPL81-2	0.35	84-77	3.20	0.35
SLK2U	10	0.64	SO82-53	0.50	CPM10-50	0.80	0.12
SLK2L	10	0.75	SO83-63	0.30	CPM10-60	1.20	0.28
SLK1	46	1.78	MR81-188	0.70	SO83-66	3.30	0.63
MYN	8	1.05	MR81-186	0.35	82-12	2.30	0.66
V7	35	0.95	MN92-16	0.31	MR80-15	1.40	0.28
SLK2	35	1.92	MR81-182	0.30	MR81-186	2.55	0.54

The final stratigraphic model contains 21 modelled coal horizons. Seam splits were modelled in two of these coal seams. The stratigraphic model is based on a rotated, regular 20 m grid cell interval. The geometric base point, grid extents and rotation angle are:

- Coordinates of lower left corner of grid: E 463,997.16 N 5,917,638.00
- Extents along longitudinal and lateral axes: 22,300 m 12,500 m
- Number of columns and rows in grids: 1,116 626
- Rotation of grids: -34°

In line with accepted practice for Canadian coal deposits, the cumulative *in situ* strip ratio was calculated and modelled. The 20:1 strip ratio margin was used as a guide to the Coal Resource Block limits. The ultimate pit shell falls within the 12:1 strip ratio limit (Figure 14.2).

Figure 14.3 shows the locations of cross sections through the southeast, central and northwest regions of the deposit. The cross sections are shown on Figure 14.4, Figure 14.5, and Figure 14.6. All plies and the final pit highwall are shown on the cross sections.

Figure 14.2 Modelled Cumulative *In Situ* Strip Ratio (12:1) defining the Ultimate Pit Boundary

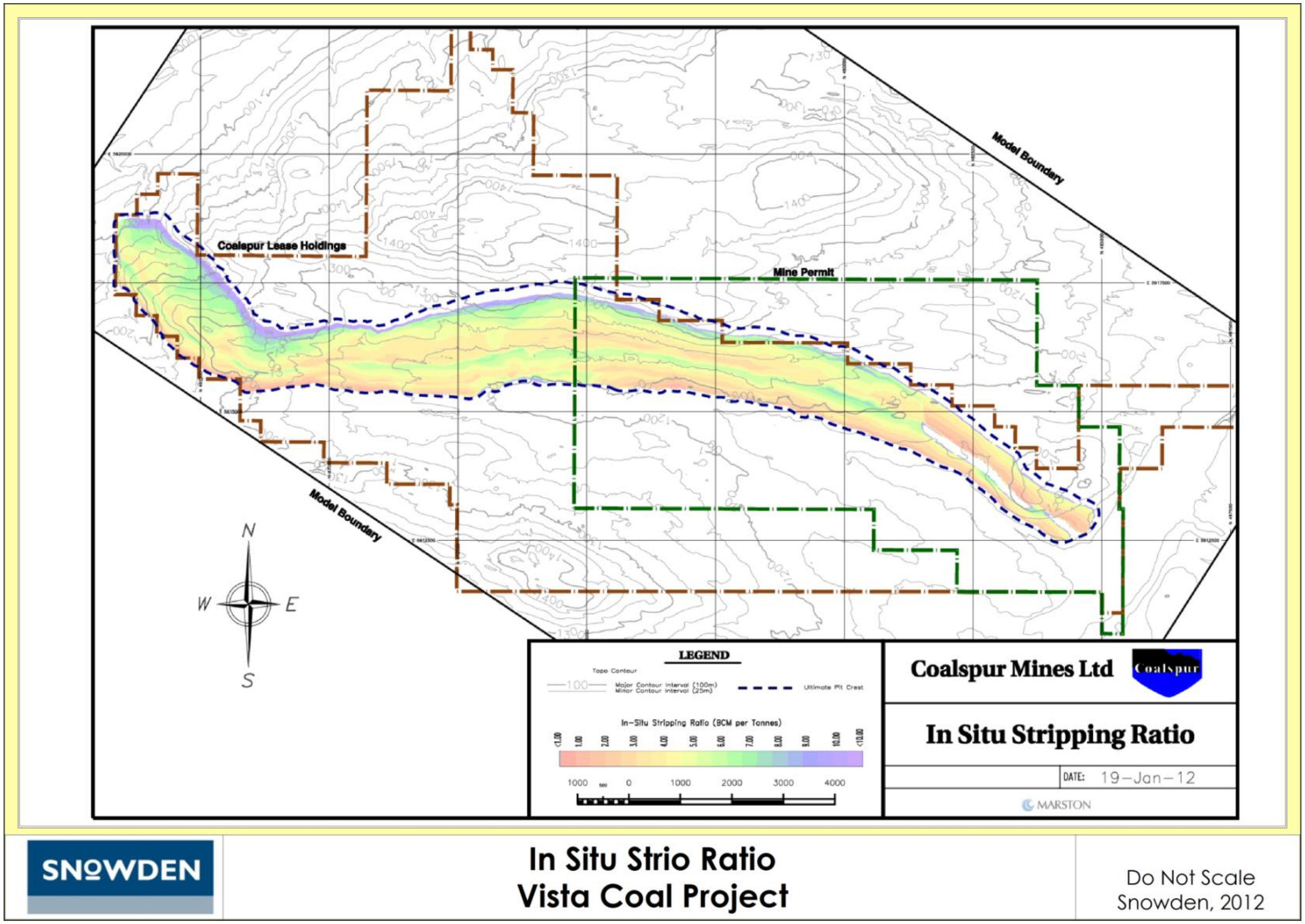


Figure 14.3 Map indicating position of cross-section lines

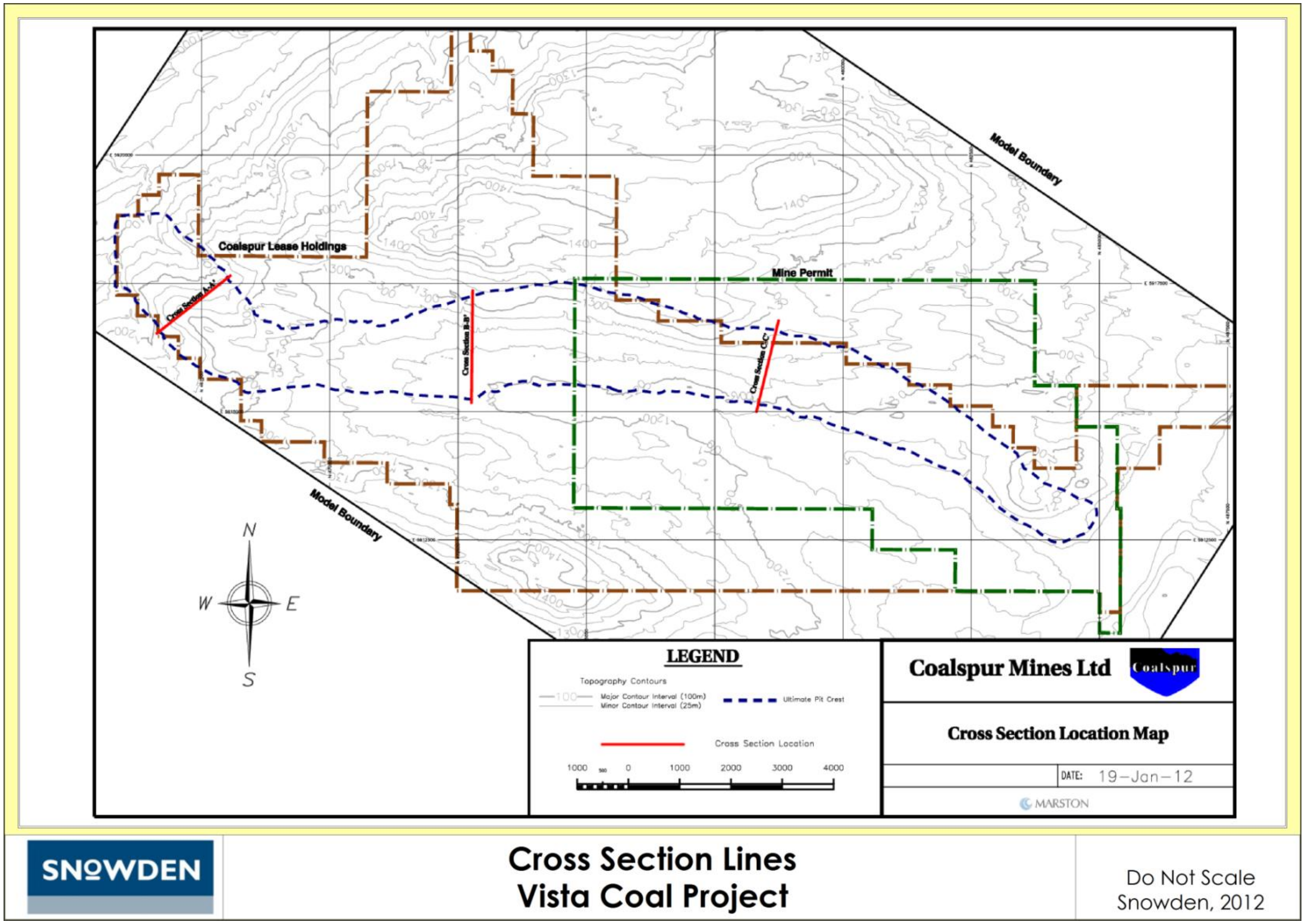


Figure 14.4 Section AA ***(approximate 2.5:1 vertical exageration)***

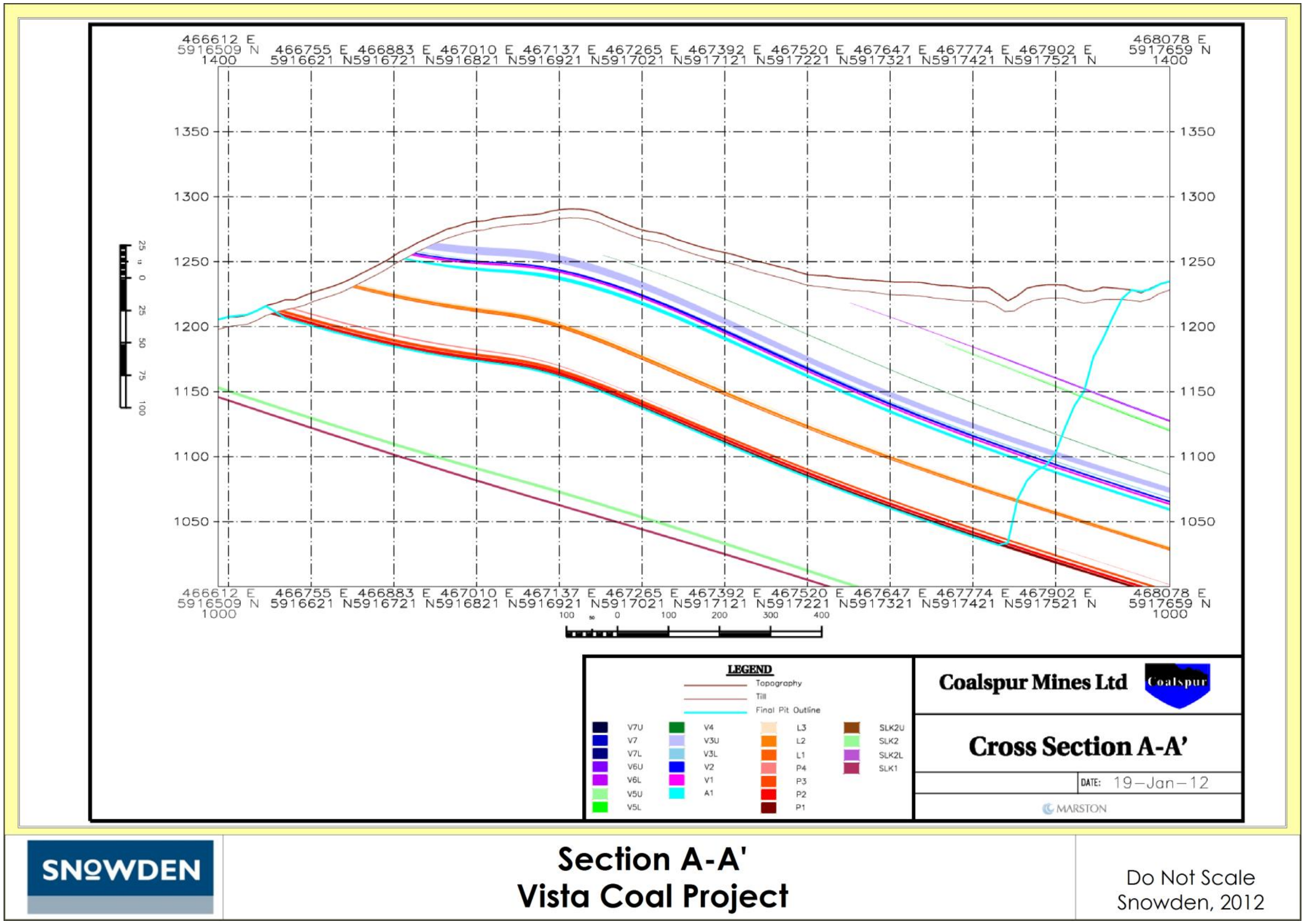


Figure 14.5 Section BB ***(approximate 3.0:1 vertical exageration)***

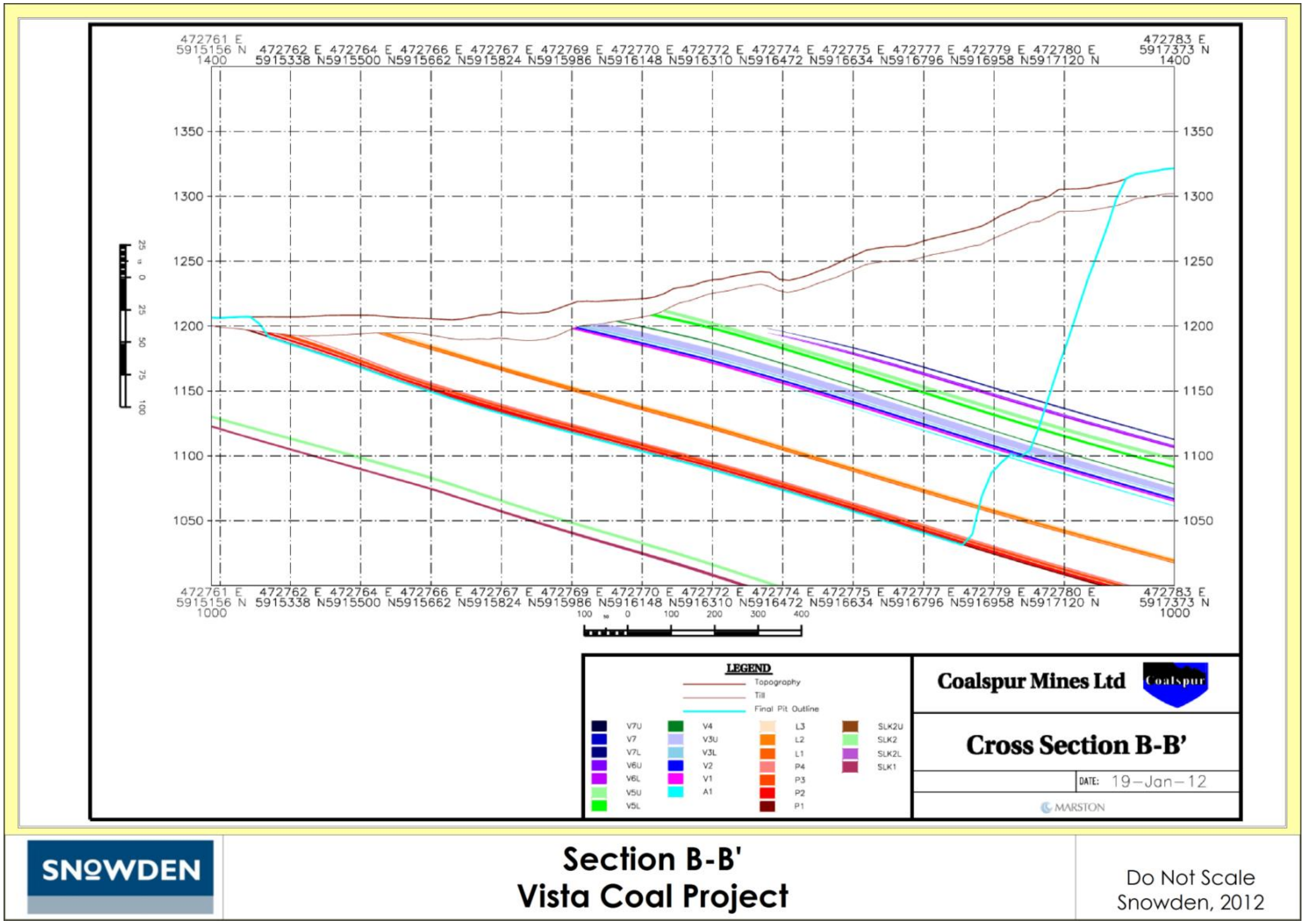
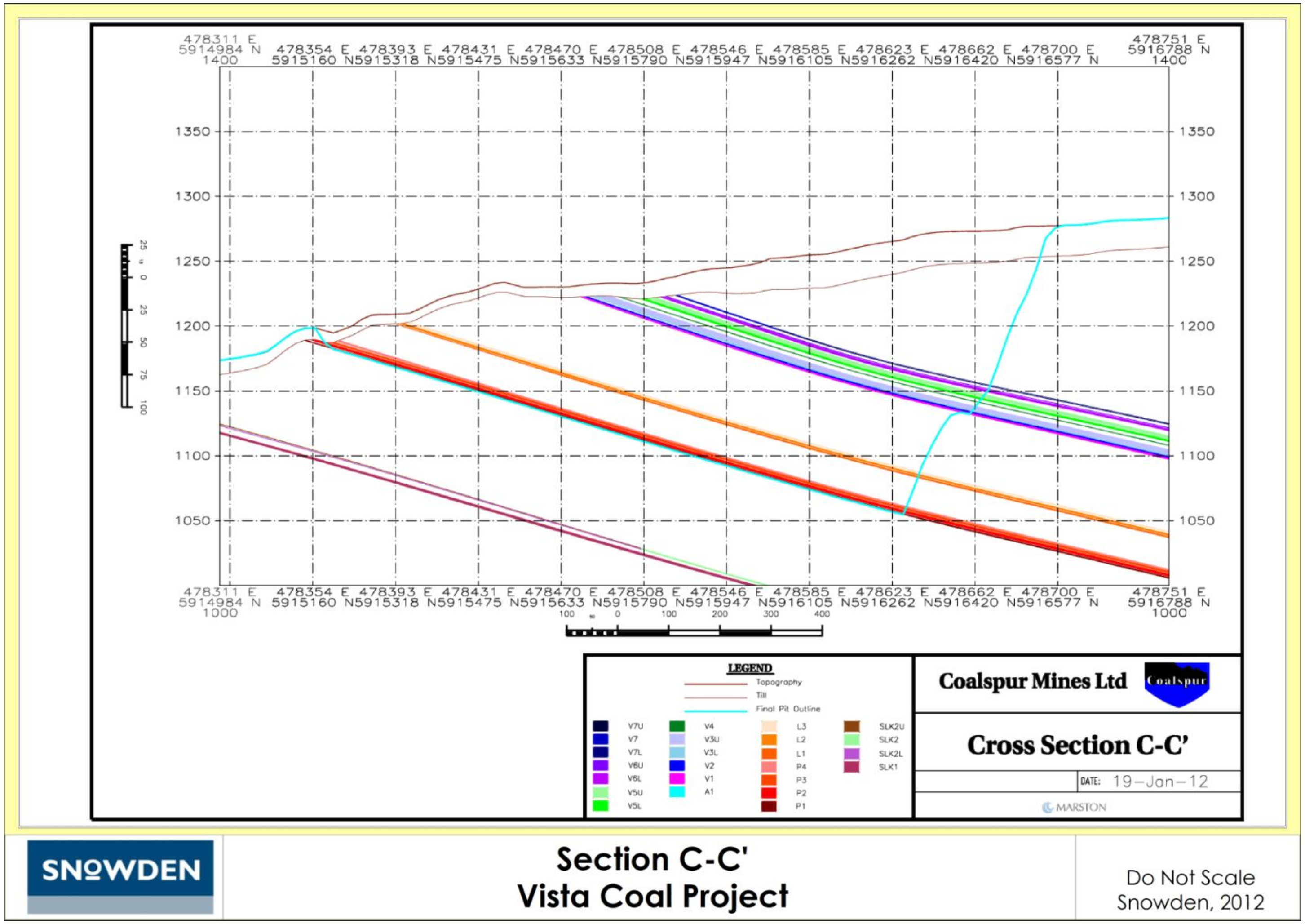


Figure 14.6 Section CC ***(approximate 2.5:1 vertical exageration)***



14.3.3 Coal Quality Model

The analytical data provided included '*As Analysed*' and '*Raw*' values for various measured and calculated parameters (Table 14.4). The '*Raw*' parameter is equivalent to the *In Situ* value as calculated by application of suitable formulae using the equilibrium moisture (very close to the *in situ* moisture).

The coal quality data for the Vista Coal Project were utilised as base data for subsequent compositing and modelling. The parameters included in the coal quality model include relative density, equilibrium and total moisture contents, ash content, sulphur content, volatile matter content, fixed carbon content, and calorific value. At the direction of Coalspur, the coal quality model was based on the *in situ* parameters as supplied.

The initial step in the creation of the coal quality models was to compare the positional data in the quality ply database to the seam positions in the stratigraphic resource model. In this fashion, the ply samples are combined to determine composite quality values for each seam in drill holes containing coal quality data. Because the major seam groups contain multiple plies, and the thickness of waste between these plies varies from non-separable to separable, this exercise had several goals, namely:

- to adjust the seam depth data in the quality database to match to the values in the lithology database
  - this included pro-rata adjustment of ply thicknesses within a given seam intercept, as required;
- to identify removable and non-removable parting horizons through appropriate lithology codes
  - this has two effects: first, to eliminate the use of quality values for removable parting horizons in seam composite quality estimates; and secondly, to enable the estimation of removable parting quantities within a given seam;
- to establish the quantity of removable partings in any given seam
  - this value is required to enable accurate accounting of coal loss and dilution values for estimates of ROM quantities and qualities

Golder reviewed the results of the compositing exercise to assess the quantity of data available per seam and general statistics calculated from those data. A summary listing of the available data for modelling for each seam resulting from the compositing exercise is shown in Table 14.5.

Table 14.4 Summary of available proximate analysis data

Item	Description	Units	# Samples	Comment
		As Analysed Values		
A	Equilibrium Moisture Content (EQM)	(Wt. %)	214	
B	Total Moisture Content (TM)	(Wt. %)	319	
C	Air Dried Moisture Content (M_{ad})	(Wt. %)	1,247	
D	Relative Density (RD)	(g/cc)	948	Air dried moisture basis
E	Ash Content (Ash_{ad})	(Wt. %)	1,247	Air dried moisture basis
F	Volatile Matter Content (VM_{ad})	(Wt. %)	907	Air dried moisture basis
G	Total Sulphur Content (TS_{ad})	(Wt. %)	908	Air dried moisture basis
H	Calorific Value (CV_{ad})	(Wt. %)	882	Air dried moisture basis
		Raw Values (In-Situ Moisture Content Basis)		
I	Equilibrium Moisture Content (EQM)	(Wt. %)	1,247	Assigned value
J	In-Situ Moisture Content (ISM)	(Wt. %)	1,247	EQM +1 (I + 1)
K	In-Situ Density (IRD)	(g/cc)		From ash: density regression curves
L	Ash Content (Ash_{is})	(Wt. %)	1,247	Ash adjusted to ISM basis – E * (100-K)/(100-C)
M	Volatile Matter Content (VM_{is})	(Wt. %)	907	VM adjusted to ISM basis – F * (100-K)/(100-C)
N	Total Sulphur Content (TS_{is})	(Wt. %)	908	Sulphur adjusted to ISM basis – G * (100-K)/(100-C)
O	Calorific Value (CV_{is})	(kcal/kg)	882	CV adjusted to ISM basis and to kcal/kg – H * 238.8 * (100-K)/(100-C)
P	Calorific Value (CV_{daf})	(kcal/kg)	882	Dry, ash free CV – O * 100/ (100-J-L)

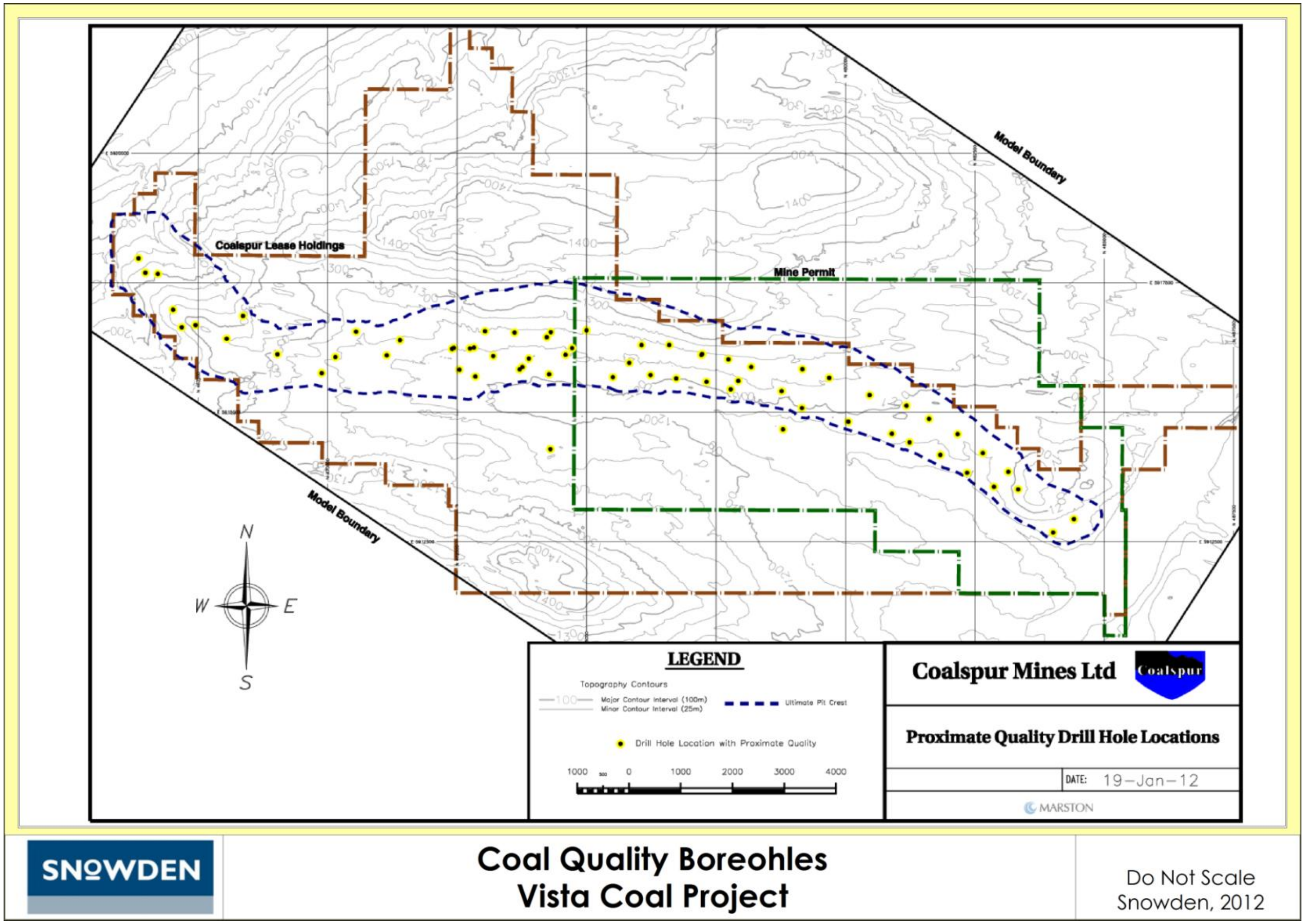
Table 14.5 Summary of coal quality composite database entries by seam/ply

Seam	Quantity of Composite Quality (Drill Holes) Available for Modelling						
	Ash	**CV**	**EQM**	**TM**	**RD**	**VM**	**TS**
V7U	*2*	*2*	*2*	*2*	*2*	*1*	*1*
V7	*6*	*6*	*6*	*6*	*6*	*5*	*5*
V7L	*4*	*3*	*4*	*4*	*4*	*2*	*2*
V6U	20	15	20	20	20	13	13
V6L	23	16	23	23	23	15	16
V5U	28	20	28	28	28	17	17
V5L	24	19	24	24	24	15	15
V4	23	21	23	23	23	15	15
V3U	36	28	36	36	36	25	25
V3L	25	22	25	25	25	16	16
V2	34	26	34	34	34	25	25
V1	35	27	35	35	35	25	25
A1	*10*	*9*	*10*	*10*	*10*	*9*	*9*
L3	20	12	20	20	20	19	19
L2	21	14	21	21	21	20	20
L1	21	14	21	21	21	20	20
P4	33	24	33	33	33	25	25
P3	33	24	33	33	33	25	25
P2	34	25	34	34	34	26	26
P1	33	24	33	33	33	25	25
SLK2U	*2*	*2*	*2*	*2*	*2*	*2*	*2*
SLK2L	*2*	*2*	*2*	*2*	*2*	*2*	*2*
SLK1	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Totals	**471**	**357**	**471**	**471**	**471**	**349**	**350**

Note: Only highlighted seams / plies have been included in mine planning

The modelling technique for the coal quality parameters consisted of the creation of grid based surfaces representing projected *in situ* qualities using the composited ply quality values as base data. The gridded coal quality surfaces were created using the same rotated, regular 20 m grid as was used for stratigraphic modelling. Grid surfaces created from data sets with less than four data points generally do not provide reasonable estimates of quality over an area the size of the Vista property. Typically, the spatial distribution of sample populations of this size localises the effects of known data points, and can produce misleading extrapolations. This was not an issue for Vista, as all seams included in estimation and subsequent mine planning had a sufficient quantity of data for the modelling of grid-based surfaces. The locations of drill holes with associated proximate coal qualities used for quality modelling are shown in Figure 14.7.

Figure 14.7 Plan of drill holes with coal quality used in modelling



14.3.4 Model Validation

Notwithstanding the grid validation exercise undertaken as a part of the initial validation of data (Item 12), Snowden undertook a further validation exercise specifically aimed at the geological model.

Snowden validated by the Vista structural model by:

- Preparing several grids from first principles using the same raw data as supplied in the CSV datasets
  - Snowden used its preferred software, Vulcan, for this exercise.
- Estimating volumes for several seams / plies
- Estimating volumes using the as received gridded data for the same seams / plies
- Comparison of the Snowden-derived volumes with the volumes derived from the as received gridded data.

The results of the brief model validation (Table 14.6) show that the estimates presented by Snowden (2012) as derived by Golder/Marston (2012) are reliable. Snowden is comfortable to continue to report these estimates and takes full responsibility in reporting the estimates in this ITR.

Table 14.6 Comparisons between as received and Snowden-derived estimates of volume and tonnage for several coal seams / plies

SEAM	As Received		Snowden		% Diff (t)
	V (Mm^3)	Mt	V (Mm^3)	Mt	
V3U	96.074	144.111	91.394	137.090	5%
L2	41.934	62.901	38.750	58.125	8%
P3	52.980	79.470	54.857	82.286	-4%
Total	**190.988**	**286.483**	**185.001**	**277.501**	**3%**

14.3.5 Mineral Resource Classification

Golder/Marston (2012) applied the drill hole spacing criteria presented in the Geological Survey of Canada's Paper 88-21, '*A Standardized Coal Resource/Reserve Reporting System for Canada*' for Surface Mineable, Moderate Geology Type deposits. The drill hole spacing is as follows (FIGURE):

- Measured Resources = 450 m
- Indicated Resources = 900 m
- Inferred Resources – 2,400 m

Coal Resource classification for the Val d'Or 3 Upper Seam, the McLeod 2 Seam, and the McPherson 3 Seam are presented in Figure 14.8, Figure 14.9 and Figure 14.10.

14.3.6 Mineral Resource Reporting

Coal has been estimated to a physical boundary representing the 20:1 incremental *in situ* strip ratio. The defined coal resource block is this boundary limited by the subcrop of the seam and the Vista Coal Project lease boundary. Table 14.1 summarises the estimated and classified Coal Resources. Table 14.7 presents the estimates on a per seam / ply basis.

Table 14.7 2014 Coal Resource Estimates for the Vista Coal Project (Golder, 2012)

Seam Ply	Resource Category			*In Situ* Quality Parameter		
	Measured Mt	Indicated Mt	Inferred Mt	Ash %	CV MJ/kg	TS %
V7	11.6	5.0	7.6	34.4	3,998	0.56
V6U	6.7	3.4	3.8	10.5	5,773	0.58
V6L	22.9	11.6	11.7	16.8	5,179	0.41
V5U	50.3	24.1	25.6	28.5	4,443	0.30
V5L	29.5	12.7	12.7	19.9	5,072	0.24
V4	12.1	5.1	3.6	17.7	5,472	0.27
V3U	116.2	42.4	44.5	25.4	4,791	0.16
V3L	35.9	11.7	7.6	37.7	4,010	0.31
V2	31.3	11.5	9.9	32.3	4,185	0.23
V1	34.3	13.2	12.6	26.2	4,721	0.20
A1	4.6	2.3	6.2	35.5	3,825	0.22
L3	19.5	11.1	8.3	40.1	3,892	0.22
L2	40.7	24.1	19.2	35.1	4,186	0.19
L1	20.3	10.0	4.9	37.7	3,843	0.20
P4	29.8	16.8	11.0	31.5	4,383	0.25
P3	58.3	29.2	21.7	25.1	4,985	0.16
P2	67.8	33.8	23.3	30.4	4,592	0.18
P1	37.1	16.6	9.6	25.2	4,917	0.23
S2	32.2	32.0	27.1	39.1	3,622	0.41
S1	26.9	26.3	19.8	20.9	5,073	0.23
Total	**688.0**	**342.9**	**290.7**			

Figure 14.8 Coal Resource Classification for the Val d'Or Seam

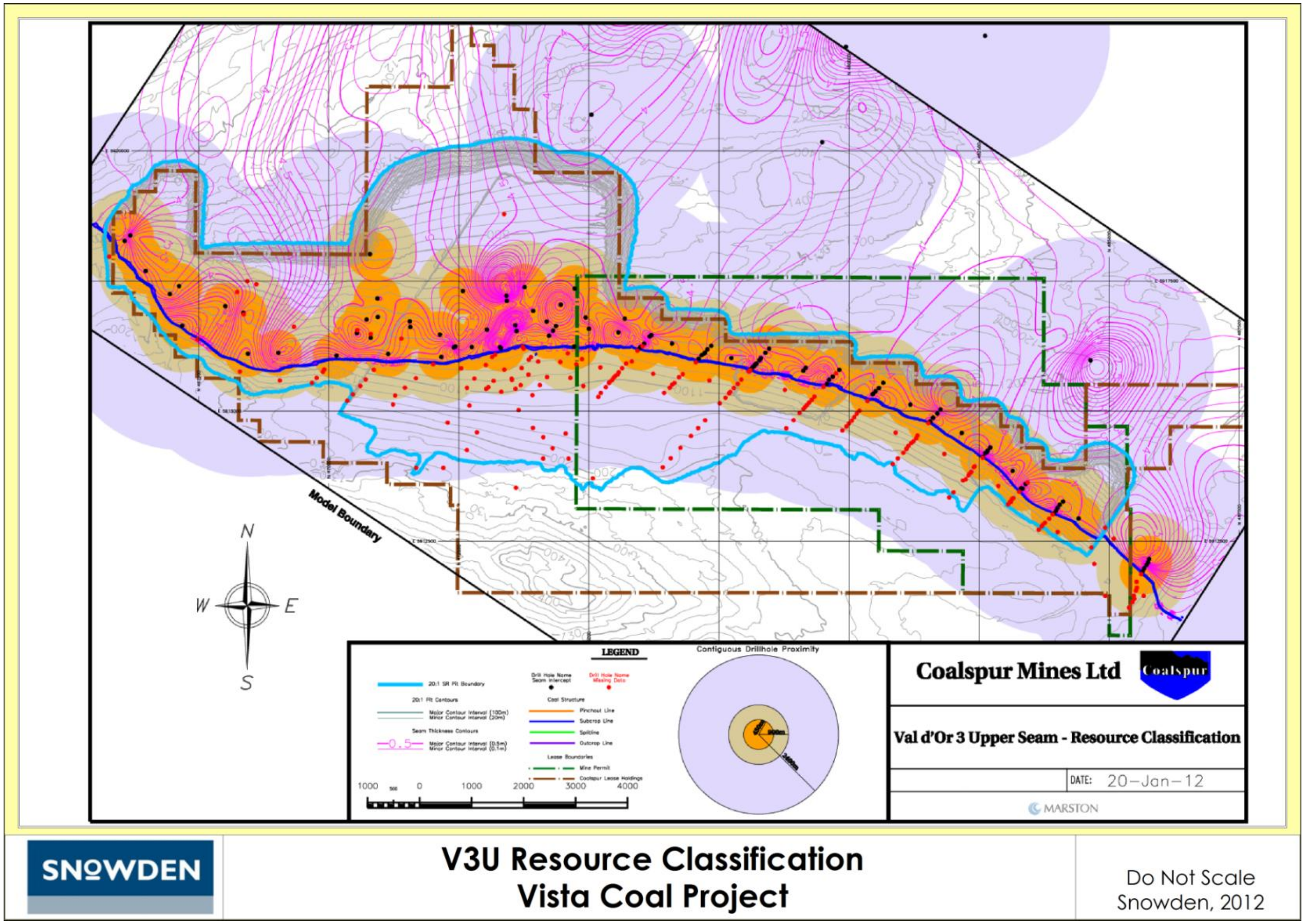


Figure 14.9 Coal Resource Classification for the McLeod 2 Seam

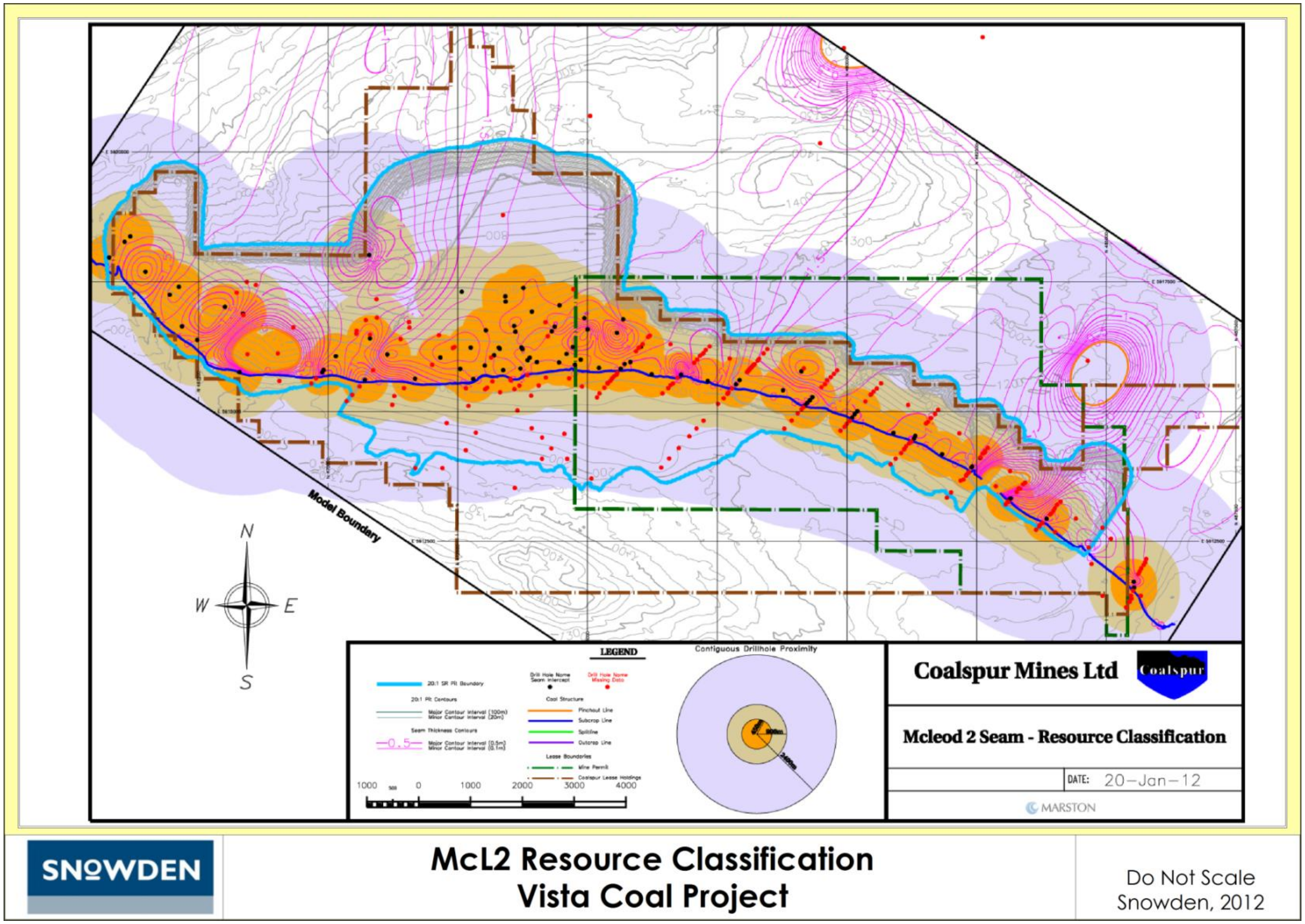
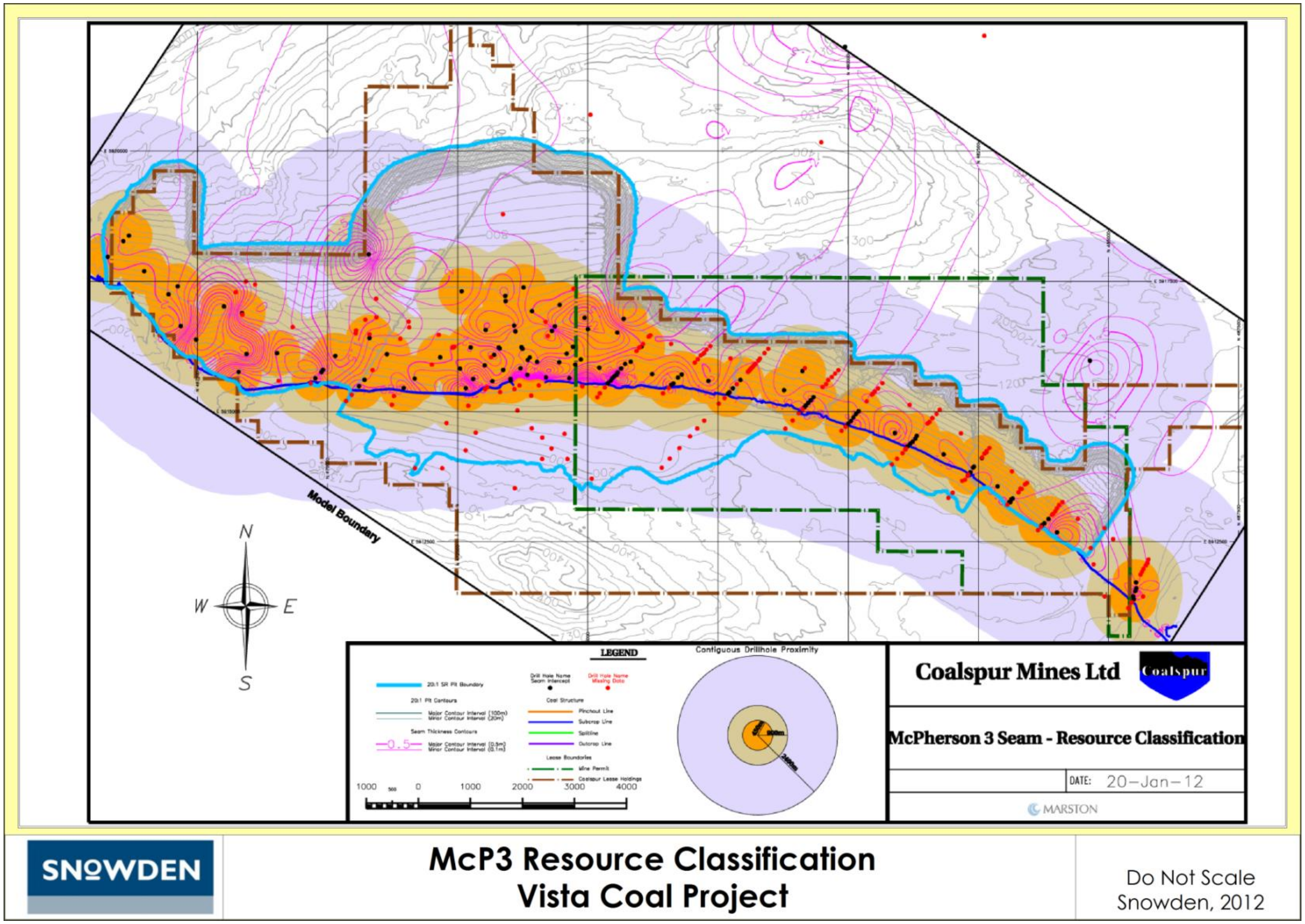


Figure 14.10 Coal Resource Classification for the McPherson 3 Seam



15 Mineral Reserve Estimates

15.1 Introduction

An NI41-103 Mineral Reserves Estimate was previously reported for the Vista project in "September 2012 - Coalspur Mines Limited: feasibility Study of the Vista Coal Project, Hinton Alberta", (Snowden). The report details the mining evaluation studies conducted to develop a detailed mine plan and financial analysis for the Vista project. Since September 2012, no new mining studies have been completed to produce a revision of mining approach, modifying parameters, production rates or mine schedule.

A key assumption which has changed compared to the previous NI43-101 technical report is that Coalspur plan to engage a contractor to undertake all waste and coal mining operations for the life of the operation. Coalspur will manage the business, the Contractor will provide all mining services which includes appropriate earth moving equipment and ancillaries, labour, supervision and maintenance services. Coalspur will be responsible for procuring the two Marion 8200 sized draglines. These will be operated and maintained by the contractor. The principal impacts to the mine plan through the use of contractors is that significant start-up capital can be eliminated and the requirement for most owner operate equipment capital is eliminated.

In terms of coal processing and associated costs, no changes have been made since the previous Coalspur NI43-101 technical report.

15.2 General

In accordance with NI 43-101, for estimating coal resources and reserves for the Vista project coal deposit, at the time of compilation of the original January 2012, the definitions of “Mineral Resource” and “Mineral Reserve” as set forth in the updated CIM Definition Standards adopted November 27, 2010 (CIMDS) by the Canadian Institute of Mining, Metallurgy and Petroleum Council were adopted.

A Mineral Reserve is defined as “… the economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when the material is mined.” A Mineral Reserve is subdivided into two classes, Proven and Probable with the level of confidence reducing with each class respectively. The CIMDS provides for a direct relationship between Indicated Mineral Resources and Probable Mineral Reserves, and between Measured Mineral Resources and Proven Mineral Reserves. Inferred Mineral Resources cannot be combined or reported with other categories.

Except as stated herein, there are no modifying factors exogenous to mining engineering considerations (i.e. competing interests, environmental concerns, socio-economic issues, legal issues, etc.) that would be of sufficient magnitude to warrant excluding reserve tonnage below design limitations or reducing reserve classification (confidence) levels from proven to probable or otherwise.

15.3 Estimated coal reserves

15.3.1 Criteria for determination of ROM coal

Estimation of ROM coal qualities were completed using the same modifying factors as were applied in the mine scheduling database to estimate ROM coal quantities. These factors are based on the blasting, coal cleaning and coal mining techniques and equipment selected.

- Minimum mineable coal thickness 0.5 m
- Minimum removable parting thickness 0.3 m
- Coal seam roof loss (except V2 Seam) see Table 15.1
- Out-of-seam rock dilution (OSD) at seam floor see Table 15.1
- OSD per removable parting 0.15 m
- Coal loss per removable parting 0.15 m

Table 15.1 Seam loss and out of seam rock dilution factors

Seam	Coal Loss at Roof Thickness (m)	OSD at Floor Thickness (m)
V6U	0.15	0.10
V6L	0.15	0.10
V5U	0.15	0.05
V5L	0.15	0.10
V4	0.15	0.15
V3U	0.15	0.15
V3L	0.15	0.15
V2	0.10	0.15
V1	0.15	0.15
L3	0.15	0.15
L2	0.15	0.15
L1	0.15	0.15
P4	0.15	0.10
P3	0.15	0.10
P2	0.15	0.10
P1	0.15	0.10

Available proximate analyses for parting, roof and floor rock material were used to establish average quality values for all dilution materials for use in calculations of ROM quality impacts. The average dilution rock material qualities used for ROM quality calculations were:

- equilibrium moisture content (Wt. %) 6%
- in situ moisture content (Wt. %) 7%
- specific gravity (g/cc) 2.10
- ash content at in situ moisture (Wt. %) 76.7%
- sulfur content at in situ moisture (Wt. %) 0.12%
- calorific value at in situ moisture (kcal/kg) 867

15.3.2 Plant Yield and Clean Coal Quality Model

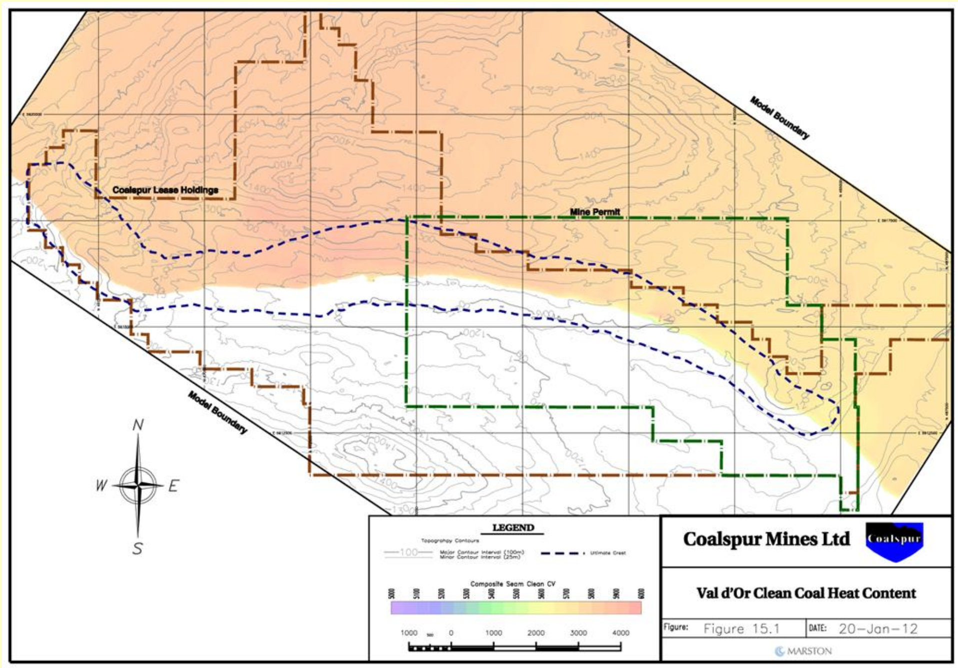
The proximate quality composite data was further utilized for the projection of clean coal qualities by seam through the use of plant simulation software under the direction of Bob Leach. Essentially, the in situ composites were modified by coal loss and waste dilution factors to estimate likely ROM coal qualities by seam in each drill hole. This approach starts with an estimate of the likely preparation plant coal feed quality by seam, with subsequent process simulation or analysis to estimate clean coal yield and qualities.

The in situ coal composite qualities were each adjusted for coal losses and rock dilution additions, resulting in projected diluted coal feed qualities to the proposed preparation plant facilities. The results of the preparation plant process simulation consisted of projected yield and clean coal quality values for the 1.50, 1.55, 1.60 and 1.65 gravity cut points. Clean coal quality parameters included in the model were yield, total moisture content, ash content and calorific value. These were available for all seams in drill holes that had proximate analysis data.

The projected seam yield and clean coal quality values were utilized in the same fashion as the proximate analyses for the preparation of grid-based surfaces. For the purposes of mine planning, clean coal results at all 4 cut points were available in the mine scheduling database. This provides flexibility during estimates of clean coal yield level and blended quality results during sequencing.

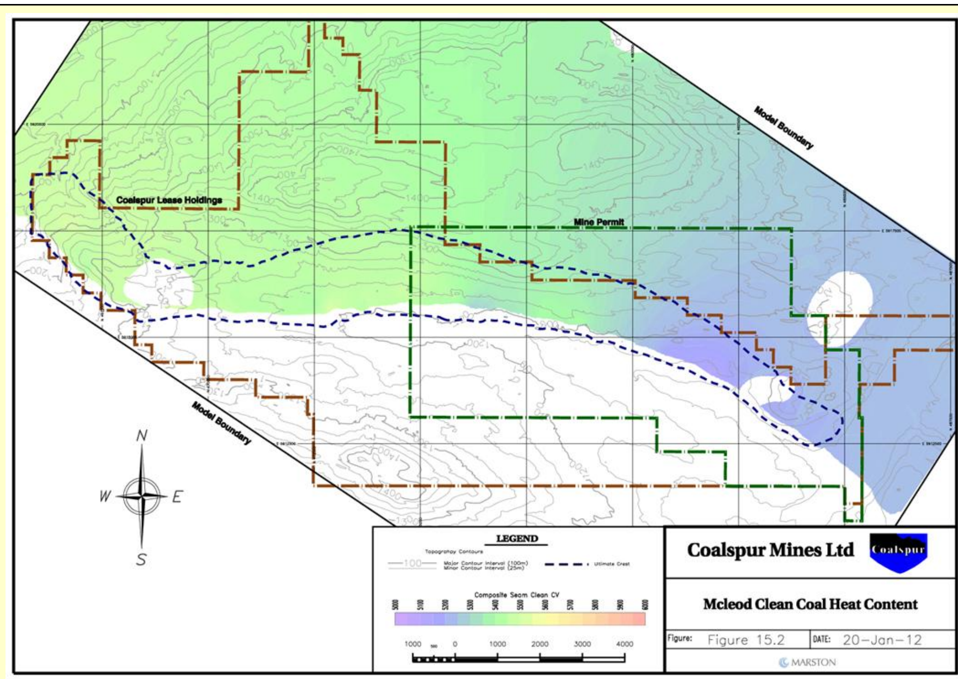
Mapping of the average calorific value of clean coal by seam group (Val d’Or, McLeod, and McPherson) illustrates an interesting trend of approximately 200 kcal/kg from low to high values as locations vary from the southeast of the project area to the northwest. These trends, which are based on the 1.55 gravity cut point cut-off, are shown in Figure 15.1, Figure 15.2, Figure 15.3 for each of the seam groups. The Val d’Or group clean coal calorific value ranges from the 5600s (kcal/kg) to the 5800s (Figure 15.1), the McLeod from the 5200s to the 5400s, and the McPherson from the 5500s to the 5700s. This is unusual, and impacts mine development sequencing as a result of the need to blend the seam group coals to achieve target product quality characteristics.

Figure 15.1 Val d'Or clean coal heat content



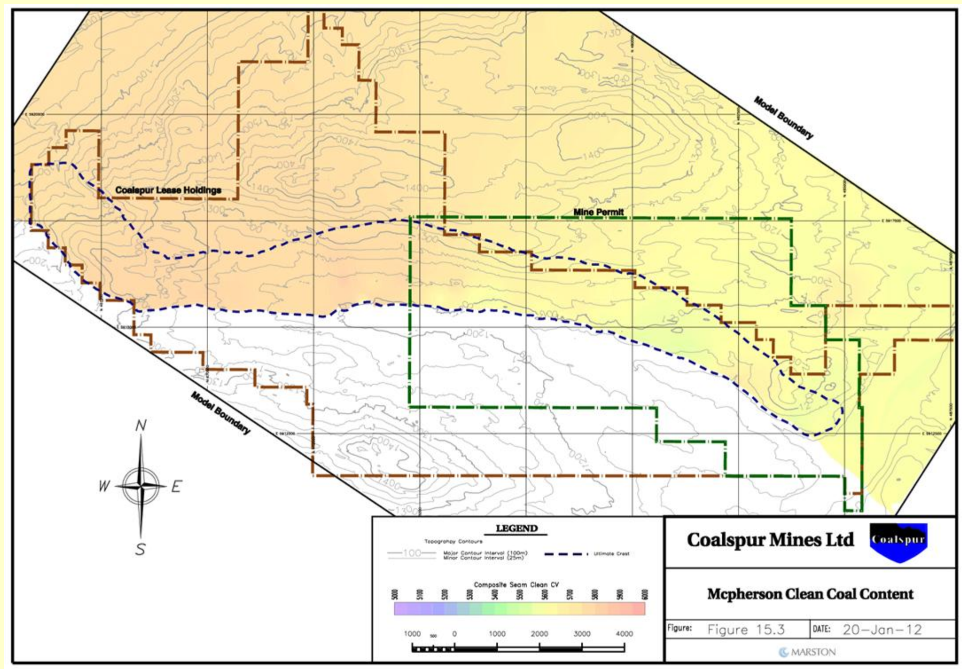
Calorific Value Vista Coal Project	Source: Snowden, 2012

Figure 15.2 Mcleod clean coal heat content



Calorific Value Vista Coal Project	Source: Snowden, 2012

Figure 15.3 McPherson clean coal heat content



SNOWDEN	Calorific Value Vista Coal Project	Source: Snowden, 2012

15.3.3 Coal Reserve Estimates

The assessment of surface mineable coal reserves within the Coalspur area was based on surface mining pit designs to adequately represent the effects of highwall and end wall laybacks on the estimated mineable reserve. The pit design resulted from a targeting process beginning with pit optimization and proceeding through final pit and access design.

The initial step in preparing the designs was completion of a series of pit optimization assessments using Whittle modified Lerchs Grossman ("LG") software. The pit boundary assessments were completed over a range of unit revenue values for product coal, with unit costs of waste stripping and haulage, and coal mining and haulage, based on existing Pre-Feasibility Study estimates. The stratigraphic and proximate and clean coal quality models formed the basis of volume estimates for a block model created over the extent of the project area. Using the modifying factors and plant performance yield and quality predictions, the blocks were populated with expected total revenue and cost levels.

Based on discussions with Coalspur management staff, the final pit configuration was based on unit pricing of C$80/t clean coal. The pit shell provided by this optimization run provided the basis for final pit designs, which included detailed highwall and endwall configurations as well as assurance of provision for pit access.

In order to construct a reasonable highwall which did not unnecessarily sterilize economic coal reserves the design does not strictly adhere to the Coalspur coal lease holdings boundary.

The design criteria for final pit configurations are as follows:

- face angle – competent rock 65°
- face angle – coal 80°
- face angle – till 30°
- overall highwall/endwall angle 45°
- truck/shovel bench height 15 m
- safety bench width 16 m every other bench
- dragline bench height 50 m (un-benched)
  - (anything over 50 m will require a safety bench)
- offset from McPherson Creek (crop limit) 100 m
- offset from McLeod River escarpment (southeast limit) 100 m
- coal recovery limited to the lease boundary
- waste removal may occur outside of the lease boundary.

Estimated ROM coal reserves and product coal tonnes for the proposed surface mineable coal are listed in Table 15.2 A breakdown by seam ply has been included in Table 15.3.

Table 15.2 Summary of estimated low sulphur, high volatile bituminous C Rank thermal coal reserves

Coal Reserve Classifications (Mt ROM)		Average Plant Yield (%)	Marketable Coal (Mt clean)
Proven	Probable		
504	62	55	313

The Measured and Indicated resource estimates as stated in Item 14 are inclusive of the resources comprising the Proven and Probable reserve estimates described in Table 15.2.

For the Vista coal project the total estimated Proven and Probable reserves are 566 Mt. Total marketable tonnes are estimated to be 313 Mt. The overall in-situ strip ratio is projected to be 9.3 BCM per marketable tonne requiring removal of 2.9 billion BCM of waste over the life of the mine.

The ultimate pit extents were utilised as the basis for preparation of a mine scheduling database. This involved estimates of coal and waste volumes and tonnages on detailed bench and block splits, to allow subsequent simulation of mine development by shovel and truck and dragline methods. The results of these efforts further served to support the estimates of coal reserves.

Table 15.3 Summary of estimated reserves by seam (t x1000)

Seam Group	Seam Ply	Coal Reserves[1]			Marketable Coal[2]		
		Proven	Probable	Total	Proven	Probable	Total
Val d'Or	V6U	4,700	200	4,900	3,200	100	3,400
	V6L	17,800	800	18,600	11,700	500	12,100

	V5U	35,000	2,100	37,100	20,900	1,100	22,000
	V5L	24,000	1,500	25,500	16,900	900	17,800
	V4	10,200	400	10,600	5,400	200	5,600
	V3U	89,500	6,200	95,700	55,600	3,700	59,300
	V3L	29,100	900	30,000	13,300	500	13,800
	V2	26,000	1,600	27,600	12,500	800	13,300
	V1	28,500	2,500	31,100	16,200	1,500	17,600
	Sub-Total	**264,800**	**16,200**	**281,100**	**155,700**	**9,300**	**164,900**
McLeod	L3	16,800	4,000	20,800	6,400	1,500	7,900
	L2	37,300	7,600	45,000	17,700	3,800	21,500
	L1	20,300	4,300	24,600	7,400	1,600	9,000
	Sub-Total	**74,400**	**15,900**	**90,400**	**31,500**	**6,900**	**38,400**
McPherson	P4	21,900	4,700	26,600	11,700	2,500	14,200
	P3	52,300	8,900	61,200	31,000	5,600	36,600
	P2	54,400	10,800	65,100	30,800	6,000	36,800
	P1	36,000	5,400	41,400	19,500	3,000	22,500
	Sub-Total	**164,600**	**29,800**	**194,300**	**93,000**	**17,100**	**110,100**
	Total	**503,800**	**61,900**	**565,800**	**280,200**	**33,300**	**313,400**

Notes:
1. Estimated coal reserves reported in thousands of ROM tonnes.
(a) All reserves are low sulphur, high volatile bituminous C Rank thermal coal.
2. Estimated marketable coal reported in thousands of clean coal tonnes.

15.3.4 Discussion of potential impacts of relevant factors on mineral reserve estimate

A basic assumption of this Report is that the estimated coal resources and reserves at Coalspur's Vista projects have a reasonable prospect for development under the existing circumstances and assuming a reasonable outlook for all issues that may materially affect the mineral resource estimates.

In February 2014, the AER granted approval for the amendment of Coalspur's Mine Permit and Coal Processing Plant Approval, as well as Coal Mine pit and waste dump licenses. Caolspur's applications for the remaining licences, permits and surface dispositions required to commence construction of Vista, are currently under reviews by the AER.

16 Mining methods

Section 16 (Mining) for the purposes of this document remains largely unchanged from 2012 reporting. Marston (now part of Golder Associates) completed the mining studies in early 2012. Their work was incorporated into the Snowden 2012 FS report and subsequently repeated in the Golder September 2012 NI43-101 technical report.

In this current report, the only item that has changed in Chapter 16 is the incorporation of contractor mining instead of an owner operated mine. Snowden notes that the schedule from 2012 is still feasible and that economic, technical and other parameters have not materially changed to the point where the mine plan is no longer applicable. As stated in the previous reports, the mine plan and schedule relies on timely regulatory approvals. Whilst the project is well advanced on the Phase 1 approvals, Phase 2 and subsequent project expansions are assumed to be in place in 2018 in order to provide feed by 2019.

Snowden understands that Coalspur has optimisation studies into terrace mining underway. These studies include ongoing investigations into extended or broader contract mining possibilities. Snowden believes that such scenarios do not pose any particular material risks to the economic results or the feasibility of the project.

16.1 Minimum Mineable Thickness

The pre-feasibility study contemplated a minimum mining thickness of 0.5 m which is slightly lower than the recommended coal thickness as stated in GSC Paper 88-21 of 0.6 m. Given the seam dips and continuity Marston found the 0.5m minimum mineable seam thickness to be appropriate and carried it forward in the feasibility study work. A minimum separable parting assumption of 0.30 m was assumed in the mine plan.

16.2 Dilution and Coal Loss

In general a 15 cm loss of coal at the seam roof contact was assumed along with 15cm out-of-seam-dilution (OSD) at the seam floor. The mine plan is based on blasting down to the top of the next seam. Partings or interburden less than 1.5 m will be ripped by dozers and hauled out. Partings greater than 1.5 m will be blasted. A series of geotechnical drill cores were examined for opportunities to reduce the amount of seam loss and dilution. Upon inspection it was found that there were a few seam floor horizons which appeared competent and had a good colour change which would allow for more aggressive seam recovery and dilution reductions. In these areas the loss/dilution assumption was reduced to 10 cm. The Table 16.1 summarizes the assumptions which were carried in the mining model.

Table 16.1 Dilution and Coal Loss

Seam	Coal Loss at Roof Thickness (m)	OSD at Floor Thickness (m)
V6U	0.15	0.10
V6L	0.15	0.10
V5U	0.15	0.05
V5L	0.15	0.10
V4	0.15	0.15
V3U	0.15	0.15
V3L	0.15	0.15
V2	0.10	0.15
V1	0.15	0.15
L3	0.15	0.15
L2	0.15	0.15
L1	0.15	0.15
P4	0.15	0.10
P3	0.15	0.10
P2	0.15	0.10
P1	0.15	0.10

16.3 Mine Design and Optimization

A pre-feasibility study was completed for the Vista Project in 2010. The study contemplated producing up to 9 Mtpa of clean coal based on an annual mining rate of approximately 18 Mt ROM. The project was reported to have a 4.6 year payback with an associated internal rate of return of 23.2%. Economic Pit Results

Using the pre-feasibility study as the basis for the input parameters, Marston (2012) performed a Lerchs-Grossman incremental economic pit limit analysis was run using Whittle software. It was found that the unit costs used in the pre-feasibility study for the various unit operations to be appropriate given the type of mining method contemplated in the pre feasibility study. Table 16.2 summarizes the unit costs used for the analysis.

Table 16.2 Whittle Unit Costs

Item	Cost	Units
Truck/Shovel Mining	$ 2.76	$/BCM
rolling capital charge	$ 0.20	$/BCM
Total Truck/ Shovel Mining	$ 2.96	$/BCM
Dragline Mining	$ 1.38	$/BCM
Coal Mining	$ 2.66	$/RMT
rolling capital charge	$ 0.15	$/RMT
Total Coal Mining	$ 2.81	$/RMT
Coal Processing	$ 3.99	$/CMT
G&A	$ 0.62	$/CMT
Ex-Mine (rail & port)	$ 26.00	$/CMT
Revenue Assumptions	Variable	$/CMT

The reported ROM tonnes from the per-feasibility study for each seam were divided by the reported in-situ volumes in order to calculate a tonnage factor. Whittle applied this factor to the in-situ coal volumes in the block model in order to calculate ROM tonnes. Table 16.3 contains the calculated tonnage factors for the various seams. Weighted average plant yields by seam group were derived from the pre-feasibility in order to generate clean tonnes.

These plant yields by seam group were as follows:

- Val d'Or 54.7%
- McLeod 34.5%
- McPherson 55.0%

Table 16.3 Tonnage Factors

Seam	Horizon	Tonnage Factor
Val d'Or	V6U	1.50
	V6L	1.48
	V5U	1.54
	V5L	1.46
	V4	1.54
	V3U	1.50
	V3L	1.60
	V2	1.58
	V1	1.53
McLeod	L	1.68
McPherson	P4	1.56
	P3	1.49
	P2	1.50
	P1	1.53

Additional assumptions used in analysis included the following:

- US$/CAN$ exchange rate set at par
- Overall wall angle of 45°
- Base case coal price was set to $80.00
- Selling price was varied by -40%($43.50) to +75% ($126.88) in 5% increments

The results of the pit finding exercise are contained in Table 16.4. As noted above the US to Canadian dollar exchange rate used in the feasibility study pit finding exercise was set at par. The economic pit analysis for the pre-feasibility study used a base selling price assumption, in Canadian dollars, of $80.55 (US$72.50 at an exchange rate of 0.90). Pit Shell 11 has been highlighted in blue as this pricing level most closely reflects the pricing assumption used in the pre-feasibility study. The selling price listed in Table 16.4 can be considered to be in Canadian dollars with the assumption that exchange rate is set at par.

Table 16.4 Whittle LG Pit Results

LG Pit Shell	Price (US$/tonne)	Total Waste (BCM)	ROM Coal (t)	Clean Coal (t)	ROM Strip Ratio	Clean Strip Ratio
1	$43.50	10,914.970	7,823,303	4,280,735	1.4	2.5
2	$47.13	63,184,739	35,846,289	19,598,347	1.8	3.2
3	$50.75	144,911,904	66,148,195	36,162,426	2.2	4.0
4	$54.38	245,109,213	94,696,430	51,748,879	2.6	4.7
5	$58.00	359,391,118	120,795,027	65,987,490	3.0	5.4
6	$61.63	532,049,704	164,213,591	87,289,054	3.2	6.1
7	$65.25	1,109,558,219	271,295,238	140,222,683	4.1	7.9
8	$68.88	1,576,352,694	349,303,786	180,240,152	4.5	8.7
9	$72.50	2,097,716,337	428,960,077	220,294,088	4.9	9.5
10	$76.13	2,419,250.777	473,757,360	243,303,124	5.1	9.9
11	$79.75	2,886,859,468	534,401,073	274,336,864	5.4	10.5
12	$83.38	3,576,985,303	621,301,642	317,982,114	5.8	11.2
13	$87.00	4,228,262,532	691,838,373	354,316,508	6.1	11.9
14	$90.63	4,888,866,872	755,587,134	387,187,721	6.5	12.6
15	$94.25	5,749,104,916	826,785,736	423,924,838	7.0	13.6
16	$97.88	6,395,918,210	875,654,431	449,112,303	7.3	14.2
17	$101.50	7,187,181,559	931,475,837	477,931,648	7.7	15.0
18	$105.13	7,990,005,176	982,959,913	504,511,913	8.1	15.8
19	$108.75	8,770,198,970	1,026,285,995	526,912,543	8.5	16.6
20	$112.38	9,689,705,609	1,075,128,344	552,188,910	9.0	17.5
21	$116.00	10,391,309,408	1,111,951,164	571,233,313	9.3	18.2
22	$119.63	11,471,569,860	1,168,875,112	600,667,818	9.8	19.1
23	$123.25	14,554,708,228	1,350,731,711	694,386,851	10.8	21.0
24	$126.88	16,486,059,195	1,447,275,946	744,383,966	11.4	22.1

The incremental material quantities between pit shells have been summarized in Table 16.5.

Table 16.5 Incremental Pit Quantities between Pit Shells

Incremental Quantities Between Pit Shells:	Price (US$/tonne)	Incremental Waste (BCM)	Incremental ROM Coal (t)	Incremental Clean Coal (t)	Incremental ROM Strip Ratio	Incremental Clean Strip Ratio
1 – 2	$47.13	52,269,769	28,022,986	15,317,612	1.9	3.4
2 – 3	$50.75	81,727,165	30,301,906	16,564,079	2.7	4.9
3 – 4	$54.38	100,197,309	28,548,235	15,586,453	3.5	6.4
4 – 5	$58.00	114,281,905	26,098,597	14,238,611	4.4	8.0
5 – 6	$61,63	172,658,586	43,418,564	21,301,563	4.0	8.1
6 – 7	$65.25	577,508,515	107,081,647	52,933,629	5.4	10.9
7 – 8	$68.88	466,794,475	78,008,549	40,017,469	6.0	11.7
8 – 9	$72.50	521,363,643	79,656,291	40,053,936	6.5	13.0
9 – 10	$76.13	321,534,440	44,797,283	23,009,036	7.2	14.0
10 – 11	$79.75	467,608,692	60,643,713	31,033,740	7.7	15.1
11 – 12	$83.38	690,125,835	86,900,569	43,645,250	7.9	15.8
12 – 13	$87.00	651,277,229	70,536,731	36,334,394	9.2	17.9
13 – 14	$90.63	660,604,340	63,748,761	32,871,213	10.4	20.1
14 – 15	$94.25	860,238,044	71,198,602	36,737,117	12.1	23.4
15 – 16	$97.88	646,813,294	48,868,695	25,187,465	13.2	25.7
16 – 17	$101.50	791,263,348	55,821,406	28,819,344	14.2	27.5
17 – 18	$105.13	802,823,617	51,484,077	26,580,266	15.6	30.2
18 – 19	$108.75	780,193,794	43,326,081	22,400,630	18.0	34.8
19 – 20	$112.38	919,506,639	48,842,349	25,276,367	18.8	36.4
20 – 21	$116.00	701,603,799	36,822,820	19,044,403	19.1	36.8
21 – 22	$119.63	1,080,260,452	56,923,948	29,434,504	19.0	36.7
22 – 23	$123.25	3,083,138,368	181,856,599	93,719,034	17.0	32.9
23 – 24	$125.88	1,931,350,967	96,544,234	49,991,115	20.0	38.6

A graphical representation of the clean tones contained in Table 16.4 can be found in Figure 16.1

Figure 16.1 Cumulative clean tonnes vs. selling price

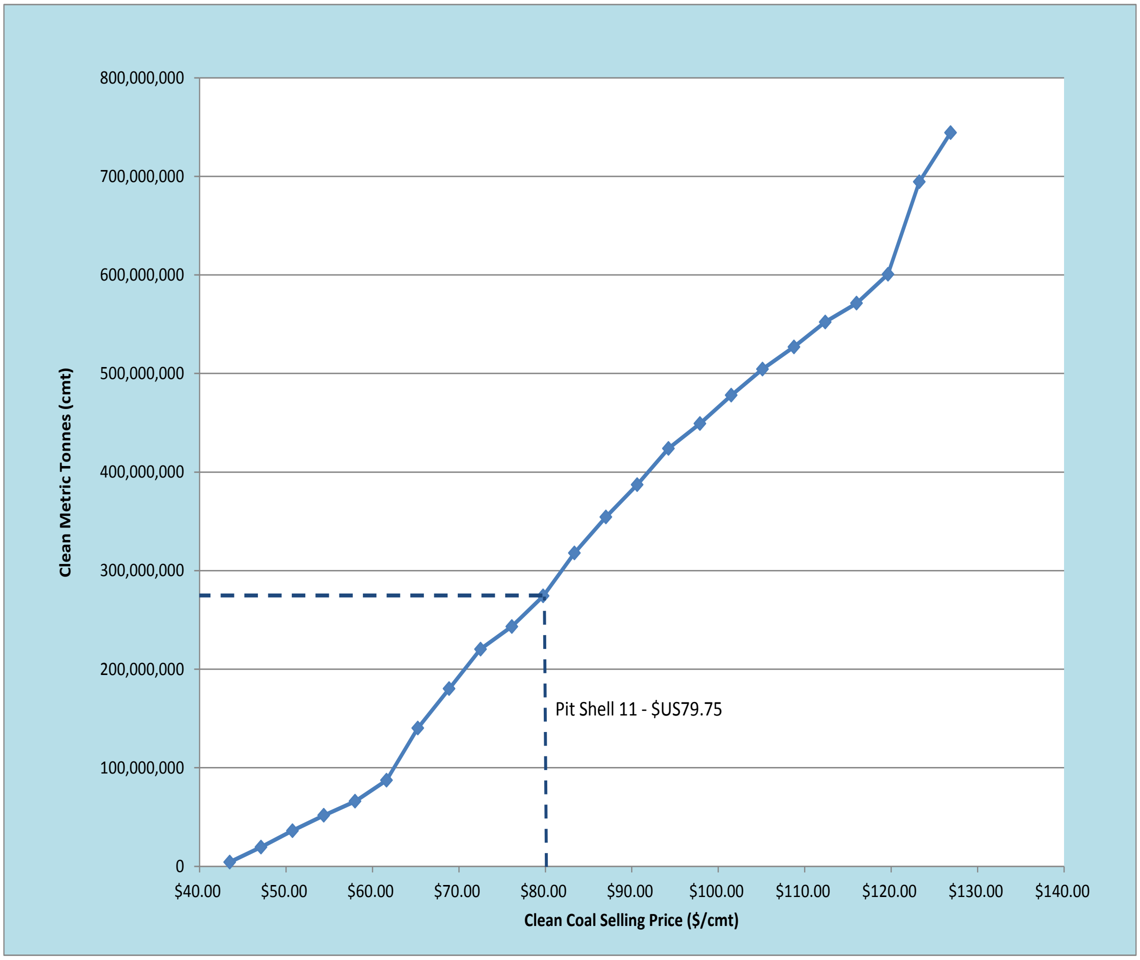


Figure 16.2 to Figure 16.5 contain plan and sectional views of the Whittle pits. Also contained in the drawings is the location of the ultimate pit from the pre-feasibility study. From the drawings it can be seen that the pre-feasibility study pit aligns most closely with Pit Shells 10 and 11 which represent the $US76.13 and $US79.75 pricing levels.

Figure 16.2 Pit shell plan view

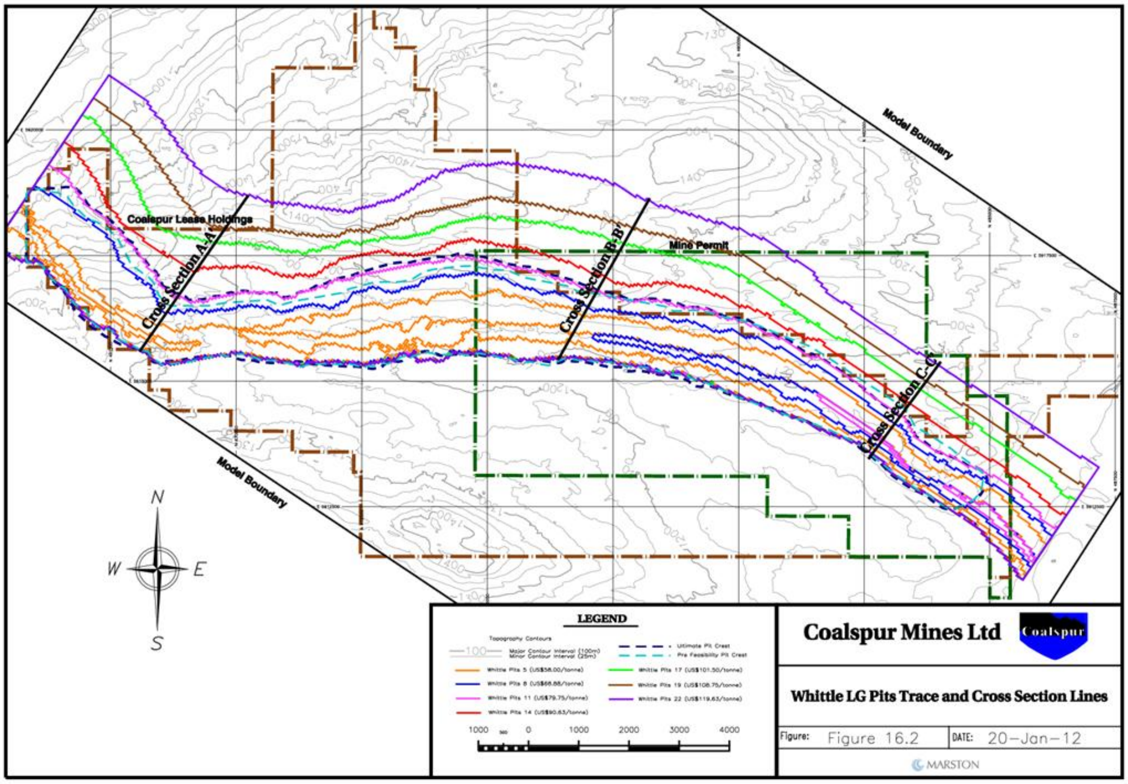


Figure 16.3 Pit shell section A – A’

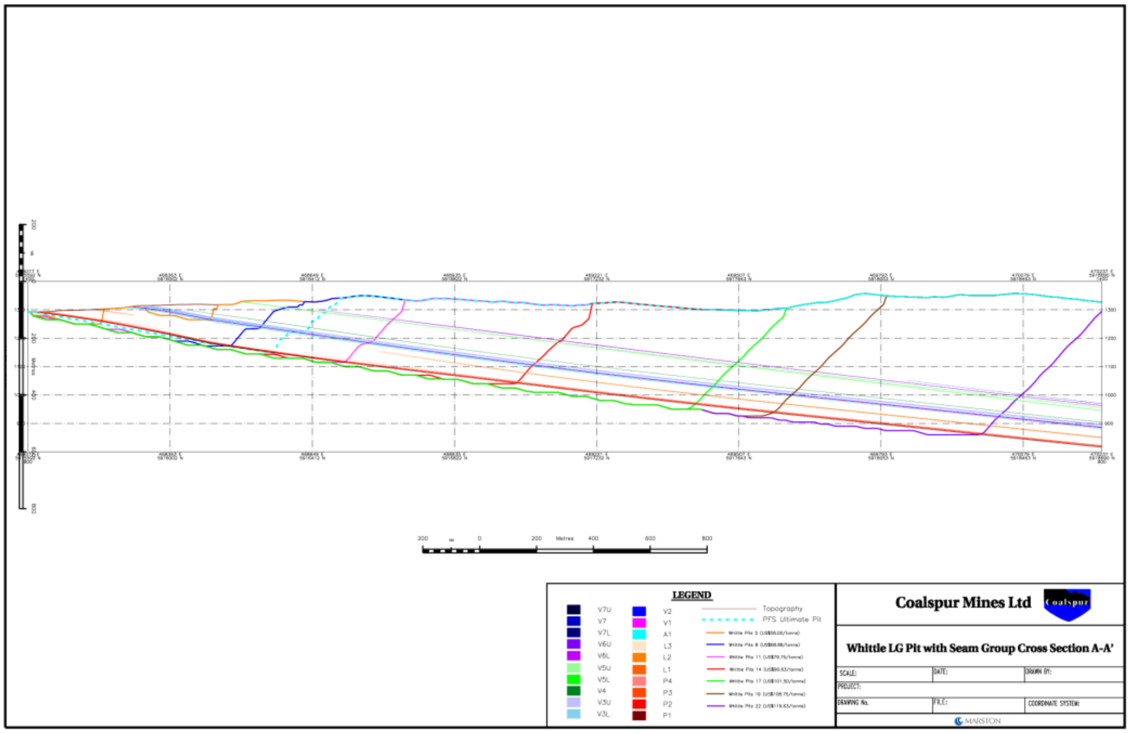


Figure 16.4 Pit shell section B – B’

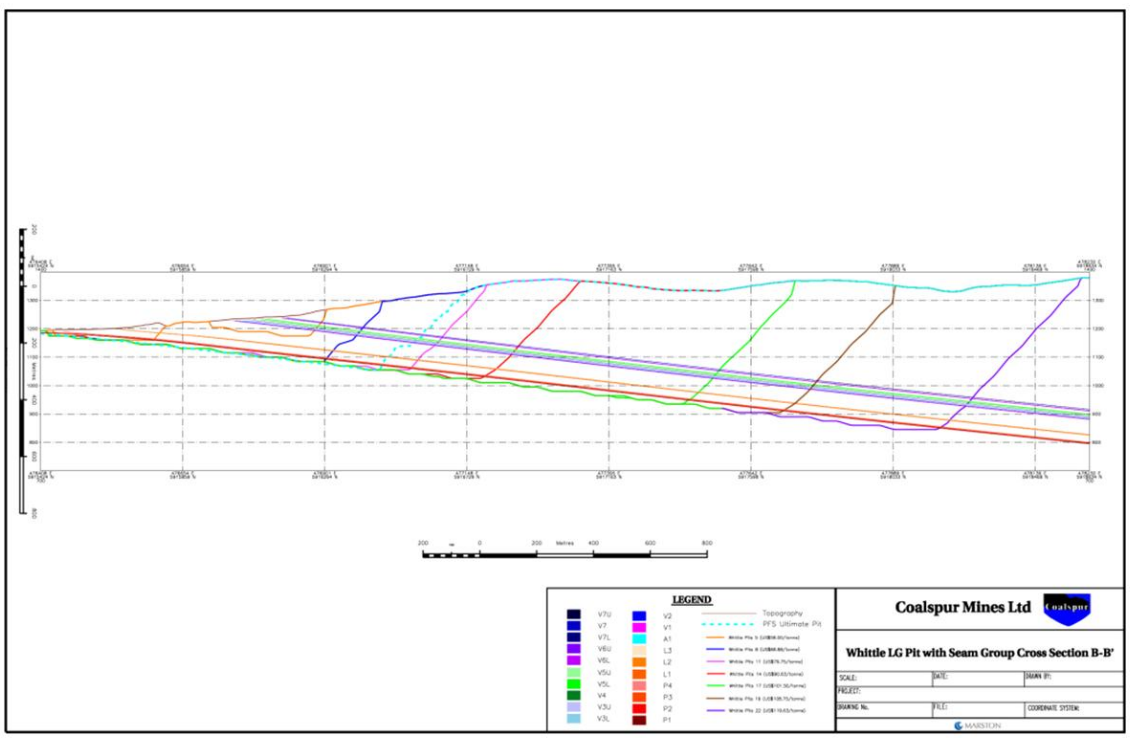
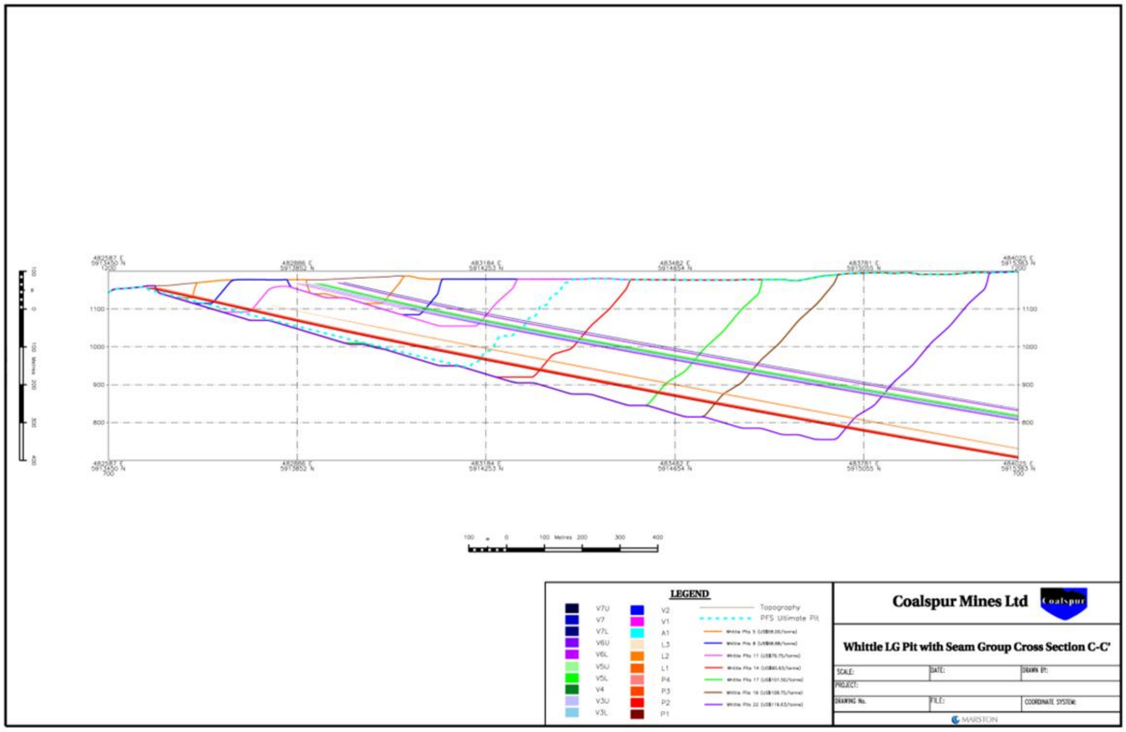


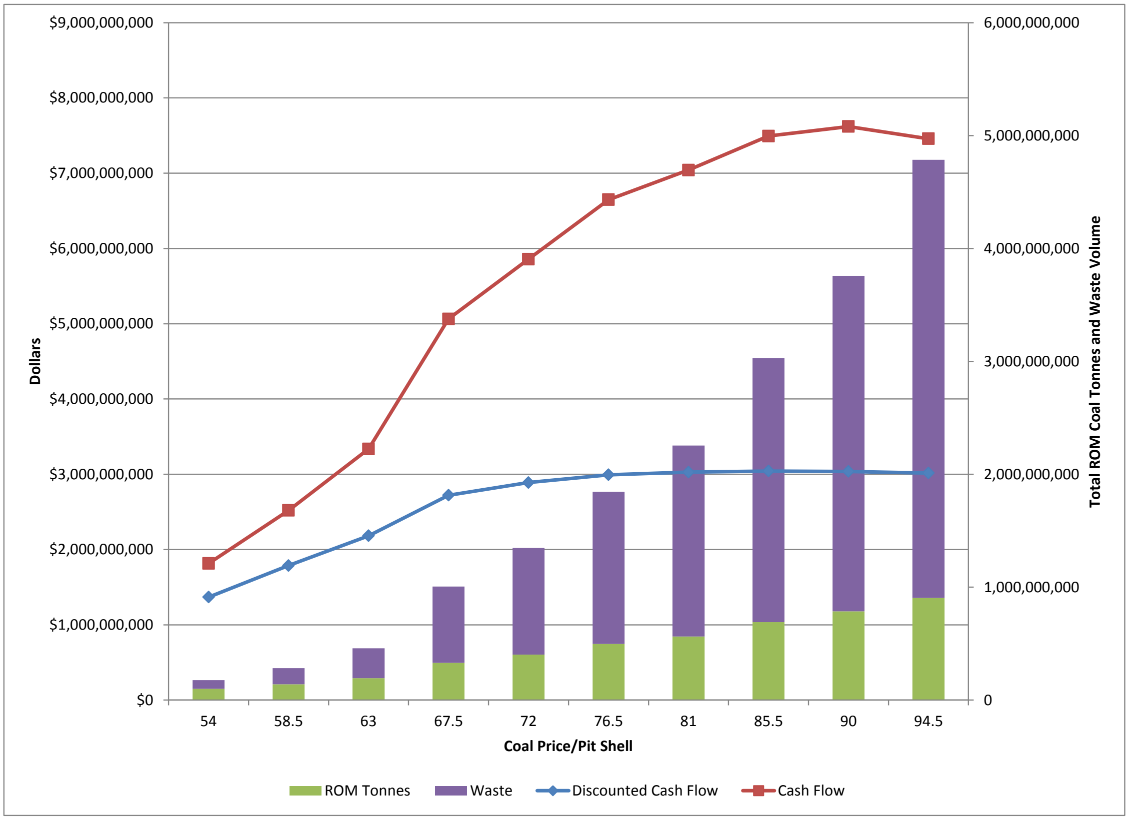
Figure 16.5 Pit shell section C – C'



16.3.1 Discounted Cash Flow Analysis

A discounted cash flow analysis using a discount rate of 8% was undertaken in order to assist with the selection of the ultimate pit shell for use in the feasibility study. The analysis compared the discounted cash flows from the pits that were generated from pricing levels of $70, $80, $90 and $100. The resultant graph for the pit generated at the $90 pricing level for a 10 Mtpa production rate has been included in Figure 16.6. During the time of the analysis Coalspur believed that a conservative long term selling price of $90 was a reasonable assumption. A review of the results revealed that the discounted cash flows began to flatten off between the $76.50 and $81.00 pit shells. The decision was made to use the $81 pit shell as the basis for the ultimate pit.

Figure 16.6 $90 Whittle results at 10 million CMT/Year



16.3.2 Geotechnical Assumptions

The pit slope parameters used in the design of the overall highwall for the ultimate pit have been summarized in Table 16.6. These parameters were later determined to be acceptable by Klohn during their geotechnical review.

Table 16.6 Pit slope parameters

Parameter	Unit	Value
Truck Shovel Pit		
Inter-bench Highwall Angle - Bedrock	°	65
Overall Highwall Angle – Bedrock	°	45
Overall Highwall Angle – Till	h:v	2:1
Dragline Pit		
Overall Highwall Angle - Bedrock	°	65
Max Unbenched Highwall Height	m	25
Set back from Crest	m	8

Additional geotechnical parameters used in the study have been summarized in Table 16.7.

Table 16.7 Additional geotechnical parameters

Parameter	Value
Overall Active Dump Slope, External Disposal Areas	35°
Final Slope, Backfilled Disposal Areas	35°
Final Overall Reclaimed Slope, External Disposal Areas	2:1
Min. Offset Distance – Pit Crest to Disposal Area	200 m
Min. Off set Distance – Dump Toe to McPherson Creek	100 m
Catch bench width	40 m
Elevation between catch benches	30 m
Construction methodology	Free dump

16.3.3 Ultimate Pit Design

An ultimate pit was designed based on the results of the pit finding exercise using the previously mentioned geotechnical parameters. The in-situ summary of the ultimate pit has been included in Table 16.8.

Table 16.8 Ultimate Pit Statistics

Seam	Interval	Volumes ('000 BCM)					In-situ Coal ('000 t)
		Till	Overburden	Interburden	Parting	In-situ Coal	
	Till	281,400					
Val d'Or	V6U		374,100	-	-	3,900	5,300
	V6L		287,600	1,100	-	12,200	17,400
	V5U		35,900	59,800	1,300	25,200	38,300
	V5L		2,700	17,900	200	16,600	24,000
	V4		16,950	93,900	-	6,700	9,500
	V3U		162,600	69,000	3,400	64,400	96,000
	V3L		100	8,200	5,300	15,800	25,200
	V2		300	23,800	800	16,400	25,400
	V1		100	7,900	600	19,800	30,000
	Sub-total Val d'Or		*880,350*	*281,600*	*11,600*	*181,000*	*271,100*
McLeod	L3		149,500	502,100	300	12,600	20,700
	L2		8,800	104,700	900	27,100	42,900
	L1		300	6,200	100	13,600	21,900
	Sub-total McLeod		*158,600*	*613,000*	*1,300*	*53,300*	*85,500*
Mc Pherson	P4		43,900	414,000	900	18,800	28,900
	P3		5,200	114,600	700	38,300	57,400
	P2		100	13,000	500	43,500	67,000
	P1		200	6,000	300	24,600	37,000
	Sub-total McPherson		*49,400*	*547,600*	*2,400*	*125,200*	*190,300*
	Grand Total	**281,400**	**1,088,350**	**1,442,200**	**15,300**	**359,500**	**546,900**
Total Waste ('000 BCM)		**2,827,250**					
Total In-Situ Coal ('000 t)		**546,900**					

The V7 Upper and V7 Lower seams were excluded from the mine plan due to limited quality sampling. The Arbour seam was excluded due to its low tonnage and that almost half the samples had raw % ash values >50%. The Silkstone seams were excluded due to the decision to leave the McPherson Creek intact at this time.

16.4 Mine Schedule

16.4.1 Preproduction Requirements

Major applications, permits and approvals required to begin operations and commence first production of coal are discussed in Item 20. The mine operations pre-production phase will consist of major equipment purchase and erection, coal wash plant, coal handling facilities, mine infrastructure, (excludes mining equipment which will be supplied by the contract mining company. Additionally there will be the requirement to develop suitable access to the initial working areas; providing power to the property; and miscellaneous mine site development such as timber salvage, topsoil salvage and drilling/blasting for the initial mining area.

Contractor and Equipment Agreements

Agreements will be made with a Mining Contractor to ensure timely availability of adequate and appropriate earth moving equipment, labour, maintenance facilities etc to commence operations. Agreements should also be concluded with the EPCM of the Coal Handling and Processing Plant. During the pre-production period Coalspur will be directing overburden from the opening cut to the starter dyke for the fine coal settling area.

Infrastructure Development

Infrastructure will need to be constructed to allow the opening and development of the mine. An aerial topographic survey and ground survey to tie the known land boundaries to the mine coordinate system should be performed to ensure that all survey and land data is accurate. Electrical power will come from the existing main transmission lines that parallel highway 16 located to the north of the project site. Power will be directed from the main lines to the site along the planned clean coal conveyor route up to the coal preparation plant site.

Mine Boundaries

The mining area within the proposed initial Mine Licence Area covers 40% of Coalspur's mineable reserves and includes the western portion of the McLeod River North lease area as well as a small portion of the eastern edge of the Hinton East lease. The initial Mine Licence Area lies within Coalspur's existing Mine Permit boundary for the property. The mine licence application and the Environmental Impact Assessment (EIA) were scheduled to be submitted at the same time in the first quarter of 2012 along with other applications. According to a news release by Coalspur dated February 27, 2014, Coalspur have approval of the Vista Project from the Alberta Energy Regulator. "The AER approval is a significant milestone in the regulatory process for the approval of Vista and places Coalspur in a position to work with the Regulators to finalise detailed licences and permits over the coming months".

McPherson Creek is located to the south of the McPherson seam subcrop and generally parallels the strike of the coal. An offset of 100 m north of this creek serves as the southern disturbance limit for all mining activities. In the licence application, mining activities are bounded to the east by an un-named tributary to McPherson Creek. The feasibility study contemplates gaining the necessary approvals to extend the eastern mine licence boundary to the far east end of the property, which is effectively a 200 m offset from the McLeod River, as well as extend the mine permit boundary to the west boundary of the Vista property (the BFS Permit Expansion). Coalspur will be required to gain additional approvals from regulators subsequent to its initial mine licence application in order for this to occur. The mining area’s northern boundary is the ultimate pit boundary as established by the economic strip ratio cut-off.

The BFS Permit Expansion area extends the initial mining area approximately 2500 m to the east within the McLeod River Lease area. This expansion area is generally scheduled for truck/shovel mining due to the increased dip of the coal seams in this area. To the west, the BFS Permit Expansion area extends through to the western end of the Hinton West Lease. This area comprises two distinct dragline mining blocks ultimately bounded to the west by a stream and high ratio coal. The southern boundary remains McPherson Creek and other stream tributaries. The BFS Permit Expansion area’s northern boundary is the ultimate pit boundary as established by economic strip ratio cut-off. The initial Mine Licence Area and subsequent BFS Permit Expansion area to the west are separated by a coal conveying corridor constructed at existing ground elevation, which will be mined out during the last two years of mine operations.

Tourmaline Oil Corp has gas wells and pipelines in the mine area. Coalspur has made arrangements with Tourmaline regarding working around these obstructions. The details are not known to Snowden. It is understood that the wells and pipelines cause no material impact to the project feasibility.

Initial Site Work

Tree clearing including recovery and sale of timber resources over key operations areas should begin two years prior to production. Key areas include power corridors, dragline laydown and erection areas, and initial roadway corridors. Tree clearing of mining areas, including stockpile base areas, should be scheduled one year ahead of production to allow for timely topsoil removal and initial haul road or stockpile base construction. Initial roads will generally be permanent structures designed for long term use by small vehicles, track equipment, haul trucks and delivery trucks. Later, temporary roads required for advancing pits and dumps will be established as the mining operation progresses.

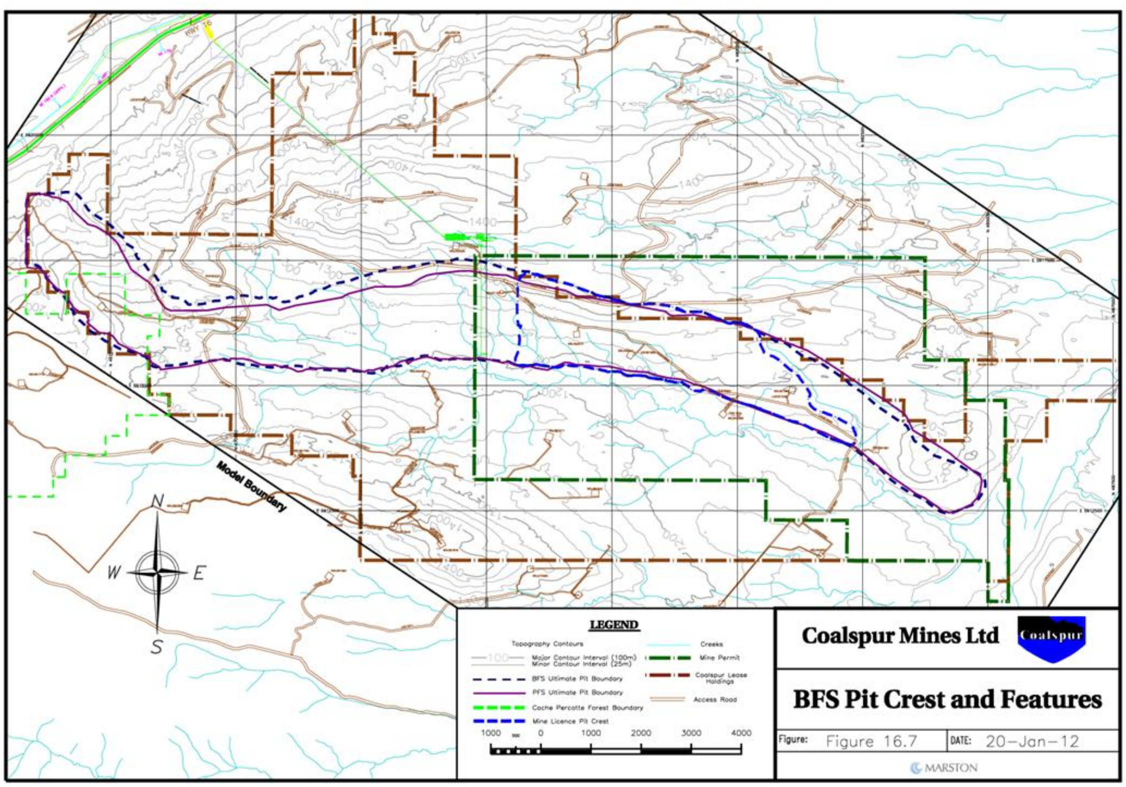
Waste disposal area site base development is important to ensure the long-term stability of waste disposal piles. Topsoil and areas of peat or muskeg must be removed prior to waste disposal construction. Waste disposal area locations are planned to the north of the ultimate pit boundaries and south of McPherson Creek. Similar preparations will be necessary prior to Processed Fines Storage Pond (PFSP) embankment construction planned in the northeast corner of the initial Mine Licence Area.

A starter dyke for the PFSP will be constructed during the pre-development period. Material required for the starter dyke will be sourced from a pit that will be established just inside the McPherson seam subcrop in the initial opening cut. Based on the proposed production, a pond staging plan has been developed. During the pre-development period the starter dyke is required to be built to a minimum elevation of 1227 m which requires placement and compaction of 5.5 million cubic metres of material.

Stream and/or Tributary Relocations

The mine licence application allows for mining activities to progress without materially impacting any existing fish bearing streams in the area. The initial mine licence pit excavation limit, external waste dumps and PFSPs have been designed to ensure that any identified fish bearing streams and tributaries of McPherson Creek remain intact. An application to amend the mine permit area to include all the subsequent mining areas will be required before mine expansion can take place. Wherever practical the feasibility study mine plan has sought to minimize the impact on McPherson Creek and its tributaries. All external waste disposal areas have been developed such that 100 m on either side of the creek has been left undisturbed. In the external waste disposal areas which are located on the south side of McPherson Creek splits have been designed to allow the existing tributaries to remain in place.

Figure 16.7 Mine development areas



16.4.2 Mine Development Phases

Key Mining Assumptions

The mine is primarily viewed as a dragline operation with dozer push, truck/shovel assist for upper seam waste material. This means scheduling and mining activities are designed to accommodate and support dragline operations. Three dragline blocks ultimately combine over the mine life and result in a long mine void, partially filled with ex-pit waste material from final highwall re-sloping activities, with some areas allowed to fill with water forming in-pit lakes.

Second, dozer-push stripping directly above the McLeod seam eliminates the need to blast through the McLeod seams as proposed in the pre-feasibility study. This significantly improves the expected McLeod seam plant yield and reduces the amount of waste material sent to the PFSP.

Third, Coalspur has requested the Mine Licence Area be developed and mined to effect a rapid ramping of production, reaching 8.8 Mtpa ROM in Year 2. Annual production then grows to 12.5 Mt ROM with the addition of a second mining fleet for the expansion area in Year 3; and ultimately reaches 20.4 Mtpa ROM in Year 4.

16.5 Mine Schedule

16.5.1 Mining Blocks

During the first 2 years of production the mining area will be limited to the initial Mine Licence pit. This block is approximately 7 km long and 1.5 km wide. The maximum depth below topography is approximately 300 m in the northwest corner of the pit. Mineable reserves total 176 Mt of ROM coal with 800 Mbcm of waste for a ROM average strip ratio of 4.5:1. Mining will begin on the south side of the block along the McPherson seam subcrop using truck/shovel mining methods. The BFS Permit Expansion area adds a 6 km long by 1.7 km wide dragline mine block west and adjacent to the Mine Licence Area and a second 3.8 km long by 1.7 km wide dragline mine block further to the west. The maximum depth below topography is approximately 300 m in the northeast corner of the mining area. BFS Permit Expansion area mineable reserves to the west total 278 Mt of ROM coal with 1525 Mbcm of waste for a ROM average strip ratio of 5.4:1. Mining begins on the BFS Permit Expansion area's eastern mine block in Year 3 on the south side of the block with a truck/shovel fleet. Waste is disposed just south of the McPherson seam subcrop in the external waste disposal areas. Mining begins on the BFS Permit Expansion area's western mine block in Year 16 with a dragline box cut by the new dragline on the southwest side of the block.

There is also a licence expansion area which adds a 3.5 km long by 1 km wide truck/shovel block to the east end of the initial Mine Licence pit. Here, mineable reserves total 86 Mt of ROM coal and 376 Mbcm of waste for a ROM average strip ratio of 4.3:1. These figures include the coal and overburden in the Hinton East lease within the Mine Licence dragline block. Mining is planned on the truck/shovel portion in Year 20.

The BFS Permit Expansion area also includes the coal conveying corridor which bisects the initial Mine Licence and western BFS Permit Expansion area dragline blocks. This corridor, 2 km long by 600 m wide contains 26 Mt of ROM coal with 112 Mbcm of waste for an ROM average strip ratio of 4.3:1. Mining is planned for the corridor at the end of the mine life.

16.5.2 Mine Progression

The mining progression is developed on:

1. Open cut mining of waste material above the McPherson seam will be performed using the truck/shovel fleet to direct waste to the southern external waste disposal areas. Truck/shovel mining activities in the early years are directed at mining down-dip low strip ratio coal from the McPherson seam subcrop to open up significant length for the eventual takeover of McPherson seam waste mining by the draglines. In the initial years waste mining above the McLeod seam is also achieved with standard truck/shovel mining methods.

2. Two draglines will be phased in to take over waste mining activities for the waste material between the McLeod and McPherson seams. Once this occurs waste mining above the McLeod seam will be achieved through a combination of dozer push and truck/shovel methods. Waste mining above the McPherson will see the dragline begin the cut from a high-wall side, extended bench application with final waste removal achieved by placing the dragline in a spoil side position. We note that the decision to use draglines following the early years of production is contingent on additional optimisation studies by the Company.

3. McLeod waste will be mined by a combination truck/shovel and dozer push operation, with the dozer push directing waste into the mined out cut with a portion of this material re-handled and hauled across the pit and placed on top of the dragline spoil piles.

4. Waste material above the Val d'Or Seam Group will be mined with large cable shovels using 10 m – 15 m benches ; and

5. Partings under 10 m within the Val d'Or, McLeod, and McPherson seam groups will be mined using smaller hydraulic excavators.

Annual mining progression maps have been included for the Val d'Or and McPherson seam groups. Please refer to Figure 16.8 and Figure 16.9.

Waste is hauled to internal and external dumps during the course of the LOM plan. Ex-pit dumps are used to limit the material handled by dragline stripping and to accommodate the Val d'Or waste materials and coal seam partings generated during the LOM plan.

16.5.3 Production Schedule

A complete production schedule for the LOM has been included in Table 16.9. An end of mine status map has been included in Figure 16.10.

Figure 16.8 Val d'Or seam progression map

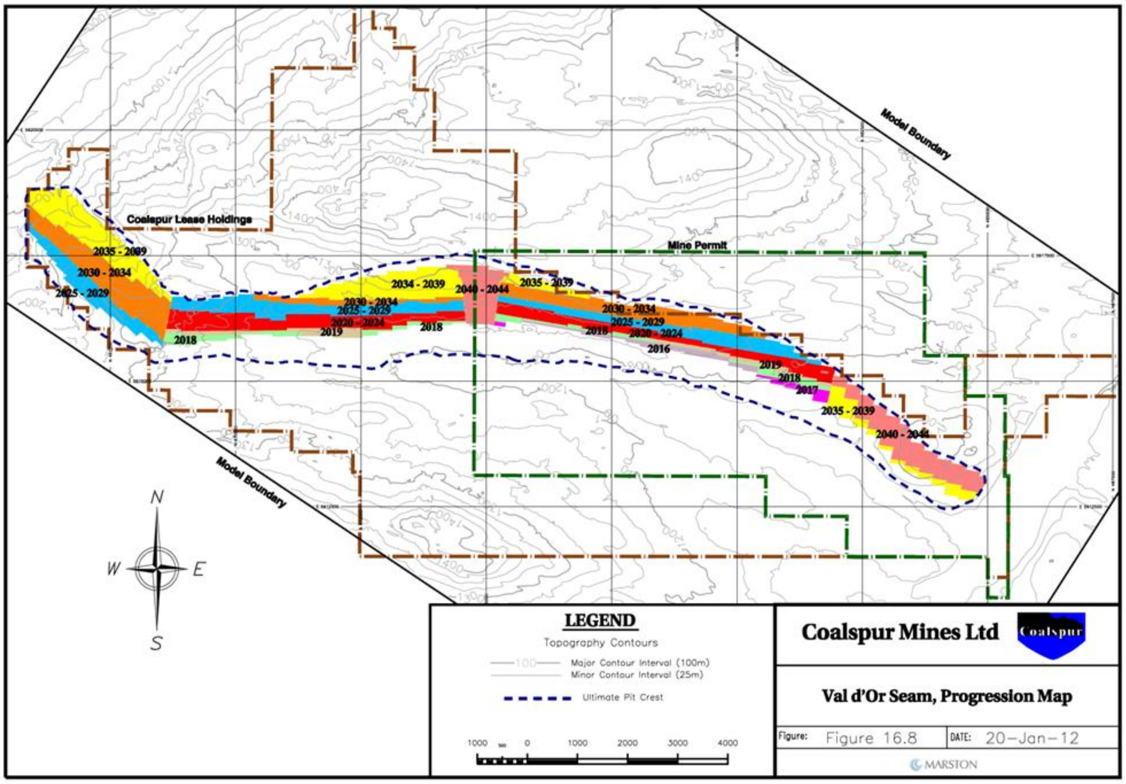


Figure 16.9 McPherson seam progression map

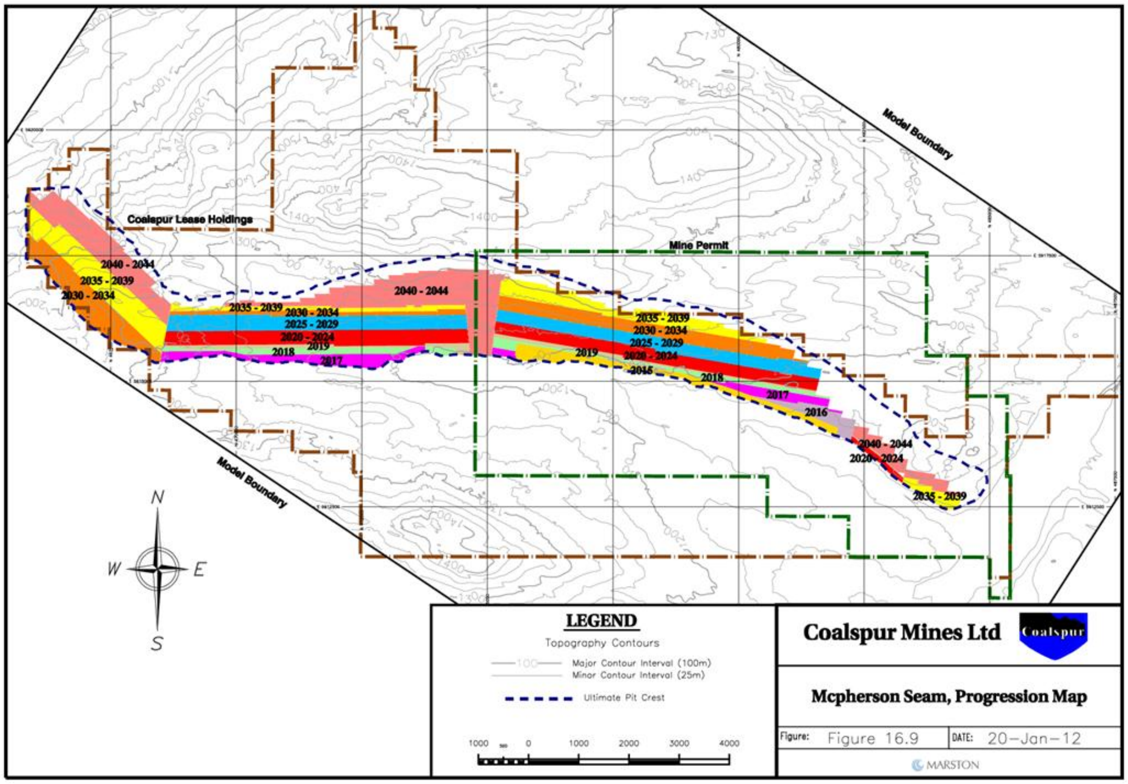
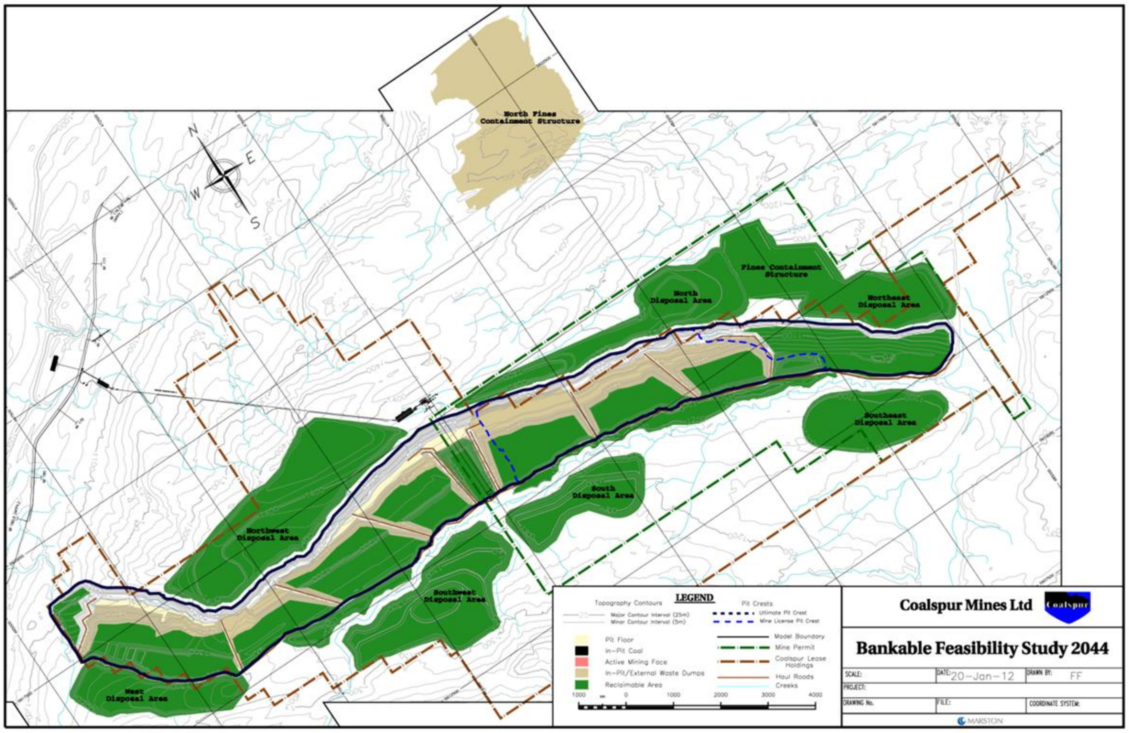


Table 16.9 LOM production schedule

		2016	2017	2018	2019	2020	2021 - 2025	2026 - 2030	2031 - 2035	2036 - 2040	2041 - 2045	Total
Waste Volumes (000 BCM)	Topsoil	336	987	1,254	1,467	1,461	4,080	3,447	2,769	2,805	498	**19,104**
	Truck/Shovel Prime	5,521	26,456	48,828	58,582	71,677	307,138	387,423	435,610	459,301	323,157	**2,123,695**
	Dozer Push Prime	184	502	1,040	1,040	1,040	64,281	94,434	87,978	78,559	49,979	**379,037**
	Dragline Prime	-	-	-	-	-	61,490	83,415	87,564	82,425	51,224	**366,118**
	Total Prime	**6,040**	**27,945**	**51,122**	**61,089**	**74,178**	**436,989**	**568,720**	**613,922**	**623,090**	**424,858**	**2,887,953**
	Re-handle	265	1,138	2,139	2,430	3,033	68,849	102,013	93,349	100,993	65,138	**439,346**
	Total Waste Handled	**6,305**	**29,082**	**53,261**	**63,519**	**77,211**	**505,839**	**670,732**	**707,271**	**724,082**	**489,997**	**3,327,300**
	Rehandle %	**4%**	**4%**	**4%**	**4%**	**4%**	**16%**	**18%**	**15%**	**16%**	**15%**	**15%**
ROM Coal (000 RMT)	McPherson Seam Mined	3,857	5,390	9,547	9,269	7,421	32,965	30,443	31,084	27,710	36,560	**194,246**
	McLeod Seam Mined	3	1,518	1,461	2,570	2,878	16,314	16,079	15,026	15,687	18,802	**90,338**
	Val d'Or Seam Mined	-	1,867	1,539	8,568	10,116	52,863	55,479	55,988	58,649	35,166	**280,235**
	Total Delivered	**3,860**	**8,775**	**12,547**	**20,407**	**20,415**	**102,142**	**102,001**	**102,098**	**102,046**	**90,528**	**564,819**
	Plant Feed	**3,735**	**8,615**	**12,352**	**20,177**	**20,150**	**101,842**	**101,701**	**101,798**	**101,746**	**90,228**	**562,344**
	ROM Stockpile	**125**	**160**	**195**	**230**	**265**	**300**	**300**	**300**	**300**	**300**	**-**
Clean Coal (000 CMT)	McPherson/Val d'Or	1,998	4,180	6,131	10,024	10,066	49,248	49,337	49,895	49,397	41,134	**271,410**
	McLeod	1	615	606	1,105	1,295	7,080	6,886	6,387	6,671	7,639	**38,285**
	Total Clean Coal	**1,999**	**4,795**	**6,737**	**11,129**	**11,361**	**56,328**	**56,222**	**56,282**	**56,068**	**48,773**	**309,695**
Product CV (kcal/kg)	McPherson/Val d'Or	5,598	5,615	5,688	5,723	5,748	5,771	5,783	5,780	5,794	5,746	**5,767**
	McLeod	5,203	5,178	5,229	5,370	5,385	5,396	5,396	5,404	5,426	5,458	**5,408**
Plant Yield (%)	McPherson/Val d'Or	51.8%	57.6%	55.3%	56.2%	57.4%	57.4%	57.4%	57.3%	57.2%	57.3%	**56.5%**
	McLeod	36.0%	40.5%	41.5%	43.0%	45.0%	43.4%	42.8%	42.5%	42.5%	40.9%	**41.8%**
Strip Ratios	Raw Prime (BCM/RMT)	1.4	3.2	4.0	3.0	3.6	4.3	5.6	6.0	6.1	4.7	**5.1**
	Raw Total waste (BCM/RMT)	1.5	3.3	4.1	3.1	3.8	5.0	6.6	6.9	7.1	5.4	**5.9**
	Clean Prime(BCM/CMT)	2.6	5.8	7.4	5.5	6.5	7.7	10.0	10.8	11.0	8.7	**9.2**
	Clean Total Waste (BCM/CMT)	2.7	6.0	7.7	5.7	6.8	8.9	11.8	12.5	12.8	10.0	**10.7**

Figure 16.10 End of mine status map



After ramp up the LOM plan was developed to provide 20.4 Mt of ROM coal on an annual basis. Please refer to Table 16.9. A ROM stockpile of 300,000 RMT has been maintained throughout the LOM plan. In-pit stockpiles of 540,000 ROMT of McPherson coal are also maintained ahead of each dragline for a total McPherson in-pit inventory of 1,090,000 RMT. Figure 16.11 summarizes the annual plant feed by seam grouping.

Figure 16.11 Plant feed by seam

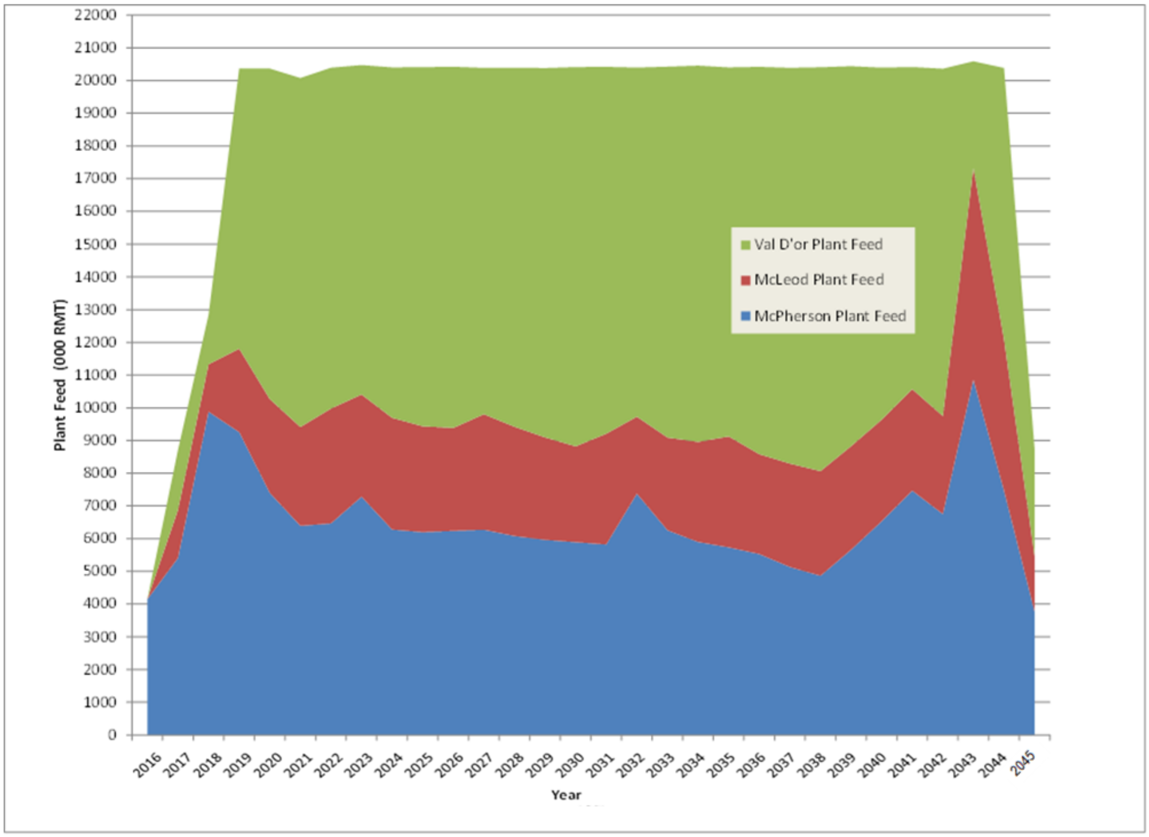
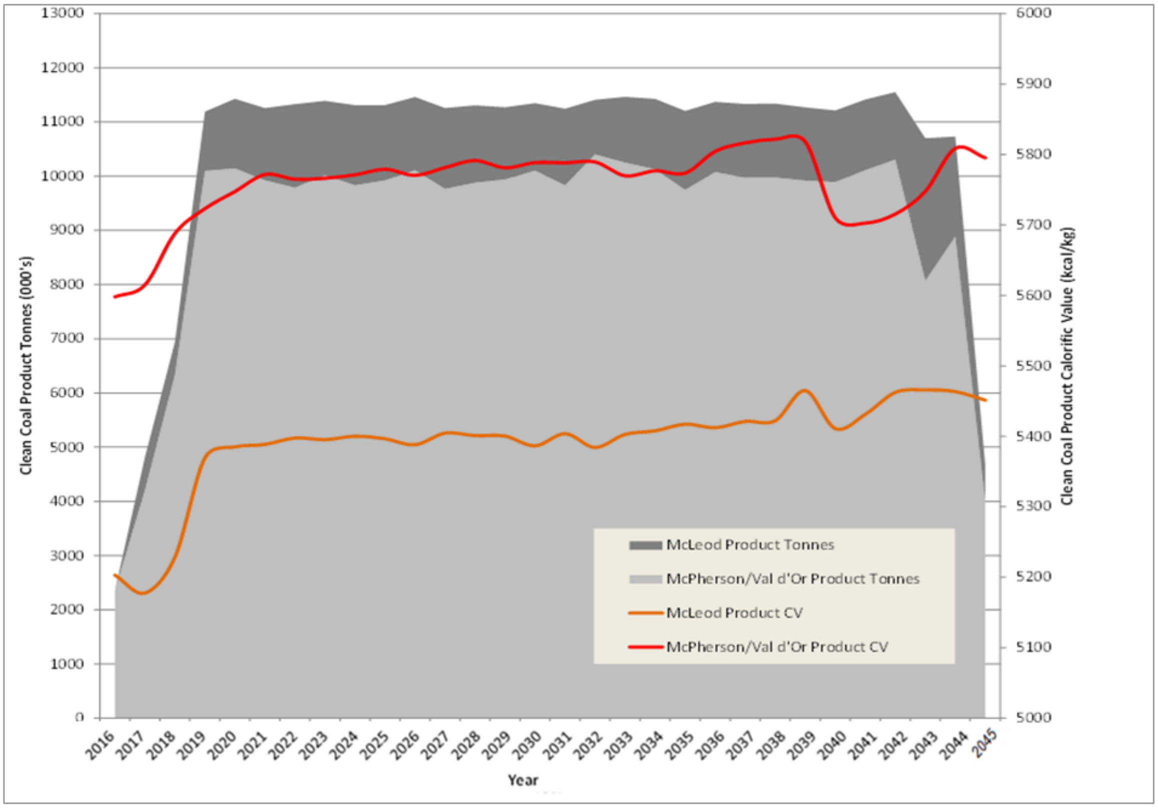


Figure 16.12 illustrates the expected annual clean tonnes with their associated product calorific values. The two main product coals are a McPherson/Val d'Or high calorific value blend and a lower heat McLeod product coal.

Figure 16.12 Clean tonnes and expected CV



16.6 Equipment Selection

A principal change for the current ITR is the use of contract miners instead of employing an owner operated fleet. While contractors are described in the following, the same mine plan, schedule and equipment are used as previously.

Equipment for the life of the operation will be supplied, operated and maintained by a contract miner engaged by Coalspur. The type and size of equipment will need to be appropriate for the in-pit room available and the production requirements set down by Coalspur, and will include all ancillary equipment requirements as well, (fuel trucks, light vehicles, graders etc). From year six, it is planned to phase in two 61 m3 draglines. It is planned that the draglines will be procured by Coalspur but operated and maintained by the contractor.

Based on range diagram analyses and review of deposit geology, it was determined that the Coalspur reserves could be effectively mined using a combination of shovel/truck, excavator/truck, dozer push and dragline stripping methods

Large mining equipment will be agreed between Coalspur and the Contractor, and selected to facilitate the efficient mining of the Vista property and to allow for the logical transitioning to the desired 20.4 Mtpa ROM coal mining rate. The selection of the draglines and primary mining equipment will be based on ramping to the maximum mining rate over the first five years of production as well as considering the long-term needs of the operation. Under these conditions, the optimum loading equipment for the waste not mined with draglines was large cable shovels.

Consequently, the primary waste mining fleet for the proposed plan consists of two 8200 class draglines with 61 m3 buckets, 57 m3 cable shovels, 634 kW dozers and 17 m3 and smaller hydraulic excavators for selective mining and topsoil salvaging. As the stripping ratio increases, additional loading units would be added as required.

16.6.1 Dragline

Once the various mining faces are established, the draglines will be phased in to mine the waste material above the McPherson seam. The mining of waste material above the McPherson seam, including re-handle of dozer material pushed from above the McLeod seam, will be mined utilizing a dragline in a high wall side, extended bench application with final waste removal achieved from a spoil side position. The dragline waste re-handle is an outcome of the dozer-push bench on the upper McLeod waste. With dozer-push, a majority of the McLeod waste bench is pushed over the high wall edge by dozers. The dozed waste material drops down to the McLeod seam bench or the McPherson seam pit bottom where it is re-handled either by the dragline or the McLeod bench truck-shovel fleet.

The ideal size of dragline for the Coalspur operation would approach a 68 m3 machine based upon range diagram analysis. A P&H 9020C 68.8 m3 dragline was initially identified for this application. At this size, the dragline would be able to handle all the waste and dozer-push re-handle allocated to the dragline for a 10.2 Mtpa ROM coal case. A similar second machine would be well suited to meet the requirements for the proposed expansion to 20.4 Mtpa ROM coal. During the feasibility study there were a number of used Marion 8200's available for purchase. The decision at the time was made to develop the mine plan around purchasing one of these used machines, a Marion 8200 (51 m3), as the first machine and to add a second new machine 2 years later. Based on discussions with the manufacturer the new 8200 could be outfitted with a 61 m3 bucket with the reach and dump height required as per the dragline range diagram analysis.

Using preliminary range diagrams, operating (i.e., labour and supply) costs for the mining of the waste material below the Val d'Or Seam for a typical year at four different seam dips for each of the dragline scenarios were estimated. Mining encompassed a combination of shovel/truck, dozer-push, and dragline stripping with the amount of material handled by each method varying with the size of dragline employed. Utilizing the smaller draglines requires a higher amount of material be directed to the truck/shovel fleet. Although results varied somewhat for the different seam dips examined, a six degree seam dip case was considered representative of all conditions encountered and therefore used for illustrative purposes.

Dragline Range Diagram

A range diagram has been included in Figure 16.13 in order to assist with the understanding of the overall mining sequence designed for the Vista project. The Val d'Or seam is located at the top of the geological sequence. Given the large differences in elevation between the upper waste benches above the Val d'Or seam and the McPherson seam footwall it was determined that in-pit backfill of Val d'Or seam waste was not practical. It was decided to employ standard truck/shovel mining methods to this material with placement in ex-pit disposal areas.

Once the Val d'Or seam coal has been mined the decision was made to employ a fleet of dozers to push the material down into the mined out cut. There are 2 reasons for this:

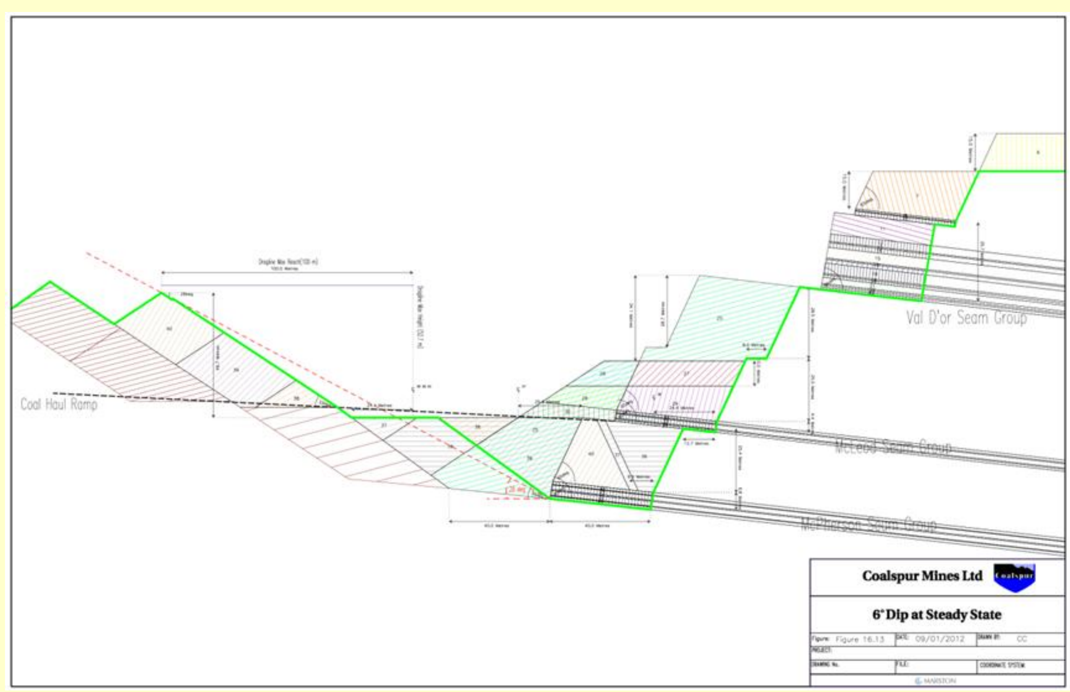
1. An appreciable amount of this material makes it into the pit bottom without the further need to re-handle it with the truck/shovel fleet.

2. The total height of the waste between the McLeod seam roof and the Val d'Or seam floor is greatly reduced. This reduces the amount of in-pit ramping that is required in order to truck/shovel mine down to the McLeod seam roof.

That material that does not fit in the previous mined out dragline cut due to geometric constraints is simply hauled across the pit and placed in-pit on top of the dragline spoil piles. The coal is also hauled across the pit and out the coal haul access ramps that have been left in the spoil piles.

The dragline is put to work at the McLeod seam footwall elevation. The cut is started in a typical key cut position. The dragline works its way across the cut from down dip to up dip finishing the cut on the soil side. The resultant dragline spoil pile has an overall effective angle of 28°. The dragline will then deadhead to the end of the cut along the spoil side bench and start a new cut once it has crossed over at the pit end to the highwall side.

Figure 16.13 Dragline Range Diagram



SNOWDEN	**Dragline Range Diagram** **Vista Coal Project**	Source: Snowden, 2012

16.6.2 Truck / Shovel

Large cable shovels (57 m^3) were assigned to handle the majority of the waste not mined by draglines. The shovels will be teamed with 363 t haul trucks. The final equipment configuration will be agreed with the Contractor. To provide needed flexibility and more effectively allow for the removal of thinner partings, hydraulic excavators scheduled to remove lesser amounts of waste material.

Based on the results of the range diagram analysis a truck shovel dozer-push combination or equivalent, will also be utilized for mining the McLeod seam waste. Shovel benches will range up to 15 m and the waste material will be spoiled in-pit between dragline spoil ridges. Shovels will also mine all waste material above the Val d'Or Seam Group. This material will be directed to the ex-pit waste dumps.

16.6.3 Large Support and Coal Handling Equipment

Given the production requirements involved, dozer push stripping was scheduled to be accomplished exclusively by 634 kW class bulldozers. Dozer-assist stripping above the McLeod Seam Group accounts for approximately 27% of waste stripping volume and the downhill and level dozer pushes are very cost effective even after accounting for the re-handle cost. The alternatives to dozer push stripping would be stripping all the McLeod waste material utilizing a higher cost truck-shovel operation or incorporating a two pass dragline stripping scenario.

The two pass dragline scenario poses a number of operational challenges including:

- There is a reduced total mine stripping capacity and thus annual coal production is based upon maximum dragline stripping capacities.
- A two pass crossover approach would shorten the dragline pit length and generate its own re-handle volume in building and removing the crossover path.
- The McPherson waste bench is thicker than that desirable for the available spoil room.
- Finally, the dozer-push approach eliminates the need to blast through the McLeod seam. This will significantly improve the coal quality delivered to the preparation plan from the McLeod seam and reduce the amount of waste material sent to the fine settling storage facility.

Large tracked dozers were also used to provide support for the draglines, perform spoil grading and for the ripping of thin partings while additional smaller dozers were used for pit support and assorted topsoil and reclamation work.

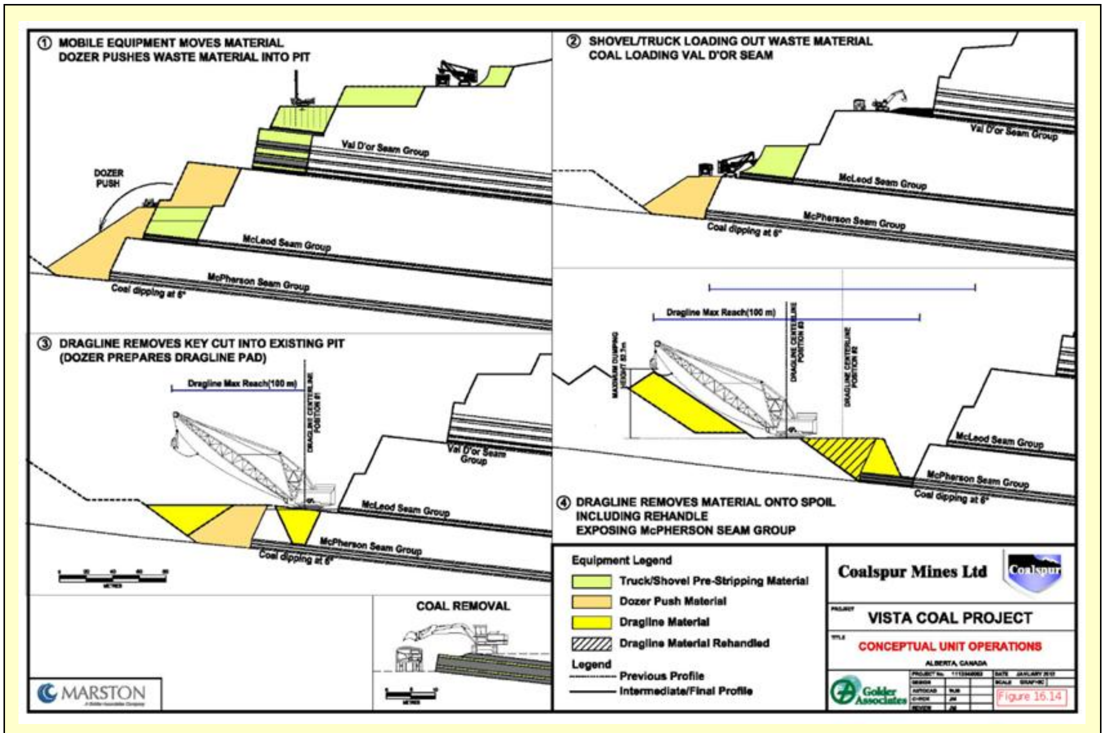
Removal of parting waste material found in all three seam groups was primarily accomplished with 17 m^3 hydraulic shovels used in combination with 177 t haul trucks. Smaller 6 m^3 backhoes are matched with 91 t haul trucks for handling unconsolidated topsoil for direct placement on reclamation areas or into the topsoil stockpile for reclamation activities later in the mine life.

Based on productivity estimates, crawler-mounted, electric blast hole drills capable of drilling 350 millimetre (mm) diameter holes were well suited for effecting the majority of waste (overburden and interburden) drilling requirements. Due to a significant drop in drilling productivity for shallower waste intervals, the drilling of overburden and interburden layers thinner than 4.5 m was allocated to smaller 152 mm diesel powered drills.

Coal is primarily recovered using a 17 m3 hydraulic backhoe in combination with 177 t haul trucks with secondary coal recovery at pit ends and in other tight pit configurations accomplished by a 12 m3 front-end loader and fleet of 177 t haul trucks.

A schematic of the planned unit operations has been included in Figure 16.14.

Figure 16.14 Conceptual Steady-State Unit Operations



SNOWDEN	Steady State Operations Vista Coal Project	Source: Golder, 2010

16.7 Equipment Productivity

16.7.1 Equipment Productivity Estimates

Production rates for assumed major mining equipment were estimated from first principles using assumed material characteristics (per cent swell and density), manufacturer performance guidelines, and factors based on engineering experience. Estimated equipment productivities for major mining equipment are summarized in Table 16.10.

Table 16.10 Major equipment productivities

Machine	Size Class	Mode or Application	Annual Production Capacity	Digging Index¹
Bucyrus 8200 Dragline	61 m³	Highwall-Side	18.4 Mbcm	301,800
		Extended Bench	17.6 Mbcm	288,900
		Spoil-Side	14.0 Mbcm	230,100
P&H 4100XPC Shovel	57 m³	Overburden	15.0 Mbcm	263,400
		Parting	14.4 Mbcm	252,400
Caterpillar 6030 Hyd. Excavator	17 m³	Overburden	5.5 Mbcm	323,500
		Parting	5.3 Mbcm	310,100
		Coal Loading	7.6 Mt	n/a
Cat. 6015 Backhoe	6 m³	Topsoil	1.9 Mbcm	n/a
Caterpillar 993K HL Loader	12 m³	Seam Cleaning	2.8 Mbcm	n/a
		Coal Loading	4.2 Mt	n/a
Cat. D11T Dozer	634 kW	Push Stripping	3.7 Mbcm	n/a
P&H 320XPC Electric Drill	350 mm	> 4.5 m Drilling	5.4 - 41.5 Mbcm²	n/a
		< 4.5 m Drilling	0.8 - 1.0 Mbcm²	n/a
Sandvik D245S Drill	152 mm	< 4.5 m Drilling	0.7 Mbcm	n/a

Notes: 1. Expressed as BCM per year per m³ of bucket capacity
2. Varies with drilling interval thickness

The equipment productivities shown are a function of numerous variables including: performance-based factors such as availability and operational usage; material characteristics (swell factors); machine characteristics (e.g., bucket fill factors and cycle times); operating configurations; and, for truck-serviced loading machines, truck saturation. Final equipment suite configuration will be agreed with the Contractor.

16.8 Manpower Estimates

For the duration of the plan, no Coalspur employed mining operations workforce is required since it has been assumed that this requirement will be the responsibility of the mining contractor. This includes:

- supply of mining equipment and ancillary equipment including light vehicles
- equipment operators
- maintenance planning, labour and maintenance facilities
- drill and blast requirements
- it is anticipated that Coalspur will procure the draglines but these will be operated and maintained by the Contractor.

Coalspur employed Contract Administrator(s) will be appointed.

There will however, be a requirement to employ preparation plant, coal conveying, and loadout employees; and administrative staff required for various support functions such as accounting/finance, human resources, procurement, and security.

16.8.1 Mine Planning

Long-term, medium-term and short-term mine planning including drill and blast, and survey requirements, will be managed by the Coalspur Technical Services group. Environmental services will also be supplied by Coalspur.

To assist in benchmarking Contractor submissions, mine hourly workforce requirements were estimated on the basis of the equipment usage dictated by the mining sequence (for primary production equipment operators) or assigned as deemed necessary to adequately support operations (for maintenance and support employee). Supervisory staff was assigned as deemed reasonable based on regional practices and engineering experience.

Average mining workforce requirements are summarized by department (i.e., operations, maintenance, and technical services) and, for hourly employees, by primary job classification. Over the 30-year life of the mine, the mine's total workforce including the Contractor workforce and salaried personnel, is estimated to vary from a minimum of 61 employees at start-up (2015) to a maximum of 1,034 employees in both 2036 and 2038, and average 794 employees.

Annual workforce requirements vary in concert with changing production parameters. For instance, mine workforce requirements are at a minimum in 2015 because of the use of a mining contractor on waste removal, coal mining, drill and blast as well as relatively low level of coal production at start-up and the lower stripping ratio encountered. Conversely, workforce requirements peak in 2036 and 2038 due to higher stripping ratios, longer haulage distances, and achievement of full ROM coal production.

17 Recovery Methods

Section 17 remains the same from the previous reports, specifically Snowden 2012 FS study work, with one exception. The dryers have been removed from the project at this time. A few references remain in the report such as in the flowsheet figures and these are to be ignored. This current ITR assumes dryers will not be used.

17.1 Process Selection

A process selection study was initially undertaken as part of the prefeasibility study in 2010, and in the ensuing feasibility study, this work was revisited to better encompass the large amount of exploration drill samples that were available for test work.

17.1.1 Available Data

Approximately 100 coal samples and 100 non coal samples were sourced from the “attrition” cores. These samples were subjected to a pre-treatment process which is generally in line with accepted industry practice aimed at providing ‘process’ or ‘in-plant’ sizing suitable for plant design purposes, namely:

- drop shatter – 20 drops (on the high end for open cut mining)
- top size reduction to 50 mm
- wet tumbling
- wet sizing at 32, 25, 16, 8, 4, 2, 1, 0.25 and 0.125 mm
- float and sink testing by size
- ash of the -0.25 mm fraction
- raw and washed composite analysis.

17.1.2 Impact of Dilution – Working Sections

At the time of the process study being undertaken, the amount of dilution originally suggested by the mine planning team seemed significantly greater than typically observed elsewhere in open cut mines (e.g. Australia). This high level of dilution had a significant impact on the sizing and washability of the CPP feed and serious ramifications for PFSP disposal. The original assumptions were:

- roof on all seams 15 cm loss and no dilution
- floor on all seams 0 cm loss and 15 cm dilution, except McLeod Seam
- floor on McLeod Seam 0 cm loss and 30 cm dilution.

Subsequent review of core samples by the mine planning team lead to a lowering of the dilution levels expected. It should be noted that the process study was undertaken with the high levels of dilution before this refinement, but the work was considered to remain valid, as the relativities were similar. Once the process was selected, the engineering design was then progressed allowing for the revised dilution levels.

Overall, the samples show a high degree of variability in sizing and washability. On a seam by seam basis, the Val d'Or and McPherson seams are a little coarser than the McLeod and Silkstone, which are typically more banded in nature. The best washability sections are in the upper Val d'Or seam, while the poorest washability sections are Val d'Or V3T and the McLeod seam splits.

17.1.3 Process Selection

In the Prefeasibility study, four samples formed the basis for design. From these data it was found that a single product plant could produce an export thermal product from Val d'Or and McPherson seams around 5700 kcal/kg GAR to 5800 kcal/kg GAR at a cut point of 1.50 to 1.60. With the vast increase in available design data, the processing calculations were re examined to determine if these findings were still applicable, and to evaluate opportunities for optimising the process beyond that proposed from the PFS.

The alternative CPP processes considered were simulated in LIMN, a Microsoft Excel based flowsheet program which is considered an industry standard tool for process engineering. Modelling undertaken in LIMN allows for practical inefficiencies and resultant misplacement of material to project yield-ash relationships and process stream flow rates. Partition of unit operations has been based on typical performance data achieved in the coal industry.

23 separate process options were considered covering dense medium and water only plants, separate processing of large and small coal, single pass versus "split" fines processing options, and various classifying cut-sizes. Flotation options were not considered as review of the -0.25 mm ash levels from the laboratory data indicate this fraction is predominantly "slimes" with little coal to be potentially recovered through flotation. Preliminary flotation test results showed very low yields at elevated product ashes, and along with the high moisture for this size fraction, a net energy benefit through recovery by flotation would be unlikely. The options considered are listed below:

1. Dense Medium Cyclones (DMC) (+2 mm), Spirals (-2 mm +0.1 mm)
2. DMC (+2 mm), Spirals (-2 mm +0.2 mm)
3. DMC (+2 mm), Spirals (-2 mm +0.3 mm)
4. DMC (+2 mm), Spirals (-2 mm +0.5 mm)
5. DMC (+2 mm), Hindered Bed Separator (HBS) (-2 mm +0.1 mm)
6. DMC (+2 mm), HBS (-2 mm +0.2 mm)
7. DMC (+2 mm), HBS (-2 mm +0.3 mm)
8. DMC (+2 mm), HBS (-2 mm +0.5 mm)
9. DMC (+3 mm), -3+0.75 to HBS, -0.75 mm +0.1 mm to Spirals
10. DMC (+3 mm), -3+0.75 to HBS, -0.75 mm +0.2 mm to Spirals
11. DMC (+3 mm), -3+0.75 to HBS, -0.75 mm +0.3 mm to Spirals
12. DMC (+3 mm), -3+0.75 to HBS1, -0.75 mm +0.1 mm to HBS2
13. DMC (+3 mm), -3+0.75 to HBS1, -0.75 mm +0.2 mm to HBS2
14. DMC (+3 mm), -3+0.75 to HBS1, -0.75 mm +0.3 mm to HBS2
15. DM Bath (+16 mm), DMC (-16+2 mm), -2 mm +0.1 mm to Spirals
16. DM Bath (+16 mm), DMC (-16+2 mm), -2 mm +0.2 mm to Spirals
17. DM Bath (+16 mm), DMC (-16+2 mm), -2 mm +0.3 mm to Spirals
18. Jig (+3 mm), -3 mm +0.75 mm to HBS, -0.75 mm +0.1 mm to Spirals
19. Jig (+3 mm), -3 mm +0.75 mm to HBS, -0.75 mm +0.2 mm to Spirals
20. Jig (+3 mm), -3 mm +0.75 mm to HBS, -0.75 mm +0.3 mm to Spirals
21. Jig (+3 mm), -3 mm +0.75 mm to HBS1, -0.75 mm +0.1 mm to HBS2
22. Jig (+3 mm), -3 mm +0.75 mm to HBS1, -0.75 mm +0.2 mm to HBS2
23. Jig (+3 mm), -3 mm +0.75 mm to HBS1, -0.75 mm +0.3 mm to HBS2

17.1.4 Simulation Results and Conclusions

DMC and 'split' fines processing was the preferred plant configuration nominated in the prefeasibility study, and this process has been confirmed as optimal in the feasibility study. DMC plus split fines circuitry provides optimal yield across the cut-point range 1.50 to 1.60 which is the likely operating cut-point to achieve the desired product specification.

In all plots presented, the optimum result (maximum yield for equivalent ash/energy) is achieved with split fines processing. Other points to note from these plots, and the process study generally, include:

- Dense medium processing is preferred over water-based processing of +2 mm material, providing higher yield at equivalent ash, and providing the ability to target lower ash.
- There is no metallurgical benefit (yield versus energy) with separate treatment of +16 mm in a bath versus washing all -50 mm +2 mm in DMC.
- Options with full fines treatment by spirals generally give higher overall ash, due to higher cut-point and poorer efficiency.
- Circuits including Hindered Bed Separators (DMC/HBS, DMC/HBS/HBS, or DMC/HBS/spirals) offer lower ashes and are more optimal for the desired target energy levels.
- Classifying cut-size around 0.2 mm appears optimal for the resource overall, although for the better washability Val d'Or coals in the higher rank Hinton East Block, classifying at 0.1 mm is more suitable.

Results for the jig and dense medium (DM) bath options have been omitted, with the jig not considered to be efficient enough for the desired target energy ranges, and the DM bath not offering any benefit over full DMC treatment of coarse coal. Inclusion of a bath adds unnecessary complexity to the plant, without any notable efficiency benefit.

It was concluded that Option 9 (DMC/HBS/Spiral) was optimal in the higher rank East Block, although little difference exists between Options 9 and 10 (DMC/HBS/Spiral) and Options 12 and 13 (DMC/HBS/HBS), when targeting a 5,800 kcal/kg GAR product, highlighting optimal classification size is within the 0.1 mm to 0.2 mm size range. When targeting a 5,700 kcal/kg GAR product, options 9 and 12, i.e. classifying at 0.1 mm, provide the best results.

In the lower rank McLeod River North Block, the split fines circuits still provide the best results, but the optimal classification cut-size is between 0.2 mm to 0.3 mm, rather than 0.1 mm to 0.2 mm as observed for the Hinton East Block.

The McLeod seam when washed individually, shows the same process outcomes as noted above, albeit at lower product energy levels (<5,400 kcal/kg GAR). Considering the resource overall, the optimal process configuration therefore appears to be a DMC/HBS/spirals plant with classifying cut-size of 0.2 mm. Although this configuration adds complexity above a standard DMC/spirals plant, the metallurgical benefit offered (1% to 2% yield in Hinton East Block, 4% to 5% yield in McLeod River North Block) will add value to the project. Additionally, by de-sliming above the standard 1.4 mm aperture, operational benefits are anticipated with the high clay contents of the ROM coal to be processed.

Following on from the above process selection study, the engineering design was progressed for the following plant configuration:

- DMC for coarse coal processing (+2.0 (ww) mm)
- classify at 0.2 mm
- HBS for fine coal processing (-2.0 (ww) mm +0.2 mm)
- spirals for reprocessing HBS product fines (-0.75 mm +0.2 mm).

Flotation Tests

In June 2011 Nalco prepared a report from flotation testwork undertaken on a sample of Vista coal, entitled “A flotation study on -0.25 mm coal sample received from Canada”. The primary objective of the test program was to investigate the floatability of the sample in terms of recovery and product quality. The flotation feed sample was very fine in sizing and had high ash content. It contained approximately 48% -0.030 mm material and had an overall ash of 70%. The laboratory-scale flotation tests showed that due to the large amount of fine particles, yield was very low (<10%) and product ash was high (greater than 38%). To minimise the effects of the ultra-fines, the sample was screened at -0.149 mm +0.044 mm and then floated. The results showed that as high as 75% combustible recovery could be achieved at 17% to 18% product ash when the -0.044 ultrafines were discarded. However, at this product ash level and at the expected total moisture of around 30%, it is unlikely to see a net energy improvement with the addition of flotation product.

Review of all data from the attrition cores shows that the -0.20 mm size fraction “flotation feed” will typically be greater than 65% ash and similar outcomes would be expected as per the Nalco testwork. However, some of Val d’Or coals may be better flotation targets, with lower ashes of the -0.2 mm material. The significant capital outlay associated with addition of a flotation circuit for treating a small proportion of the feed coals was not warranted given significant unknowns. If the project moves to execution, flotation site testwork could be then undertaken to improve the knowledge of the floatability of the coals and ensure an informed decision is made.

17.2 Sizing and Washability Curves

The sizing and washability curves which have formed the basis for design are presented below. The revised coal loss and dilution assumptions (circa June 2011) were applied to generate expected working sections for processing in the CPP.

The logic for the assumed dilution and coal loss parameters is discussed in detail in the mining chapter, but are summarised below:

- V6U/L 15 cm roof loss, 10 cm floor dilution
- V5U 15 cm roof loss, 5 cm floor dilution
- V5L 15 cm roof loss, 10 cm floor dilution
- V4 15 cm roof loss, 15 cm floor dilution
- V3 15 cm roof loss, 15 cm floor dilution
- V2 10 cm roof loss, 15 cm floor dilution
- V1 15 cm roof loss, 15 cm floor dilution
- McL 15 cm roof loss, 15 cm floor dilution
- McP 15 cm roof loss, 10 cm floor dilution

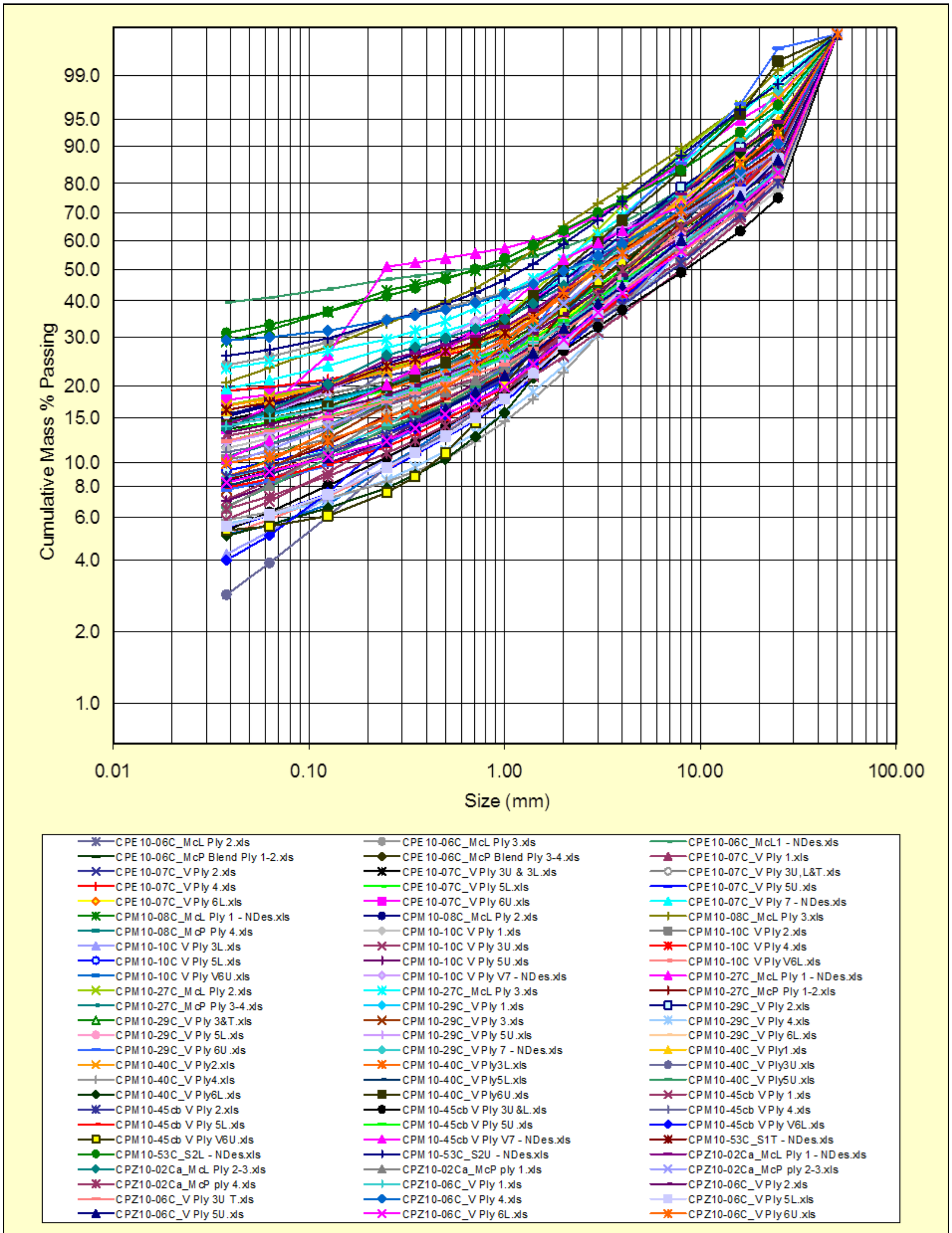
The non-coal, or dilution samples, varied widely in size distribution highlighting the variable nature of the roof, floor and parting material encountered in the resource. ROM coal sections for simulation were prepared by combining floor material to each coal seam (after coal loss) in the correct proportions, weighted on a length times density basis. From the available data, 78 feed samples were prepared from the available ply data. The proportion of dilution in ROM ranged from around 2% for thick sections up to around 40% for thin sections. Coal sections less than 0.4 m will not be selectively mined, and any non coal parting greater than 0.30 m will be selectively removed.

A Rosin-Rammler (sizing) plot for the available ROM sections developed from the ply data is provided in Figure 17.1. In this figure it can be seen that between 30% and 72% of coal passes 3 mm (50% typical), while around 5% to 43% passes 0.10 mm (15% typical). All seams show large variation in size distribution. On a seam by seam basis the Val DO’r and McPherson seams are a little coarser than the McLeod and Silkstone, which are typically more banded in nature.

In Figure 17.2, the combined +0 mm yield-ash curves are presented for the available ROM ply samples. These curves represent the theoretical yield-ash relationship on a total sample basis (100%) and do not allow for any processing inefficiencies. To enable an overall +0 mm washability to be calculated for each sample, it was necessary to estimate the float-sink of the -0.25 mm material, based on an adjusted -2 mm +0.25 mm washability to meet the “as analysed” ash of the -0.25 mm fraction.

Overall, the samples show a high degree of variability in washability. Raw ashes range from 17% to 56%, and at high cut-point, the coals will produce product ashes ranging from around 8% to 25%. On a seam by seam basis the variability is still quite high due to the number of different plies present.

Figure 17.1 Process Sizing Distribution for ROM "Ply" Samples

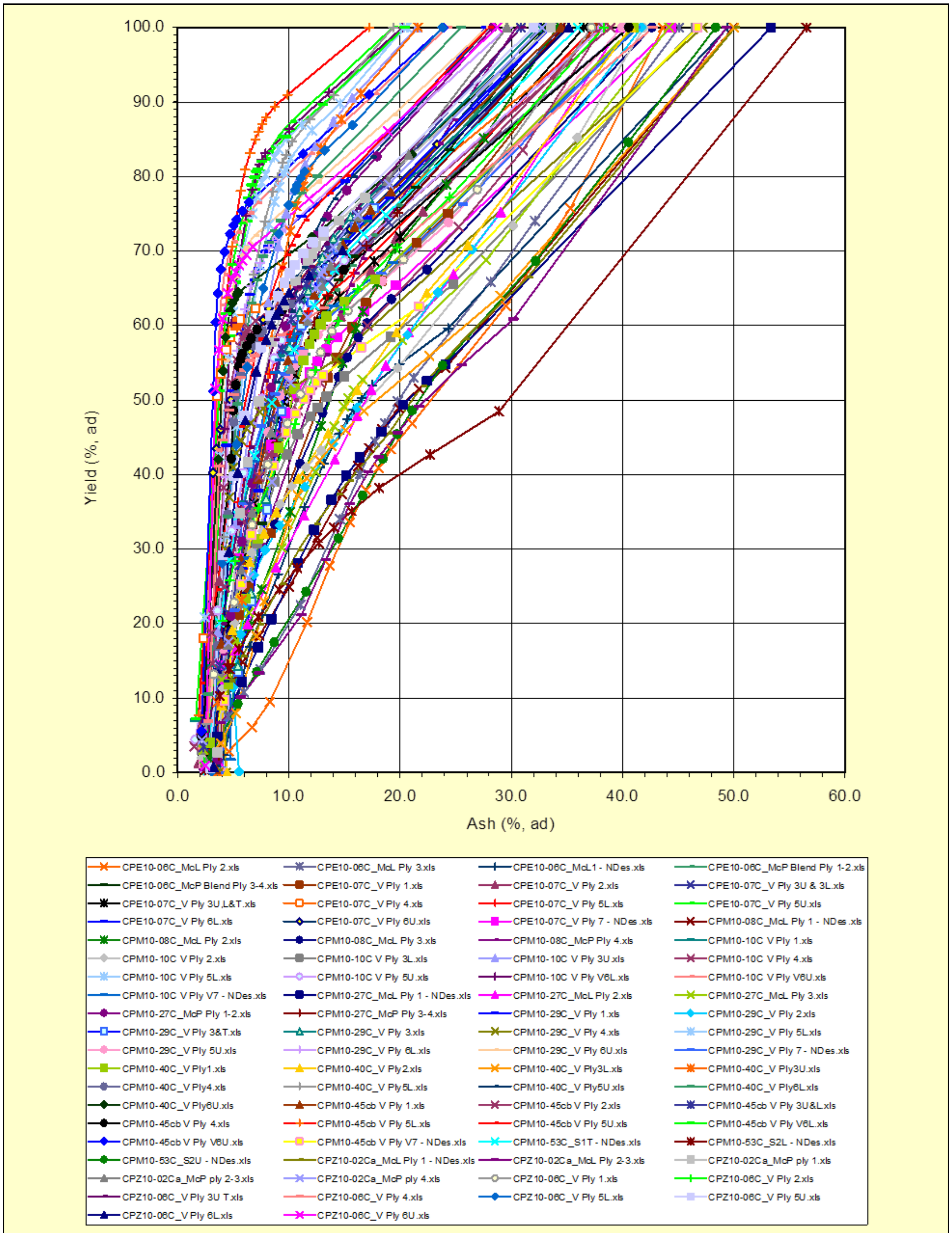


SNOWDEN

Washability Simulation
Vista Coal Project

Source: Snowden, 2012

Figure 17.2 Combined +0 mm Theoretical Yield-Ash for ROM "Ply" Samples



SNOWDEN	Washability Simulation Vista Coal Project	Source: Snowden, 2012

In addition to the ROM ply samples, a number of average data sets were calculated to cover the weighted washability for each seam within each core, the average washability for each ply over the mine, the average washability for each full seam over the mine, and the weighted average washability for the first five years of the mine plan. The average sizing and washability plots for these average feeds are presented in Figure 17.3 and Figure 17.4 respectively. These plots show that consideration of the average data sets rather than the full range of plies reduces the ranges in sizing and washability, as “extreme” samples are blended out of the mix.

17.3 Equipment Selection

A detailed LIMN model including solids, water and magnetite balances was developed for the proposed CPP circuit. This model was used to develop circuit loadings which would result if all ROM “ply” feeds were processed at the nominal plant feed rate of 1500 tph “as received” (ar).

Following the initial simulations of all data sets at DMC cut-points 1.50, 1.6 and 1.70, a review of the loading was undertaken and logical equipment selections were made to cover most of the coals. Due to the high degree of variability in both sizing and washability for the coals to be processed, it was not considered feasible to enable every ply to be processed at 1500 tph (ar), without significant additional capital outlay. Therefore, the equipment selections were undertaken on the premise that some coals would need to be processed at a rate lower than the nameplate plant capacity. Alternatively, depending on the available mix of seams available at the time, some seams could be blended in a limited capacity in effort to enable processing at a consistently higher rate.

The minimum achievable feed rate of 850 tph (ar) from all ply data was observed for CPM10-27C_McL Ply 1, which would likely not be mined as a discrete section. If this sample is excluded, the next lowest feed rate achieved was 950 tph (ar) for CPM10 45cb_V Ply V7, which is also unlikely to form a discrete feed for processing. Samples included in the design set showed the need for derating plant feed rate below 1500 tph with the lowest being CPM10-45cb_V Ply2 (1330 tph). Therefore, the equipment which has been selected will be suitable for processing the vast majority of coals at the nameplate capacity of 1500 tph.

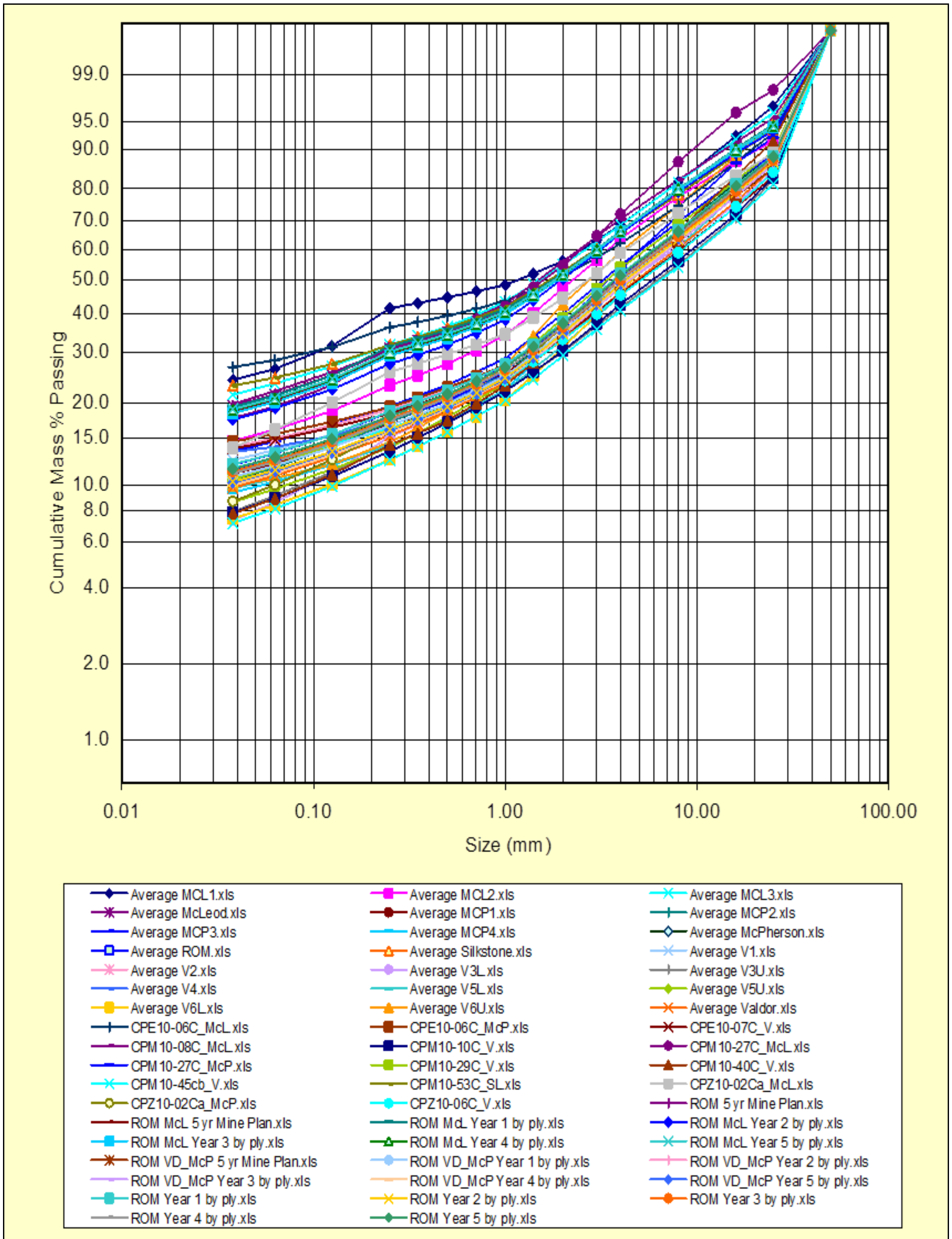
17.3.1 Nominal Material Balance

The nominal material balance for plant operations processing an average mix of McLeod + McPherson + Val d’Or + Silkstone is presented in Table 17.1 with tonnage throughputs expressed as “air dry” (ad) values.

Table 17.1 Nominal material balance

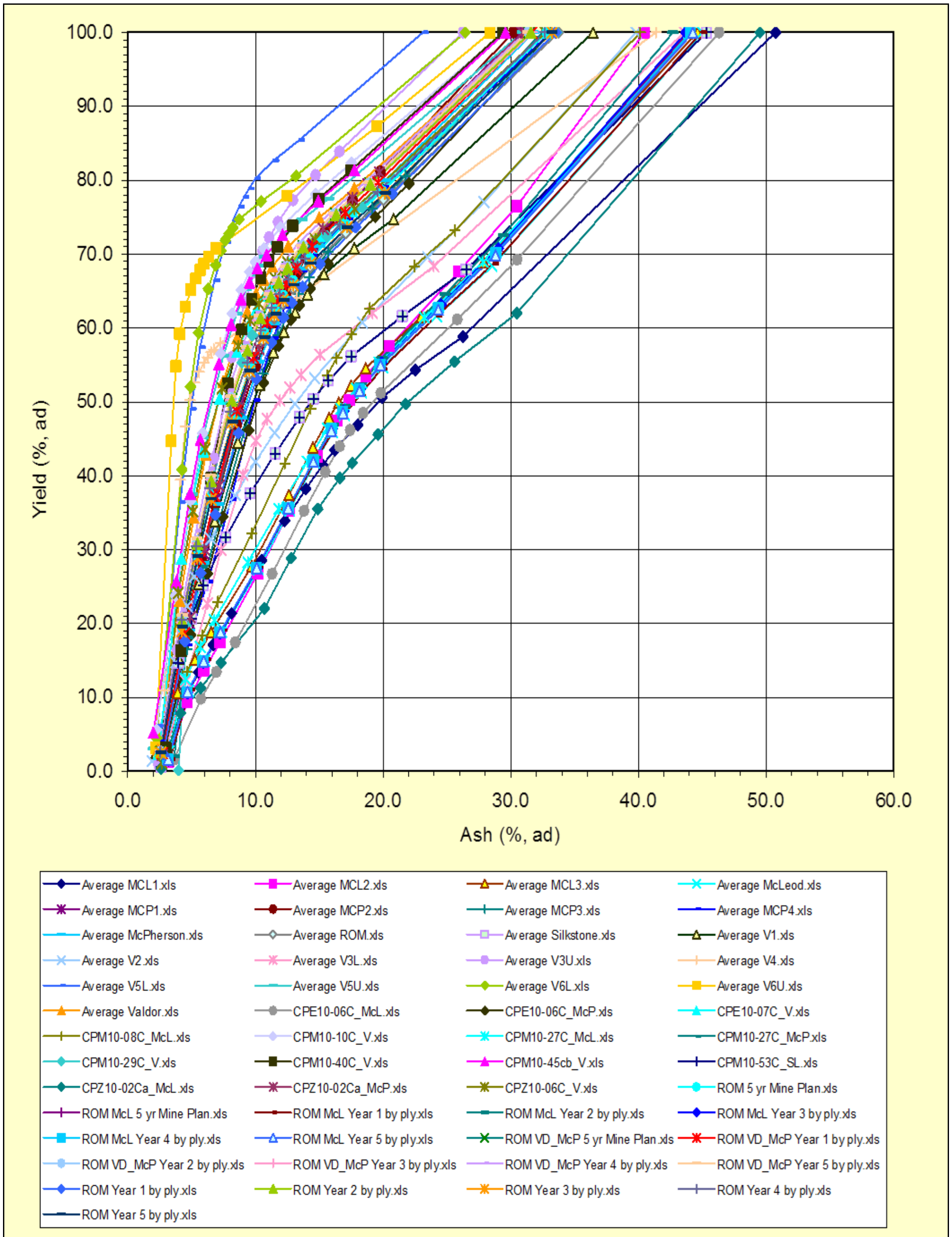
Plant Stream	Module 1 tph (ad)	2 x modules tph (ad)
Feed	1408	2816
Product	741	1482
Trucked Reject	398	796
Processed fines	267	534

Figure 17.3 Process sizing distribution for ROM "Average" samples



SNOWDEN	Washability Simulation Vista Coal Project	Source: Snowden, 2012

Figure 17.4 Combined +0 mm theoretical yield-ash for ROM "Average" samples



SNOWDEN	Washability Simulation Vista Coal Project	Source: Snowden, 2012

A detailed LIMN model including solids, water and magnetite balances has been developed for the proposed CPP circuit. LIMN is a Microsoft Excel based process simulation program which enables practical washing inefficiencies to be applied to theoretical (laboratory) data such that allowances are made for the misplacement of material likely in the sizing and density based separation processes within the CPP. By running simulations for the agreed design conditions, the maximum circuit loadings which have been projected from the detailed LIMN model formed the basis for the equipment selection, and subsequently the estimate of capital and operating costs.

Based on the selected design data set, DMC cut-points of 1.5, 1.6 and 1.7, and a feed rate of 1500 tph wet “as received” (ar) coal per module, the maximum projected “air dry” (ad) tonnages reporting to each of the process circuits are shown in Table 17.2.

Table 17.2 Maximum loadings to the process equipment per 1500 tph module

Plant Process Stream	Max. Simulated Loading (tph, ad)
Plant Feed	1442
De-sliming Screen Feed	1499
DMC Feed	1136
DMC Product Screen	899
DMC Reject Screen	627
Coarse Coal Centrifuges	428
Small Coal Centrifuges	611
Classifying Cyclone Feed	897
Sieve Bends	326
Teetered Bed Separators	508
Spirals Feed	120
Fines Product Centrifuges	209
Fines Reject Screens	297
Thickener Feed	1222
Screen bowl Centrifuge	67

A “nominal” flow sheet has been developed to reflect the typical or average circuit loadings expected. This nominal flow sheet is based on the McLeod + McPherson + Val d’Or sections from the relevant LD cores, weighted on a length times density basis to provide an overall resource weighted average feed washability. For this combined nominal washability, a DMC cut-point of 1.55 is required to achieve the desired product energy specification 5,800 kcal/kg GAR from McPherson + Val d’Or and 5,400 kcal/kg GAR from McLeod. The nominal projected “air dry” tonnages reporting to each of the process circuits are shown in Table 17.3.

Table 17.3 Nominal loadings to the process equipment per 1500 tph module

Plant Process Stream	Nom. Simulated Loading tph (ad)
Plant Feed	1421
De-sliming Screen Feed	1459
DMC Feed	929
DMC Product Screen	599
DMC Reject Screen	330
Coarse Coal Centrifuges	194
Small Coal Centrifuges	381
Classifying Cyclone Feed	546
Spirals Feed	69
Fines Product Centrifuges	126
Fines Reject Screens	144
Thickener Feed	247
Teetered Bed Separators	329
Sieve Bends	210
Screen Bowl Centrifuge	43

17.3.2 Plant Water Usage

For the large CPP proposed, and the fine nature of some of the coals to be processed, plant water usage will be significant. Although much of the process water is recovered for re-use via the processed fines thickener, water is ultimately consumed due to:

- water leaving the plant as part of the product stream (~14% total moisture, ex plant)
- water leaving the plant as part of the +0.2 mm truckable reject stream (~18.1% total moisture)
- the water contained within the thickener underflow which is pumped to the designated emplacement area at around 30% solids (by weight).

The water contained within the processed fines stream is the major single loss of water from the process. Alternative technologies for further dewatering of processed fines from thickener underflow can be applied to reduce this water loss if required, although full mechanical dewatering of processed fines, such as through the use of solid bowl centrifuges or paste thickeners, will require additional (significant) capital outlay for a CPP of this size.

The thickener will recover most of the process water as clarified water, with thickener overflow reporting to a clarified water tank. Clarified water will be utilised throughout the CPP for:

- sump level make-up water
- spray water.

Due to the unavoidable loss of water through the washing process, raw water make-up will be required to offset the loss of water through the plant product and reject streams, in particular the processed fines stream.

In the LIMN simulations, ROM coal moistures have been modelled according to the air dry moisture for each sample (laboratory result) offset by 5% to a total ROM moisture. For the nominal case this equates to 6.1% air-dry and 11.1% total moisture, but the ranges are +2.5% around these averages. On this basis, 1500 tph ROM coal can be considered to consist of:

- 1500 tph wet coal at ~11.1% TM, which equates to
- 1420 tph air-dry solids, plus 80 tph of free water, which equates to
- ~1333 non dry solids, plus ~87 tph nom of air-dry “inherently bound” water, plus 80 tph of free water

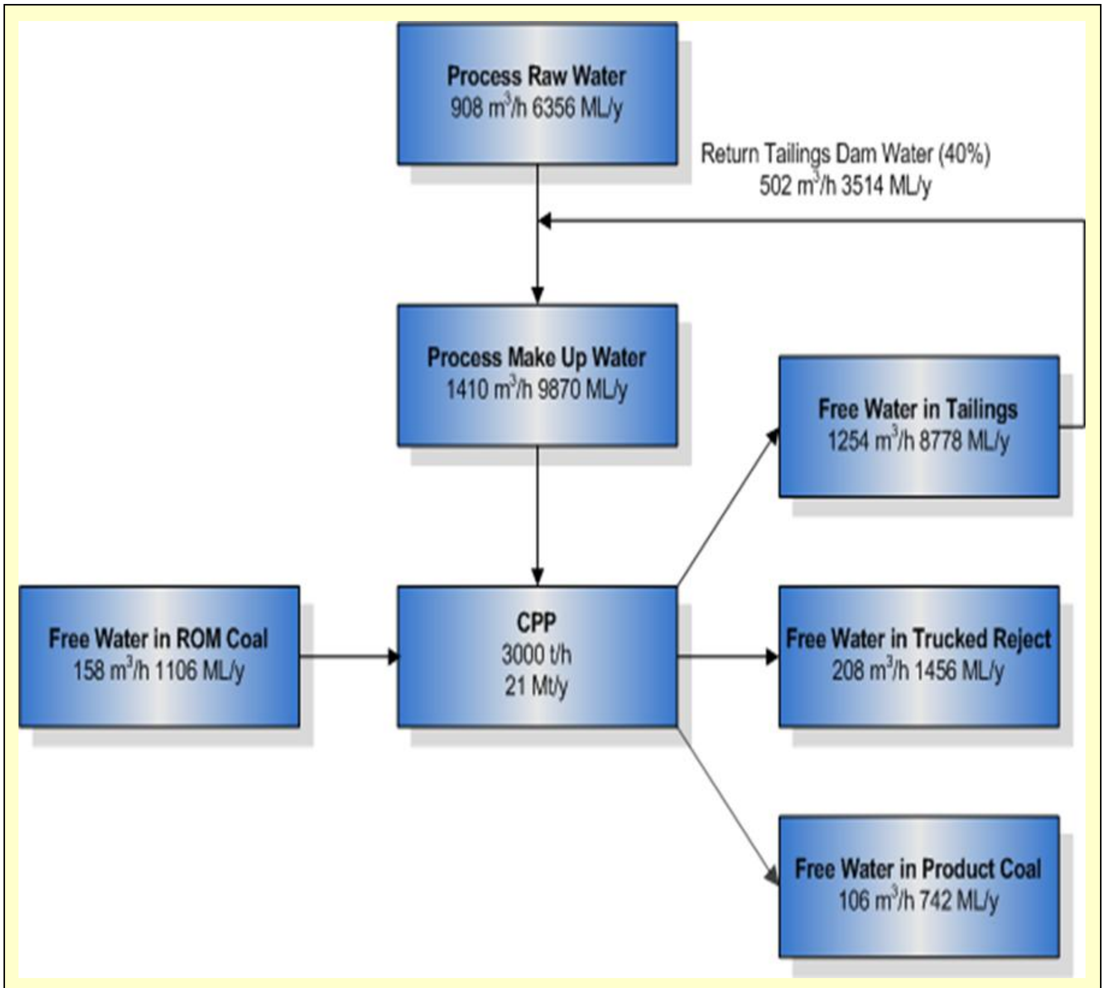
It was assumed that the inherent moisture in the ROM material, product, reject and processed fines remained unchanged at 6.1% for simulations; although the coal quality data suggests the product coal will have a higher air-dry moisture due to the relationship between ash and air dry moisture for these coals. However, for an assumed product total moisture of 14.3%, the assumption is that some of the free moisture being simulated will fill the pores to increase air-dry moisture thus reducing effective “free moisture” in the product but not impacting on the water usage.

From the LIMN simulations undertaken, it is predicted that the plant will require between 324 m3/h to 1257 m3/h of make-up water per 1500 tph module, or 648 m3/h to 2514 m3/h for full 3000 tph being processed through two modules. This range is a result of the coarse to fine sizing range observed in the design envelopes, in particular the need to allow for washing individual seams. For the nominal design case, the CPP process water makeup requirement is 705 m3/h per module or 1410 m3/h in total for 3000 tph. This equates to approximately 470 litres of make-up water per tonne of ROM coal processed on average based 7000 operating hours.

In total, this equates to around 9870 mega litres per year (or 9.87 million m3/y) of process make-up water being required, based on 21 Mtpa ROM processing. Once the PFSP is fully established after the first 12 months of operation, it is expected up to 40% of the water pumped out with the processed fines will become available for re-use in the plant. If smaller PFSPs are cycled over time rather than taking a traditional single dam final emplacement approach, there is a risk that the return water may not reach the 40% level on a long term “stable” basis.

Figure 17.5 shows the process water balance for the nominal hourly and annual average flows for processing 3000 tph and 21 Mt ROM coal respectively. Note that this figure is for the CPP process only and does not include provision of wash down water, dust suppression water, potable water etc, which are discussed elsewhere. Based on an assumed recovery of 40% of processed fines water, the net raw water requirement for the CPP at full production is 454 m3/h or 3,178 Ml per year.

Figure 17.5 CPP Process Water Balance at 3,000 tph



SNOWDEN | CPP Water Balance Vista Coal Project | Source: Snowden, 2012

17.4 Process Description

17.4.1 CPP Plant Feed

The coal preparation plant will consist of two modules. Module 1 and Module 2 are identical modules rated to 1500 tph each.

Module 1 will be constructed initially and will be rated to treat 1500 tph of open cut material.

CPP feed conveyor CVR-1101 discharges raw coal into Raw Coal Distribution Box (BOX-1201) which feeds straight onto the de-sliming screens SCR-1201 and 1202.

Module 1 and Module 2 are fed from separate conveyors CVR-1101 and CVR-2101.

The raw coal distribution box BOX-1201 splits the feed off CVR-1101 (approximately) 50/50 two the de-sliming screens. The raw coal is sluiced with water in launders and transported from the raw coal from BOX-1201 to the de-sliming screens.

From here on the process description will only concern itself with Module 1 as Module 2 is an identical module.

17.4.2 De-sliming Circuit

The -50mm raw coal reports to the de-sliming screen (SCR-1201 and SCR-1202) which are both fitted with 2.0 mm (ww) aperture deck panels. Overflow from the de-sliming screen will be sluiced with correct medium into the wing tank (SMP-1301 and SMP-1302). The underflow from the de-sliming screen will drain to the de-sliming cyclones feed sump oversize protection screen (SMP-1501-3001).

The coal slurry passing through the screen flows into the de-sliming cyclones feed sump (SMP-1501). The oversize material is rejected and discharged on the CPP floor. Dense medium pumps PMP-1301 and 1302 pump from the sumps 1301 and 1302 respectively.

17.4.3 DMC Circuit

Slurry consisting of medium and coarse coal will be pumped by the primary DMC feed pumps (PMP-1301 and 1302) to DMC's (CYC-1301 and 1302) located on the top floor of the plant. Due to the need for accurate pressure control, the primary DMC feed pumps will have variable speed drives which will regulate the speed of the pump to maintain a constant feed pressure to each of the DMC's. The pressure to the DMC's will operate with a dead band to minimise the occurrence of unnecessary slight changes to pump speed.

Product coal and medium will collect in the DMC overflow boxes (CYC-1301-3201 and CYC-1302-3201) and flow to the DMC product Drain and Rinse (D&R) screens (SCR 1301 and SCR-1302).

The drained and rinsed coal passes over an extended screen with an extra section at the end separating the coarse into a +16 mm stream and a -16mm stream. The +16 mm is discharged from the end of the screens to the Coarse Coal Centrifuges (CFT-1301 and CT-1302).

Dried coal reports to the product conveyor (CVR-0801). The -16 mm coal passes through the screen panels and reports to four Small Coal Centrifuges (CTF-1303, CTF 1304, CTF 1305 and CTF-1306) from where dried coal reports to the product conveyor (CVR 0802).

The cyclone reject and medium will collect in the DMC underflow collectors (CYC 1301 3301 and CYC-1302-3301) and flow together into a common screen feed box (SCR-1301-3001) prior to discharging onto a single reject D&R screen (SCR 1303) that processes reject from both cyclones.

The reject from SCR-1303 discharges onto the reject conveyor (CVR-0701).

17.4.4 Medium Recovery Circuit

The following report to the dilute medium sump (SMP-1305) via the oversize protection screen SCR-1305-3001:

- clarified water from pump PMP-1601
- effluent from centrifuges CTF-1301, 1302, 1303, 1304, 1305 and 1306
- correct medium splitter box SBX-1301
- DMC reject screen SCR-1303
- DMC product screens SCR-1301 and 1302
- oversize from the protection screen is sent to the CPP floor.

Material in sump SMP-1305 is pumped by the dilute medium pump PMP-1305 to the magnetic separators MSR-1301 and 1302.

Concentrated Magnetite from the magnetic separators is returned to the correct medium sump SMP-1303.

Effluent from the magnetic separators is returned to the raw coal distribution box BOX 1201.

Magnetite addition is achieved via the magnetite addition sump SMP-1307 and pit pump PMP-1307. Magnetite is delivered via the splitter box SBX-1302 to both the correct medium sump SMP-1303 and the dilute medium sump SMP-1305.

17.4.5 Fine Coal De-sliming and Primary Separation

Underflow from de-sliming screens SCR-1201 and 1202, together with spray water from the fine coal centrifuge distribution box BOX-1501 is delivered to the classifying cyclones sump SMP-1501

Classifying cyclone feed pumps PMP-1501 and 1502 supply classifying cyclones CYC 1501 and 1502. Each pump is controlled by a variable speed drive in order to maintain a constant delivery pressure.

Overflow for each cyclone cluster reports to the thickener de-aeration tank TNK-1701.

Underflow from the classifying cyclones is delivered to the teeter bed separators (TBS) GRC-1501 and 1502 for further treatment, with the overflow reporting to TBS product sieve bends and the underflow via collectors to the fine reject distribution box BOX 1502.

Material separated by the TBS product sieve bends is delivered to the spiral feed sump SMP-1503 and the over flow is sent to the fine coal centrifuge distribution box BOX 1501.

Material from the spirals feed sump SMP-1503 is pumped by the spirals feed pump PMP-1503 to the spirals feed cyclones CYC-1503. This pump is also controlled using a variable speed drive.

Spirals cyclones overflow reports to the thickener de-aeration tank TNK-1701 or to the raw coal distribution box BOX-1201. Underflow is fed to the spirals bank GRC-1503 feed distributors.

Spirals product is delivered to the spirals product sump SMP-1504 while reject from the spirals bank is delivered to the fines reject distribution box BOX-1502.

Spirals product is further treated by the spiral product cyclones CYC-1504, with the over flow reporting to the raw coal distribution box BOX-1201 and underflow reporting to the screen bowl centrifuge oversize protection screen then on to the screen bowl centrifuge CTF-1504.

Concentrate from the screen bowl centrifuge will be delivered to the spirals product sump SMP-1504. The effluent from the screen bowl is delivered to the fines effluent sump SMP-1505, from where it is pumped to the thickener de-aeration tank TNK-1701.

The effluent of the fine coal centrifuges CTF-1501, 1502 and 1503 is returned to the spiral feed sump SMP-1503.

The fine effluent sump SMP-1505 receives material from fines reject screens SCR-1505, 1506 and 1507.

17.4.6 Product Dewatering

Product dewatering is achieved by material being dried by coarse coal centrifuges CTF 1301 and 1302, fine coal centrifuges CTF-1501, 1502 and 1503, small coal centrifuges CTF-1303, 1304, 1305 and 1306 and screen bowl centrifuge CTF-1504. Product from the centrifuges is delivered to the outgoing conveyors while centrifuge effluent is delivered to sumps SMP-1305, 1504 and 1505.

The effluent from the coarse coal and small coal centrifuges is returned to the dilute medium sump while that from the fine coal centrifuges is delivered to the spirals feed sump.

The fines reject screens SCR-1505, 1506 and 1507 process material delivered from the spirals underflow collectors and the reject from the TBS units via the fines reject distribution box BOX-1502, with reject to the outgoing conveyor and underflow to the fines effluent sump SMP-1505.

17.4.7 Processed Fines Disposal

Material is delivered to the two processed fines thickener THR-1701 from the following:

- fines effluent sump SMP-1505
- classifying cyclones CYC-1501 and 1502
- spirals feed cyclones CYC-1503
- thickener area sump SMP-1703, via pump PMP-1703.

Thickener underflow pumps PMP-1701 and 1702 deliver to the processed fines disposal pipelines.

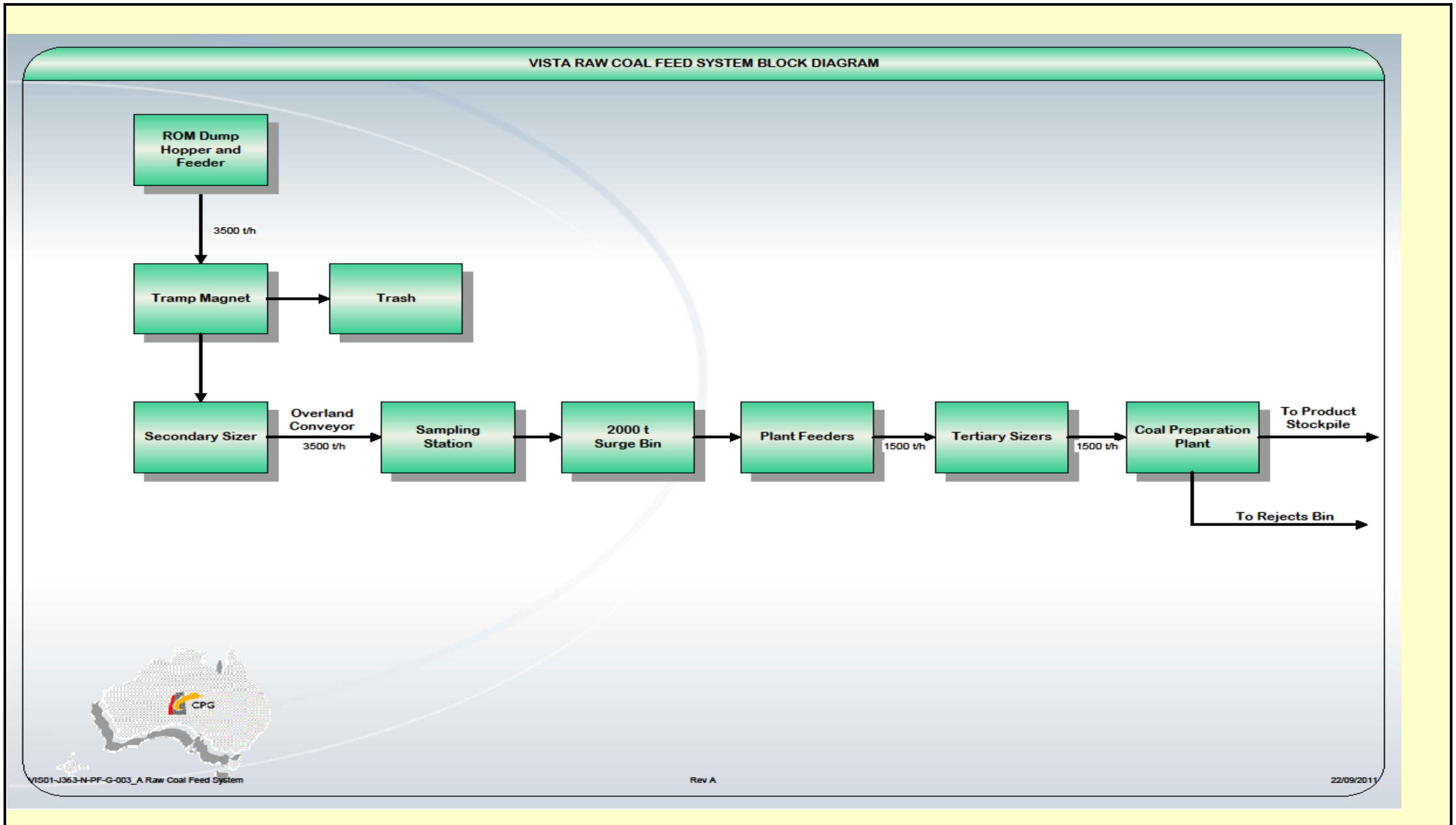
The primary processed fines thickener and monitoring system is a complete vendor supply package.

The secondary processed fines thickener and cationic flocculent systems and dosing pumps are supplied as a complete vendor package plant.

The processed fines discharge pipelines anionic flocculent system and dosing pumps will also be supplied as a vendor package plant.

17.5 Plant flow sheets

Figure 17.6 Raw coal feed flowsheet

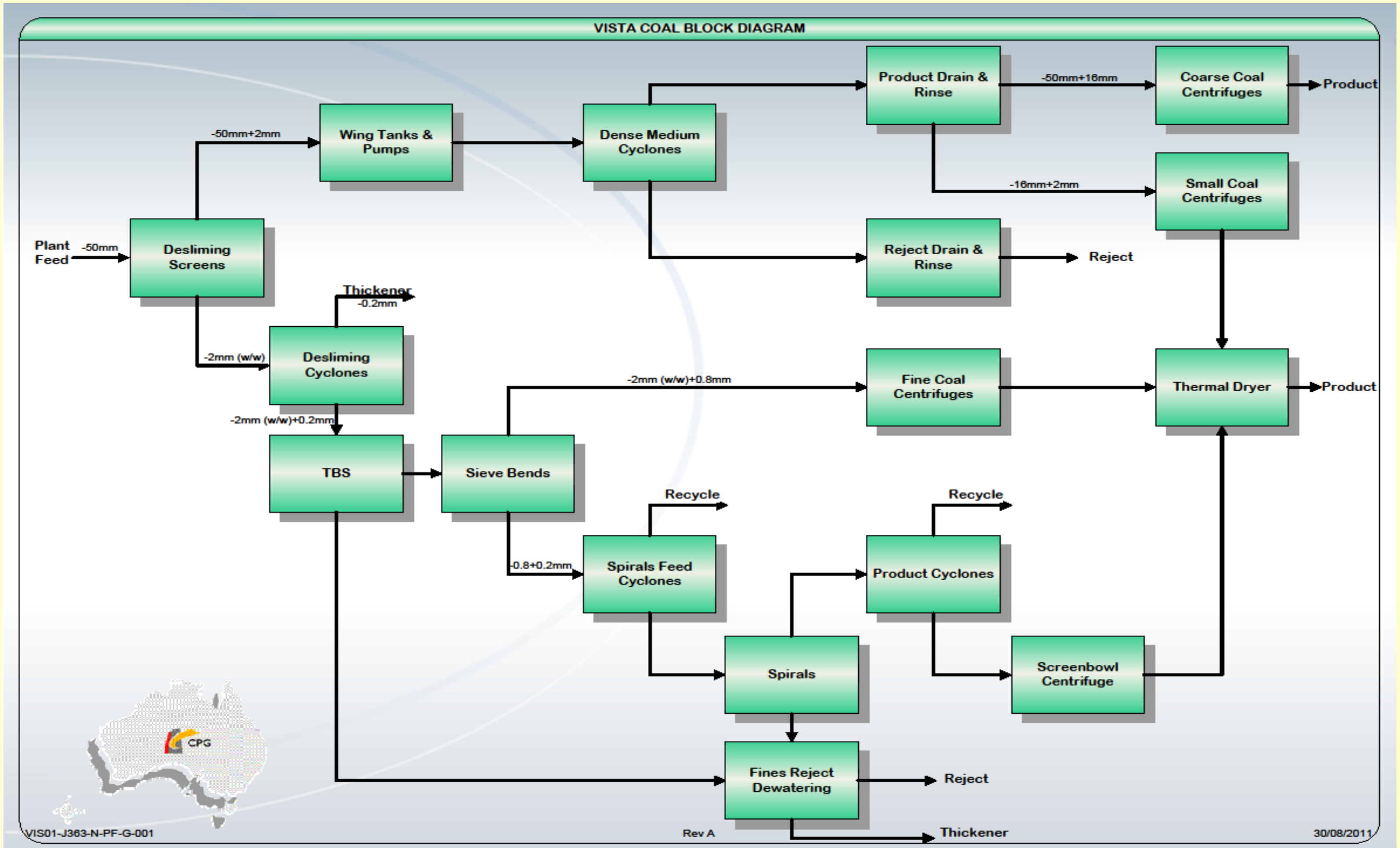


SNOWDEN

ROM to CPP Flowsheet
Vista Coal Project

Source: Snowden, 2012

Figure 17.7 CPP flow sheet (thermal dryer is excluded with centrifuge material reporting direct to product)



CPP Flowsheet
Vista Coal Project

Source: Snowden, 2012

Figure 17.8 Product coal flow sheet

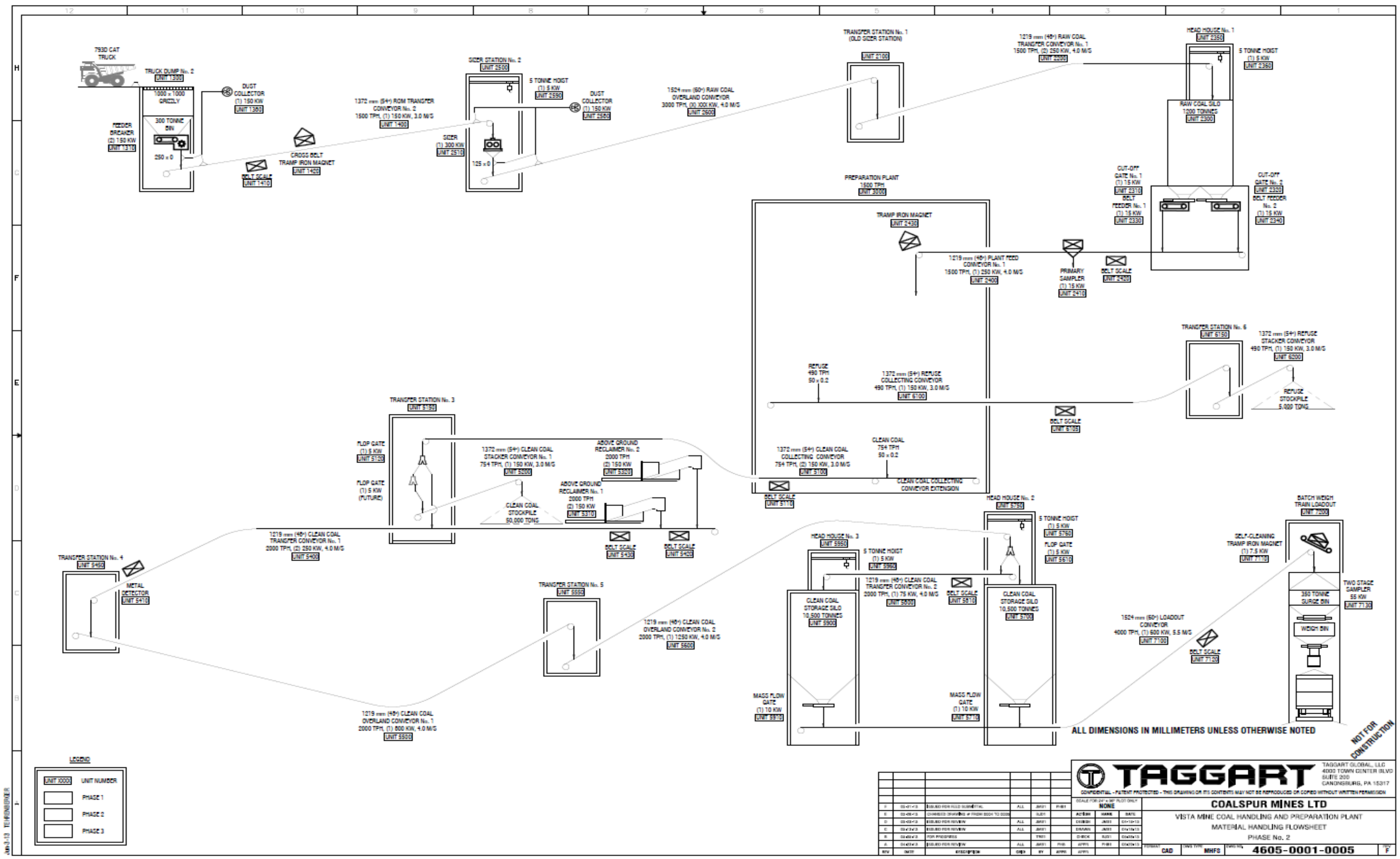
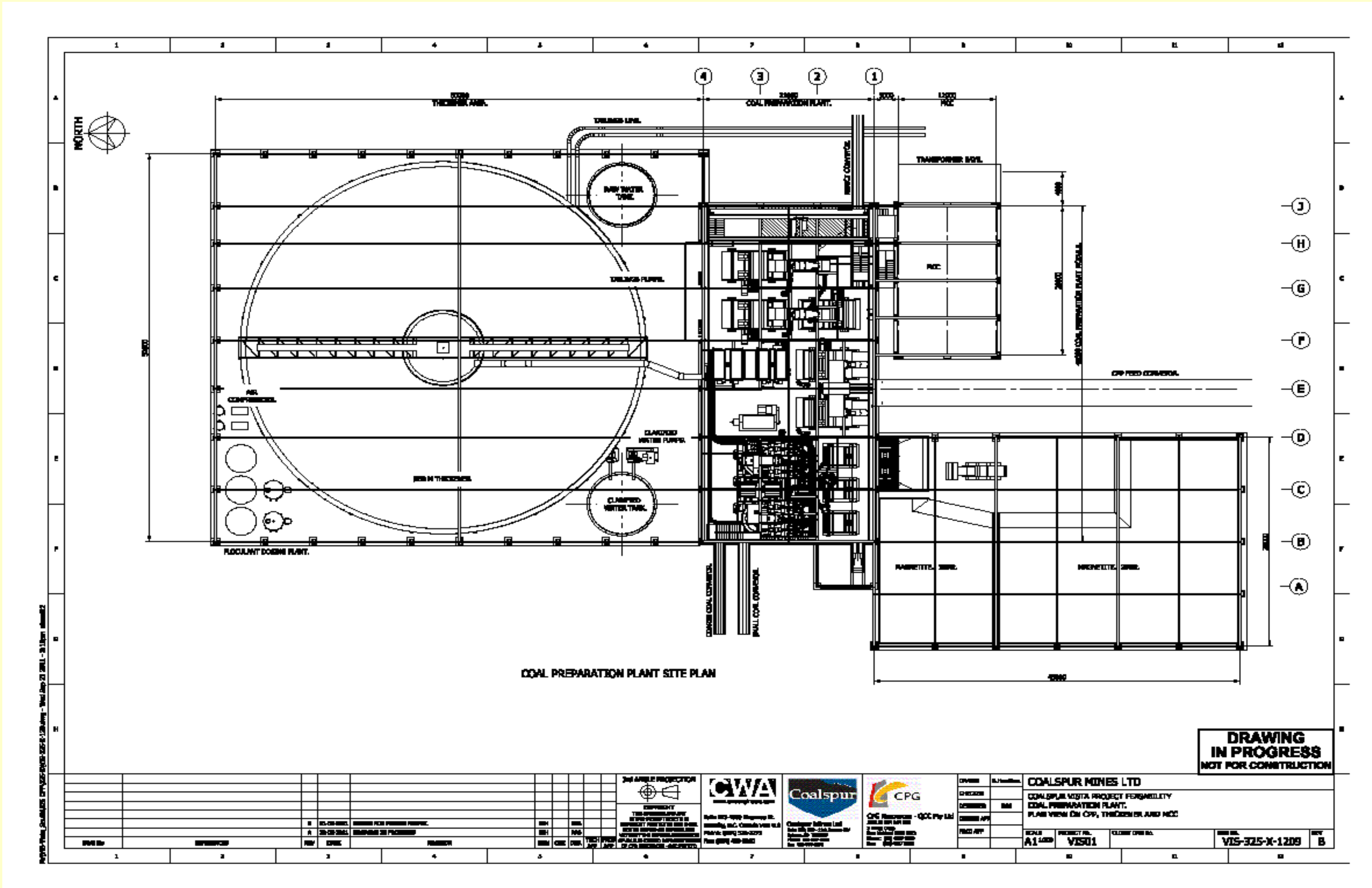


Table 17.4 Major equipment (per module)

Description	Value	Model
Raw Coal Desliming Screen	2 x Single Deck Banana Screens	3.6 m x 6.1 m
Heavy Medium Equipment	2 x Heavy Media Cyclones	Ø1150 High Capacity
Product D&R Screen	2 x Single Deck Banana Screen	3.6 m x 7.3 m
Reject D&R Screen	1 x Single Deck Banana Screen	3.6 m x 6.1 m
Fines Solids Equipment	2 x Teetered Bed Separators	Ø3600 - 4 Reject Spigots
Fines Solids Equipment	16 x Four turn triple start spirals	LD7
Coarse Coal Dewatering	2 x Centrifuges	Ø1400 Horizontal Shaft
Small Coal Dewatering	4 x Centrifuges	Ø1400 Horizontal Shaft
Fine Coal Sizing	4 x Sieve bends	2 m Radius x 2.4 m Wide
Fine Clean Coal Dewatering	3 x Fine Centrifuges	Ø1300 Horizontal Scroll
Fine Clean Coal Dewatering	1 x Screenbowl Centrifuge	Ø1100 x 3300 long
Fine Reject Dewatering	3 x Single Deck Decline Screen	2.4 m x 3.6 m
Processed fines Thickener	1 x High Rate	Ø45 m High Rate
Processed fines Mechanical Drying	1 x Solidbowl Centrifuge	Allowed space in building only

Figure 17.9 Coal preparation plant layout



CPP Layout
Vista Coal Project

Source:
Snowden, 2012

18 Project Infrastructure

Chapter 18, Infrastructure, has changed somewhat from the previous Snowden 2012 FS report. There has been a change in engineering firms and concurrently the design basis for a number of infrastructure items. These changes have improved the economics and reduced the risks. Importantly, the designs are more optimised and detailed and supported by firmer cost quotations. The changes are incorporated into the current financial models used in this report.

18.1 Civil Infrastructure

18.1.1 Civil Construction Materials

Backfill materials for the construction of the civil works will be obtained locally.

Bulk earthworks, such as those used for road construction, plant grading, and the rail siding, will primarily consist of cut-fill material obtained at the source of construction. Generally, the geotechnical conditions indicate that the local materials will be suitable for bulk fill.

Structural fills and road base will be manufactured at a local quarry. A number of private local quarries are available and there is opportunity for Coalspur to develop a quarry near the site.

18.1.2 Structural Construction Materials

Concrete supply will be contracted to local producers who have available capacity in the township of Hinton.

Steel will be sourced from overseas suppliers that are qualified and have obtained the required certifications to be able to export steel fabrications into Canada. A quality control program will be implemented by the EPC to ensure fabrication meets design requirements.

18.1.3 Access Roads

The primary access to the plant site will be by a new road approximately 8 km long originating at Highway 16. The plant site access road will intersect Highway 16 adjacent and to the west of the Hinton Gun club and will follow an alignment approximately due south to the mine and plant site. The road will consist of a two lane gravel surfaced road designed to provide an all-season, all-weather access with a maximum grade of 8%.

A new intersection at the Highway will be required. The intersection is designed to also accommodate access to the Hinton Gun Club. The existing Gun Club intersection will be removed.

Access to the plant site currently exists along the McPherson forest service road. This road will only be used during the initial stages of construction until the new access road is constructed.

Access to the Train Load Out (TLO) area will also originate from the new intersection at Highway 16. A short section of road running north from the Highway intersection will provide access to the TLO area.

18.1.4 Train Load Out Rail Siding

A new rail siding will be constructed to accommodate unit coal trains. The siding will be constructed to the south and immediately adjacent to the CNR mainline. The siding will be approximately located between CNR mile marker 176 (east) and 180 (west).

The design unit train will consist of 175 gondola cars with 3 locomotives, for a total train length of approximately 3 km. The total coal carrying capacity of the unit train is 18,550 t.

The rail siding will be configured with the TLO located at the siding mid-point. The siding will extend approximately 3.5 km to the west and 3.5 km to the east of the TLO for a total length of 7 km. Initially on the main line, a single switch will be provided just to the east of the TLO for the train to crossover to the siding and a switch will be provided at the East end to allow locomotives to move around to the Western end of the train to return to the port. Trains will arrive heading east bound and will enter the siding to the east of the TLO. The train will then be scaled as it moves through the TLO towards the west and will then reverse direction to the east as it is loaded with coal.

A contract has been signed between CNR and Coalspur for the coal haul contract from the mine TLO to sea ports on the west coast.

The present agreement has facilitated CNR to purchase the land and allow Coalspur to develop the siding for primary use by Coalspur. CNR will deliver empty trains and take them away once they are full. Coalspur personnel will operate the rail loading system including the train during loading.

18.1.5 Plant Site Civil Development

The plant site has been located to the north of the pit on a plateau that is situated just to the south of the prevailing ridge that runs east-west. The area is relatively flat and can accommodate all of the plant facilities and the clean coal storage yard. The ridge forms a natural visual barrier between the plant site and the communities around Hinton including Highway 16.

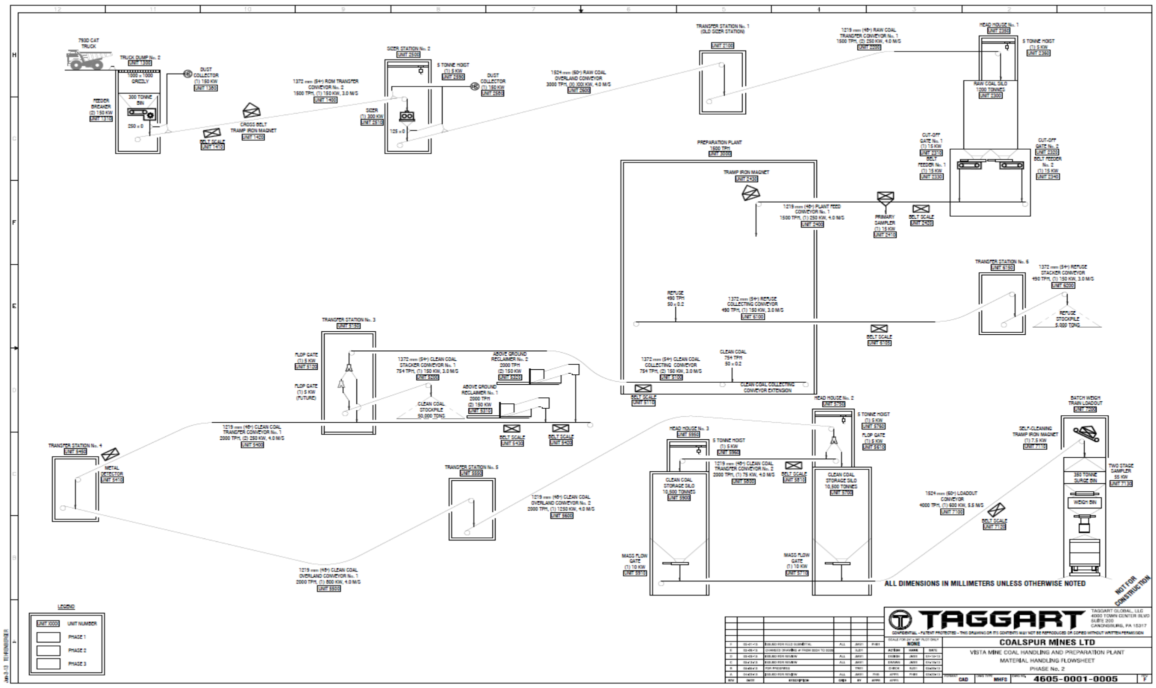
The civil works for the plant site and clean coal storage area will require the development of approximately 39 ha. Generally the site will be levelled and compacted to accommodate the facilities.

18.2 Raw and Clean Coal Handling Systems

The proposed raw coal handling and clean coal handling systems are shown in Figure 18.1 and are described below.

The CHPP at Vista will be constructed to initially support 2 CPP modules to a capacity of 6 Mtpa but with expansion capacity to 12 Mtpa. The overland conveyors, silos and Train Load out will be built for 12 Mtpa capacity in the initial construction.

Figure 18.1 Coal handling system flow diagram



18.2.1 Raw Coal Feed

Coal from the Mine will be delivered by heavy haul truck the ROM facility. The ROM infrastructure will consist of a 200,000 t raw coal storage pad and a crushing station. ROM coal will be delivered to the CHPP via 785, 789, or 793D (or equivalent) end dump trucks. Trucks will dump at the Truck Dump No. 1. A 1000 x 1000 grizzly will protect the truck dump from oversize material.

1000 x 0 ROM coal will be reclaimed from the Truck Dump No.1 at a variable rate up to 1500 TPH via a Feeder Breaker. The Feeder Breaker will reduce the ROM coal to a nominal size of 250 x 0. Sized Raw Coal will discharge from the Feeder Breaker onto ROM Transfer Conveyor No. 1. A dribble chute under the Feeder Breaker will discharge fines material onto the tail of ROM Transfer Conveyor No. 1.

A dust collector will be employed at the ROM Dump to extract dust from the Feeder Breaker discharge and the skirt board of the ROM Transfer Conveyor No. 1.

ROM Transfer Conveyor No. 1 will convey 250 x 0 raw coal to the Sizer Station No. 1. A Belt Scale will measure the coal reclaim rate. A cross belt magnet located on ROM Transfer Conveyor No. 1 will remove tramp metal from the ROM coal.

ROM Transfer Conveyor No. 1 will discharge coal into Sizer Station No. 1 at a maximum rate of 1,500 tph. A Sizer will reduce raw coal from a nominal size of 250 x 0 to a nominal size of 125 x 0.

The Sizer will discharge onto the tail of Raw Coal Transfer Conveyor No. 1. A dust collector will be employed at the Sizer Station to extract dust from the Sizer feed, Sizer discharge, and the skirt board of the Raw Coal Transfer Conveyor No. 1.

Raw Coal Transfer Conveyor No. 1 conveys 125 x 0 raw coal from the Sizer Station No. 1 and discharges into a 1200 tonne capacity Raw Coal Silo.

The Raw Coal Silo provides surge capacity in front of the CPP. 125 x 0 raw coal will be reclaimed from the Raw Coal Silo via two Belt Feeders. Cut off gates provide isolation for the Belt Feeders. Belt Feeders discharge raw coal onto Plant Feed Conveyor No. 1.

Plant Feed Conveyor No. 1 conveys raw coal from the Raw Coal Silo into CPP Module No. 1. The CPP raw coal feed is measured by a Belt Scale. A self-cleaning Tramp Iron Magnet is located at the head of the Plant Feed Conveyor No. 1 to remove tramp metal from the plant feed.

A Primary Sampler is located on the Plant Feed Conveyor No. 1 to provide raw coal feed samples for the Coal.

18.2.2 Rejects Handling

Wash plant rejects will be conveyed to a 300 t rejects storage bin. Heavy haul mine trucks will be utilized to empty the rejects bin and transport the material to designated storage piles.

18.2.3 Clean Coal Storage and Reclaim

Clean product coal from the CPP will be conveyed to the clean coal storage silos.

The Clean Coal Handling system has a nominal capacity of 377 tph and max capacity of 473 tph for Phase 1 with an upgraded nominal and max capacity of 754 tph and 946 tph respectively for Phase 2. The overland conveyance system has a capacity of 2,000 tph for all phases.

The Coal Preparation Plant produces 50 x 0 product coal from the following locations:

- One 1400 clean coal centrifuge discharge chute.
- Two EBR centrifuge discharge chutes.
- Two screenbowl centrifuge discharge chutes.

The Clean Coal Collecting Conveyor receives coal from these five load points and conveys product coal to Transfer Station No. 3. A Belt Scale measures the quantity of clean coal produced by the CPP.

The Clean Coal Collecting Conveyor discharges product coal at Transfer Station No. 3. A flop gate at Transfer Station No. 3 allows coal to be discharged to Clean Coal Transfer Conveyor No. 1 and to the overland conveyance or alternately to the 150,000 t Clean Coal Stockpile via a Clean Coal Stacker. The Clean Coal Stacker forms a radial product stockpile.

The product stockpile will be reclaimed using mobile equipment pushing product coal to two (2) Above Ground Reclaimers. Each Above Ground Reclaimer will have a capacity of up to 2000 TPH. Above Ground Reclaimers will discharge to the Clean Coal Transfer Conveyor. Belt Scales located after each Above Ground Reclaimer discharge point will measure the reclaim rate from the stockpiles.

Clean Coal Transfer Conveyor will convey product coal at a rate of up to 2000 TPH to Transfer Stations where product coal is discharged onto the tail of the Overland Conveyor. The Overland Conveyor lands at the top of Clean Coal Silos and a flop gate diverts product coal into Clean Coal Silo No. 1 or onto a transfer that discharges to Clean Coal Silo No. 2. A Belt Scale measures the quantity of coal delivered to Clean Coal Silo. Total silo capacity of 21,000 t is available 600m from the TLO, with two 10,500 tonne silos.

18.2.4 Clean Coal Overland Conveyor and Train Loading

The clean coal overland conveyor will deliver material from the coal storage yard and plant directly to the clean coal silos. The TLO conveyor will then deliver coal to TLO from the silo feeders.

The Overland Conveyor will be 5.8 km long and is rated at 2000 tph. The conveyor alignment will generally follow the plant access road and will terminate at the head of the clean coal silos just to the south of Highway 16. The overland conveyor will cross a number of gullies and logging roads. The crossings will incorporate a combination of overhead galleries with underground tunnels. Also, wildlife crossings will be located at approximately every 500 m to 800 m along the length of the overland conveyor.

The TLO Conveyor will take coal from the silos across Highway 16 overhead and will feed coal to the TLO. The conveyor will be rated at 4000 tph to facilitate the required train load times.

The TLO will consist of a 300 t surge bin located overtop of the rail siding. The bin will discharge into a four compartment batch weigh system for the rapid and accurate loading of rail cars. The train will travel under the TLO at a continuous speed of 0.3-0.35 mph which will result in a train loading rate of 3500-4000 tph. Nominally, the 175 car unit train will be loaded in 5.5 hours.

18.3 Ancillary Facilities

18.3.1 Offices and Mine Dry Facility

The offices and mine dry facilities will initially be designed to accommodate approximately 300 hourly and 45 staff personnel. A future expansion to accommodate an additional 300 hourly personnel has been planned for 2018.

The personnel facility will consist of a main office and mine dry facility attached to the primary site warehouse and workshop facilities.

18.3.2 Shops and Warehousing

A steel building structure will house the heavy truck shop, the warehouse, mine rescue and first aid bay, the fire truck bay, as well as plant maintenance shops. Separate truck bays will also be provided for truck washing as well as tire service.

The initial installation will accommodate four heavy truck bays and the facility will be designed for future expandability to add truck bays if the mine haul fleet increases in size.

18.3.3 Fuel Storage

Two fuel storage facilities will be installed: one at the plant site and one at the mine closer to the pit. The plant site fuel storage facility will hold 200,000 litres at each location. The tanks will all be double walled for spill protection and installed on engineered pads with appropriate liners.

18.4 Utilities

18.4.1 Power Supply

Power to the site will be provided by AltaLink. A 138 KV power line will be installed to deliver power to the plant site from the high voltage line running along the south side of Highway 16. The estimated power demand for the entire project site is 18 MW for 6Mtpa and up to 42MW depending on final electrical equipment loads in the mining area for 12Mtpa. AltaLink will terminate their power supply on the downstream side of a transformer station located at the plant site. From that point, all power distribution systems will belong to Coalspur.

18.4.2 Fresh and Potable Water Supply

Fresh and potable water will be required for process water as well as water for personnel use. All water will be obtained from ground water wells located around the plant and mine sites. It is estimated that 8 wells will be required for initial start-up. An outdoor fresh water pond with 450 Million litre capacity will be constructed for the storage of water to be used for process. The main process water feed tank will be directly fed from the fresh water pond. A separate potable water tank will be located near the personnel complex.

Total annual process water requirements are 930 ML – 1020 ML depending on moisture results thereby providing that a fresh water pond at full capacity can store up to 6 months of process water.

18.4.3 Fire Water

Fire water will be supplied from the fresh water wells and stored in a dedicated Fire Water Storage Tank. The tank will be located on the hill side to the north of the plant at an elevation sufficient to provide adequate hydraulic head without the need for pumps. The tank will be insulated and heated.

18.4.4 Sewage Treatment Plant

A sewage treatment plant will be located at the plant site to service the grey and black water systems facilities. Treated effluent from the plant will be discharged into the fresh water pond and recycled for use as process water.

Toilets at smaller remote plant locations such as the ROM, the gatehouse, and the TLO will be serviced with local septic fields or portable toilets.

19 Market Studies and Contracts

19.1 Product(s) specification

A description of the five quality parameters of the coal to be produced is provided below:

Total moisture is the total amount of moisture contained in an untreated sample of coal. It consists of the free moisture, which is the moisture on the surface of the coal, and the inherent moisture, which is the moisture held within the molecular structure of the coal.

It is important to note that the moisture increases the transportation cost of the coal and also consumes heat during combustion in the furnace.

The **ash content** of coal is the non-combustible residue that is left after the coal is burnt. There is an inverse relationship between the calorific value and the ash content. Also, the higher the ash content the higher the ash disposal cost.

Sulphur in coal is liberated in the form of sulphur dioxide into the atmosphere which is a major cause of acid rain. For this reason, most countries regulate the amount of sulphur dioxide discharged into the atmosphere.

The **calorific value** (CV) is the amount of heat released during combustion. The gross calorific value (GCV) refers to the amount of heat released when coal is combusted under standard conditions in the laboratory. This energy is not achieved in practice in boilers since some of the products of combustion, mainly water, are lost in the gaseous state with the associated heat of vapourisation. The maximum achievable CV is the net CV.

The **Hardgrove grindability index** (HGI) is an empirical measure of the difficulty of grinding a specific coal to the particle size necessary for effective combustion in a pulverised coal fired boiler. The lower the figure the more difficult it is to grind.

The quality of each of the two products to be produced by Coalspur is provided in Table 19.1. Product 1 is produced from the Val d'Or seam and Product 2 is a blend of the McPherson and McLeod seams. The qualities of Products 1 and 2 are compared against the benchmark Australian Newcastle coal index which has published pricing and a forward pricing market. The pricing is transparent and represents the pricing of competitors to Vista in the Pacific basin. For comparison purposes, a high quality Indonesian coal, Adaro Envirocoal, is also listed.

Table 19.1 Vista's product quality

Product	Product 1	Product 2	Newcastle (Typical)	Adaro Envirocoal
Total moisture (AR) (%)	11.5 – 14%	11.5 – 14%	9	26
Ash (AD) (%)	9 – 11 %	10 – 12%	15	1.2
Sulphur (AD) (%)	0.35 – 0.45%	0.35 – 0.45%	0.60	0.1
Gross CV (AR) kcal/kg	5,750 - 5,800	5,550 – 5,660	6,322	5,200
HGI	40 – 41	39 – 40	55	50

The Vista coal products have higher total moisture than the Newcastle type but significantly lower than the Indonesian Adaro Envirocoal.

All products have a lower ash content compared to Newcastle. The Coalspur products have higher ash content than the Indonesian Adaro Envirocoal.

All four Coalspur products have lower sulphur content when compared to the benchmark Australian Newcastle coal but are higher than that of the Indonesian Adaro Envirocoal.

19.2 Competitor description

Direct competition comes from Australia and Indonesia as the largest players in the Pacific seaborne thermal coal markets.

The ten largest producers account for 74% of Australia's coal production due to active consolidation in Australia's coal industry. Glencore Xstrata continues to be the largest producer of coal in Australia, followed by BHP Billiton. They are expected to remain the two largest producers until 2020.

Glencore Xstrata is Australia's largest coal producer: we expect marketable output of 65.2 million tonnes in 2013, estimated to be 16% of Australia's 2013 coal production. Glencore Xstrata owns a share in 24 Australian operations and projects; the largest number of any company in Australia. Mangoola in the Hunter Valley of New South Wales will become Glencore Xstrata's largest operating mine, ramping up to 9.5 million tonnes of saleable product in 2014.

BHP Billiton is the second largest coal producer in Australia by production with production of approximately 53 million tonnes. BHP Billiton will remain one of Australia's largest coal producers into 2020. Forecasted annual production of 64.6 million tonnes by 2017 due to expected expansions at Mt Arthur and significant expansions as part of BMA's Bowen Basin Coal Growth.

Adaro Energy and Bumi Resources are Indonesia's equal largest coal producers in terms of annual production volume. Both companies produce approximately 50 million tonnes on an attributable (share of asset ownership) basis. Bumi and Adaro dominate Indonesia's coal industry and together are expected to account for a quarter of the country's total marketable production. Both companies have a good pipeline of greenfield and expansion projects that will ensure they remain Indonesia's largest coal producers for the foreseeable future.

Indonesia's ten largest coal producers account for two-thirds of total marketable production. All of Indonesia's ten largest producers have plans for expansion over the next five years and they will account for a large proportion of Indonesia's production growth over that period.

Source: Wood Mackenzie Global Thermal Coal Long-Term Outlook 15 November 2013

19.3 Supply/demand Outlook

19.3.1 Demand forecast

Global demand for coal to fuel electricity generation is forecasted to grow from about 4.9 Bt now to about 8.3 Bt in 2035. Demand for coal for non-power purposes is expected to mirror the growth in demand for electricity generation; 1.3 Bt of growth will occur by 2035 when total non-power demand for thermal coal will reach 3.6 Bt. Combined, total demand for thermal coal will grow to 11.9 Bt in 2035 from its level of 7.2 Bt today. Demand for thermal coal will be increasingly focused in Asia, the target market for Coalspur. Thermal coal of desired quality, location and cost is not available in sufficient amounts to fuel demand, especially in Asia. This situation is expected to get worse over time, not better.

Indigenous resources of low cost coal encourage developing nations to use it to fuel growth. However, the pace of growth in most of Asia will require rapid increases in all energy fuels. It is expected that the amount of coal required in Asia to fuel expected growth will exceed the capability of each nation to provide it economically from its own resource, even if the physical resource, with proper quality, is in place

Elsewhere in the world, coal self-sufficiency will either remain steady or improve. Self-sufficiency in the US is expected to remain at 95% levels. In EMEA countries, paradoxically, self-sufficiency will improve but solely because demand is expected to weaken. In both North America and Europe coal self-sufficiency is aided by policy decisions that favour the use of other energy sources at the expense of coal.

Declining coal self-sufficiency in regions with increasing demand provides a basis for growing imports, the majority of which will be seaborne. All told, seaborne thermal coal demand will grow by 1.13 Bt, from about 0.95 Bt now to about 2.08 Bt in 2035.

19.3.2 Thermal Coal Long-Term Outlook[9]

Major suppliers in today's thermal market are expected to be the major suppliers into the foreseeable future; the bulk of global seaborne thermal coal supply will be sourced from Indonesia (396 Mt or 42%) and Australia (196 Mt or 21%). Most of the remainder will be provided by Russia (98 Mt or 10%), Colombia (80 Mt or 8%) and South Africa (79 Mt or 8%). Ten countries share the remaining supply led by the US, which will maintain a high thermal export level for yet another year (44 Mt or 5%). The remaining countries will provide 102 Mt or 11% of total 2013 thermal coal supply.

In 2035, supply is forecasted to have increased significantly reaching 2.1 Bt. A large amount of the supply expansion is expected from low cost mines. Much of this low cost increase is a result of growth in the low rank seaborne coal market sourced from Indonesia, and later, from the US. Cost of mining operations is estimated to increase in real terms over the forecast period.

[9] *Source: Wood Mackenzie Global Thermal Coal Long-Term Outlook 15 November 2013*

19.4 Price strategy

The price strategy for traded thermal coal is to follow world market pricing based on quality parameters; these are the gross calorific value, total moisture, volatile matter, sulphur content, ash content, hardness measured by the hardgrove grindability index (HGI) and ash fusion temperature.

Pricing is generally directly proportional to the calorific value relative to a reference coal. This approach has been adopted in the study price forecast. For example the price of Product 1 is computed as follows:

$$Product\ price = \frac{product\ GCV}{reference\ product\ GCV} \times Reference\ price$$

So, for Product 1, the forecast price is $\frac{5800}{6300} \times Newcastle\ reference\ price$

Of the remaining quality parameters, the HGI is the only parameter that may attract a price penalty.

19.5 Market and price forecast by product

Vista's 2014 forecast coal prices as determined above are shown in Figure 19.1 below.

Figure 19.1 shows the Coalspur prices for Products 1 and 2 as derived from the Newcastle 6322kcal/kg forecast prices provided by Wood Mackenzie. The two Vista coal products shown in the table are the premium quality export coal (Product 1) and the lower quality export coal (Product 2).

Figure 19.1 Vista forecast coal prices

2013 US$ Real	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Vista Product 1 (5,800 kcal/kg)	72.91	75.03	78.67	79.08	75.01	73.69	77.88	76.63	78.03	79.43	80.06	83.46	94.99	102.64	113.32
Vista Product 2 (5,550 kcal/kg)	69.76	71.80	75.28	75.67	71.78	70.51	74.52	73.33	74.67	76.01	76.61	79.86	90.90	98.22	108.44

19.6 Product shipping

Vista's export products will be transported by rail to the Ridley Coal Terminal at the Port of Prince Rupert in British Columbia for shipment to the international markets. Ridley Terminals Inc. has announced an expansion of facilities to increase annual shipping capacity from 12 Mtpa to 24 Mtpa by 2015.

Coalspur has reached an agreement with Ridley Terminals Inc. for port allocation that entitles Coalspur up to 10.7 Mtpa on an agreed ramp-up schedule. The term of the agreement is 14 years, with an option to extend 7 years, and will commence in January 2015. The agreement reflects the expected production profile of Vista. Ridley Terminals Inc. is a Canadian federal crown corporation based in Prince Rupert that operates the terminals.

Coalspur has also signed a contract with CN Rail under which they will develop a high-quality logistics supply chain to transport export thermal coal from Coalspur's Vista Coal Project near Hinton, Alberta, to Western Canadian ports starting in January 2015. The contract has a 7 year duration with agreed rail rates and escalations.

19.7 Opportunity for market growth

There is a general expectation that the worldwide demand for thermal coal will exceed supply capabilities due to the expected future coal demand from China, India, Japan and South Korea.

The expected main exporters of thermal coal in the foreseeable future include Indonesia, Australia, China, South Africa, Russia, Columbia and the USA. China is in the process of modernising the coal mining industry and will continue to increase its imports of thermal coal until modernisation of the industry is completed, following which there is the likelihood that China will reduce thermal coal imports. The Chinese government's restrictions on exports are expected to remain for the foreseeable future. Russia is unlikely to increase its contribution to the export market due to the high transport costs. South Africa is not expected to significantly increase its export supply. Colombia and Venezuela are expected to increase export supply; however this will be constrained by current infrastructure. The USA could potentially increase its supply but like Russia, will be constrained by high transportation costs, lack of port capacity and opposition from environmental groups.

Of all suppliers, Australia and Indonesia are expected to see the most significant growth in export supply. The use of coal for power generation in the Asian region is expected to increase with the increase in goods production and economic wealth within the region. It is expected that there will not be significant barriers to entry into the thermal coal export sector for new suppliers of high quality coal products.Strong economic growth in emerging Pacific basin economies, especially in China and India, will ensure that the centre of gravity for thermal trade will become increasingly Asian. In 2008, 62% of seaborne thermal coal was headed to Asia; today, that has become 79%. By 2035, 93% of seaborne thermal coal is expected to be destined for Asia. The impact of this continued shift will be significant on the ocean vessel fleet where trade volume increases will require more vessels and where vessel routing will be impacted. It is expected that an average annual increase in seaborne thermal trade of 34 Mtpa which will result in 2035 levels being 1.1 Btpa greater than those of today. To place this in context, Vista's annual output at 12Mtpa will contribute 0.1% to thermal seaborne trade. In the near and medium term, this increase is almost completely supplied by Asian producers. But, in the long term, increasing amounts of US and Colombian coal will be required as well as other nations. Thus, inter-basin trade flow will increase in the long term.

19.8 Upside opportunities

The rapid industrialisation of China and India and the electrical supply shortfalls that have resulted, coupled with the current perceived risks associated with nuclear power generation, have created an opportunity for alternative sources of power generation such as that from coal. There is continued use of coal for power generation, in particular due to low capital cost for new power plants and low cost of thermal coal relative to other energy sources. However, there continue to be associated environmental concerns.

With the increase in world population and the current increase in the demand for energy, there is the expectation that the demand for all means of electricity generation, including that through coal, will continue to increase at a rate higher than the supply.

20 Environmental Studies, Permitting, and Social or Community Impact

20.1 Introduction

In February 2014, the Alberta Energy Regulator ("AER") granted approval for Coalspur's applications under decision 2014 ABAER 004, for an amended Mine Permit and Coal Processing Plant Approval and for coal mine pit and waste dump licences. In March 2014, Coalspur's applications under the Environmental Protection and Enhancement Act ("EPEA") and Alberta Water Act ("WA") were transferred to the AER. These applications are currently under review by the AER. Coalspur has also applied for surface dispositions under the Alberta Public Lands Act, which is currently under consideration by the AER.

20.2 Summary of Results of Environmental Studies

A comprehensive set of environmental studies was conducted in the Project area commencing in Q4 2010 and completed in Q1 2012. The objective of these Vista Coal studies was to determine baseline environmental and socio-economic conditions, and then to assess potential impacts of the Project, on its own and in combination with other existing and proposed local development. Fourteen environmental and social aspects were assessed, including noise, air quality, hydrology, surface water quality, aquatic systems (e.g. fisheries, benthics), groundwater, soils and terrain, vegetation and wetlands, wildlife, human health, socio-economic, land uses, traditional uses and historic resources.

The studies consistently concluded that baseline conditions were similar to that of the general area, and there were no unique or critical environmental sites or values. Further, with effective mitigation and environmental management systems in place, the project would not result in any environmental or social impacts that could materially impact the viability of the project. These studies were submitted to provincial regulatory agencies, stakeholders and First Nations for review in April 2012. In June 2013 the Provincial regulator concluded that the Environmental Assessment was complete, in January 2014 the last Intervener withdrew their statement of concern on the project, and in February 2014 the Alberta Energy Regulator approved the Project.

20.3 Project Permitting Requirements

20.3.1 Current Permits and Applications

The Vista Coal Project has a regulatory history extending back over 30 years. The eastern portion of the Vista Property in an area that was originally part of the McLeod River Coal Project, received approval from the Government of Alberta in 1983, following the completion of an extensive regulatory process that included an environmental assessment (EA), technical applications to the Energy Resources Conservation Board (ERCB), and a public hearing held by the ERCB. The Provincial approval included a Coal Processing Plant Approval and a Mine Permit to produce 4.2 Mtpa saleable export thermal coal. The Coal Processing Plant Approval and the western half of the Mine Permit were transferred to Coalspur by the Alberta Government in May 2011, as Approval C2011-3 and Permit C2011-5.

In May 2012, Coalspur applied to the ERCB and the Alberta Environment and Sustainable Resource Development (AESRD) for: the amendment of the Mine Permit and Coal Processing Plant Approval and the grant of coal mine pit and waste dump licences under the Alberta Coal Conservation Act (CCA); approval for the construction, operation and reclamation of the Project under the EPEA; and approval for construction of water management works and licences for diversion of surface water and groundwater under the WA.

In June 2013, Coalspur's applications under the CCA were transferred to the ERCB's successor, the AER. In February 2014, the AER granted approval for Coalspur's applications under decision 2014 ABAER 004, for the amended Mine Permit and Coal Processing Plant Approval and for the coal mine pit and waste dump licences. In March 2014, Coalspur's applications under the EPEA and WA were transferred to the AER. These applications are currently under review by the AER. Coalspur has also applied for surface dispositions under the Alberta Public Lands Act, which is currently under consideration by the AER.

In June 2013, Canadian National Railway Company (CN) obtained authorization under the Fisheries Act for the construction of culverts over some of the streams that may be impacted by the railway siding. In August 2013, the Canadian Transportation Agency (Agency) granted an approval to CN under the Canada Transportation Act, to construct a railway siding to support and service the Project.

20.3.2 Future Permit Applications

Vista is planned to be developed as two sequential phases. The first phase will use Coalspur's existing Mine Permit (C2011-5) and Coal Processing Plant Approval (C2011-3), as amended in February 2014 under AER decision 2014 ABAER 004, as a regulatory base to obtain the approvals described above for the construction, operation and reclamation of a 5.0 Mtpa operation. The first phase designs and plans do not require any Federal permits or approvals that would necessitate initiating the EA process defined by the Canadian Environmental Assessment Act.

Subsequent to obtaining all approvals/permits for the first phase, Coalspur will initiate the regulatory process for the second phase of the Project. The second phase will involve expanding the Mine Permit and increasing the mining rate, adding a second module to the coal processing plant and expanding ancillary facilities as necessary. It is anticipated that the second phase will require applications to the AER to amend Mine Permit C2011-5 to include the remaining Vista coal leases to the west of the existing Mine Permit; amend the Coal Processing Plant Approval to include the additional processing module to increase coal processing capacity up to 11.2 Mtpa; and grant the necessary coal mine pit and waste dump licences for a second mining area in the expanded Mine Permit. The second phase of the Project will also require a new EA and applications to amend the EPEA and WA approvals and permits issued for the first phase of the Project.

Coalspur and its consultants will identify specific Project aspects where Federal agencies have regulatory authority and where the potential exists for authorisations and/or permits. Terms of reference documents will be prepared to address the requirements of the Federal EA Act, in order to assist Federal agencies to make a decision regarding their regulatory involvement in the Project. The primary areas of interest include the Fisheries Act, the Navigable Waters Protection Act and the Explosives Act. The technical review will also include the Species At Risk Act. Similar to the first phase, Coalspur will work diligently to minimize environmental impacts, but given recent changes to the federal process requiring Comprehensive Studies for any coal project producing greater than 3,000 metric tonnes per day, Coalspur believes that the second phase of the Project will trigger the requirement for regulatory approvals from Federal agencies.

20.3.3 Mine Financial Security Program (MFSP)

Upon receipt of an approval under the EPEA, Coalspur will be required to post reclamation security as determined by the Mine Financial Security Program (MFSP). A fundamental principle of the MFSP is that the EPEA approval holder is responsible to carry out suspension, abandonment, remediation and surface reclamation work to the standards established by the Province of Alberta and to maintain care-and-custody of the land until a reclamation certificate has been issued. The approval holder must have the financial resources to complete these obligations.

Assets under the MFSP represent the estimated financial capability of an approval holder's project to address its future obligations. The approval holder will be required to submit its financial security estimate to the AENV Director no later than June 30 of each year. The amount of the financial security will be based on the MFSP liability calculations. The approval holder's Chief Executive Officer, Chief Financial Officer or Designated Financial Representative must certify the MFSP liability calculation data provided by the approval holder in respect of the MFSP. The initial liability calculation will be based on forecast disturbance to the end of the first year following EPEA approval.

20.3.4 Social or Community Related Requirements and Plans

Regulatory processes for coal mines in Alberta require extensive public involvement and Aboriginal consultation programmes. These programmes were initiated in the Fourth Quarter of 2010 and have continued since then. Coalspur has held four sets of formal open houses in Hinton in addition to a significant number of informal meetings and discussions to keep the public informed about the progress of the Project. The community input has been used to assist Coalspur with selection of various options for the design of infrastructure facilities and locations. In addition, the AER held a public hearing related to Coalspur's applications for approval under the CCA, which was held in two parts: the first in Calgary, and the second in Hinton. Public involvement will continue throughout the regulatory process and subsequent operational life of the Project.

Aboriginal consultation activities were initiated in the Fourth Quarter of 2010 and have continued since then. The emphasis has been to work with potentially affected communities to complete traditional use studies for the proposed Project area to assist Coalspur in the preparation of its EA. Consultation will continue throughout the development and operational life of the Project with an emphasis on developing better understanding of impacts, accommodation and mitigation actions, and other programmes and commitments needed to fully address Aboriginal issues. Coalspur has entered into binding agreements related to the Project with six Aboriginal groups, each of which have given their written support for the Project.

20.3.5 Requirements and Plans for Waste and Tailings Disposal, Site Monitoring and Water Management

Mining and waste rock sequencing will be integrated to ensure efficient waste rock removal and to maximize back-filling of mined out areas. Waste rock will be removed by large off road haul trucks and initially hauled to external rock dumps located along the south side across McPherson Creek, along the McPherson subcrop, and to the north of the pit. Once sufficient exposed pit floor is available, the waste rock will be dumped back in the pit. Upon completion of the initial cuts, a backfill waste disposal plan will be used in order to keep waste haul distances short, minimize the area disturbed by mining, and enable progressive reclamation so as to reduce overall reclamation costs and to reduce final reclamation efforts. On the north side of the pit, the toe of the dump will be offset from the pit crest by a minimum distance of 100 m. Waste dumps located on the south side will be offset from McPherson Creek by a minimum distance of 100 m. These offset distances are preliminary and may be increased upon further geotechnical evaluations in future studies.

A conveyor will collect all of the coarse refuse material from the wash plants and send it to the rejects bin located east of the plant location. A haul truck will transport this material from the rejects bin to one of the mine waste dumps.

The fine refuse material from the wash plant will be thickened prior to being pumped to a settling pond. After settling of the ultrafine coal and clay slimes solids in the fines settling pond, water will be decanted and stored in a clean water impoundment. The clean water from the impoundment will be pumped back to the coal processing plant clarified water system for reuse as processing water. As much as possible of the decanted water returning from the fines settling pond will be re-used as process water to minimise the volume of raw water needed to sustain the coal processing plant. Coalspur is reviewing belt press systems to determine if this technology would improve upon the cost-effectiveness of the fines settling pond system.

The AER’s decision 2014 ABAER 004 dated February 27, 2014, approving Coalspur’s applications under the CCA for an amended Mine Permit and Coal Processing Plant Approval, a coal mine pit licence and waste dump licences, contains a number of conditions or requirements with which Coalspur will comply, in addition to the requirements of existing regulations and guidelines relating to surface and groundwater management and testing, as well as to the construction, management and monitoring of the end pit lake, waste rock dumps and fines settling pond.

20.3.6 Mine Closure Requirements

A comprehensive land reclamation plan has been prepared for the Vista Project, and approved by AER. Reclamation will be progressive throughout operations of the Project and, as the mine plan is revised, the reclamation plan will be updated in conjunction with the mine plan. The primary reclamation goal of the Project is to return the lands to a capability that is equivalent to predevelopment conditions and consistent with end land use objectives. The key components of the reclamation plan that will ensure these goals are met include:

- a soil conservation plan to ensure the Project has sufficient coversoil to achieve equivalent land capability. This plan includes salvaging and replacing both upland soils and organic soils, adding diversity to the reclaimed mine soils
- the reclamation plan emphasizes productive upland forest ecosystems and landforms, with the inclusion of interspersed small wetlands and an end pit lake
- a significant amount of direct coversoil replacement is a key aspect of re-establishing ecological diversity on the reclaimed landscape
- vegetation patterns will be self-sustaining and similar in ecological function and species assemblage to what existed prior to disturbance, commencing with early seral stages that are capable of ecological succession
- progressive reclamation allows for approximately two thirds of the disturbance area to be reclaimed by the time of mine closure
- an end pit lake will outflow to McPherson Creek and will provide enhanced fish habitat
- input from stakeholders and Aboriginal communities has been used to develop and refine reclamation objectives; and
- an extensive monitoring and assessment program will support the incorporation of adaptive management into all development and reclamation activities.

21 Capital and Operating Costs

The capital and operating costs were provided by the client and reviewed by Snowden. These costs as given appear as inputs to the financial analysis.

They are shown in

Table 22.2.

The coal handling plant capital costs are based on a turnkey fixed price contract negotiated with a highly experienced coal processing contractor. Selected EPC has delivered 110 capital projects, including 23 Greenfield CHPPs, in North America since 2007.

The mine and the coal handling plant will be operated by contractors and the operating costs for both the CHPP and for the Mine, reflect reasonable benchmark rates for using contractors in this environment.

The revised operating and contracting strategy has significantly de-risked the project through firm commitments with EPC contractors including guarantees on quality of construction and the throughput of the process. 90% of capital by value within nine contracts with agreed terms, including performance guarantees, and tendered pricing.

Capital Summary for 6mtpa capacity

Capital Cost Summary (1)	
Item	(C$M)
EPC	311
Site Preparation	78
Rail Siding	29
Infrastructure and Utilities	26
Other	14
Contingency	20
Total	**478**
(1) Mining equipment to be provided by mining contractor (~C$300M)	

22 Economic Analysis

22.1 Cash flow model

A cash flow model was developed by Snowden in 2012 to allow an after tax economic evaluation of the Vista project. The model was subsequently reviewed by BDO Canada LLP to ensure that the taxation considerations were entirely consistent with current Revenue Canada regulations. For the current work Snowden updated the model with new cost and coal pricing data and recalculated the economic results (shown in Table 22.1) which are summarised as;

- Internal Rate of Return (IRR) of 13.4% after taxes and royalties
- Net Present Value (NPV) of $ 498 million at an 8% discount rate
- 7.9 year payback period
- 30 year mine life

The coal selling price that was used is the Base Case price as developed by Wood Mackenzie coal consulting and published November 2013, are shown in Table 22.3**,** along with all the other input assumptions. A deduction of $33.69 was applied to the Export coal price for rail transport and port costs based on negotiated contracts with the rail line and port facility. For the purposes of this study, it is assumed that all coal will be sold on the international market. An adjustment to the selling price for each coal price was made based on the actual calorific value from the mine model compared to the calorific value assumed by Wood Mackenzie for their study as illustrated below.

$$Forecast\ price\ \ Product\ 1 = \frac{Actual}{5800} \times \text{Wood Mackenzie Price}$$

$$Forecast\ price\ \ Product\ 2 = \frac{Actual}{5550} \times \text{Wood Mackenzie Price}$$

The capital and operating costs that had been derived by Coalspur consistent with the change in operating strategy were checked and validated and entered into the model. The average annual cash Flow forecast is shown in Table 22.3.

These NPV results are impaired relative to the 2012 economics largely due to the drop in coal price forecast. Coalspur has significantly reduced capital costs, and capital risk through an EPC contract approach and have held benchmarked reasonable operating costs while developing into largely a contractor operation.

Federal income taxes and Alberta income taxes were calculated at 15% and 10% of taxable income respectively. No inflation, interest or financing costs were applied to this analysis.

The economic modelling for this project was both deterministic, and based on a Monte Carlo approach used to evaluate the impact of variability in some of the key input parameters to the mine economics. Table 22.3 shows the results of the summary deterministic analysis.

22.2 Discount rate

The cash flows in the cash flow model were discounted at 0% (Constant Dollar rate), 5% and 8%. Coalspur is a project development company at this time and so the 8% discount rate does not represent a corporate or operating cost of capital but rather is considered to be a risked rate of return suitable to an investment of this magnitude.

Table 22.1 Annual cashflow forecast

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Vista Product 1 Coal Mined ('000 tonnes)	-	-	2,014	4,240	6,170	10,106	10,164	10,153	9,789	10,019	9,832	9,923	10,109	9,766	9,880	9,940	10,104	9,830	10,402
Vista Product 2 Coal Mined ('000 tonnes)	-	-	-	594	617	1,104	1,289	1,335	1,541	1,372	1,481	1,391	1,353	1,493	1,428	1,333	1,245	1,416	1,007
Vista Product 1 Coal sales ('000 tonnes)	-	-	1,945	4,142	6,065	9,911	10,069	10,039	9,715	9,895	9,751	9,833	10,011	9,692	9,795	9,856	10,010	9,747	10,304
Vista Product 2 Coal sales ('000 tonnes)	-	-	-	578	616	1,090	1,283	1,330	1,535	1,372	1,478	1,393	1,353	1,489	1,430	1,336	1,247	1,410	1,018
Vista Product 1 Coal Price (US$ /tonne)	0.00	0.00	75.93	76.57	73.50	72.72	77.14	76.24	77.56	78.97	79.66	83.15	86.66	88.27	91.03	94.26	94.81	95.96	96.59
Vista Product 2 Coal Prices (US$ /tonne)	0.00	0.00	0.00	70.60	67.60	68.20	72.30	71.20	72.62	73.89	74.54	77.66	80.91	82.53	84.90	88.05	88.23	89.59	89.84
CASH FLOW ($'000)																			
+ Revenue	$0	$0	$89,547	$254,214	$336,728	$548,674	$625,891	$616,415	$632,872	$646,456	$655,903	$696,395	$747,153	$759,570	$794,460	$829,696	$838,279	$850,101	$859,194
- Operating costs	$0	$0	$102,997	$195,914	$312,972	$418,479	$468,178	$460,550	$471,767	$514,897	$561,787	$566,832	$567,059	$630,727	$628,155	$616,136	$618,126	$630,132	$631,504
- Capital costs	$197,710	$198,197	$83,232	$184,930	$93,802	$1,450	$2,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450
- Accounts receivable/payable	$0	$0	$3,127	$9,716	$1,971	$13,084	$4,304	($465)	$892	($656)	($1,151)	$3,121	$4,163	($1,596)	$2,973	$3,390	$624	$478	$691
- Annual change to supplies and stores	$0	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Cash flow before taxes	($197,710)	($203,197)	($99,809)	($136,346)	($72,017)	$115,660	$150,958	$150,880	$158,763	$126,765	$93,816	$120,993	$174,482	$124,990	$161,882	$204,720	$218,079	$214,041	$225,550
Cumulative cash flow before taxes and royalties	($197,710)	($400,907)	($500,717)	($637,062)	($709,079)	($593,419)	($442,461)	($291,581)	($132,818)	($6,053)	$87,764	$208,756	$383,238	$508,228	$670,109	$874,829	$1,092,909	$1,306,949	$1,532,499
- Income tax	$1,357	$0	$0	$0	$0	$0	$0	$0	$4,201	$9,632	$6,083	$18,006	$33,370	$23,072	$33,287	$45,286	$47,682	$48,082	$50,800
- Project Specific Tanager royalty	$0	$0	$0	$0	$894	$1,913	$1,389	$2,101	$2,005	$2,380	$2,038	$3,380	$1,500	$3,980	$3,568	$4,834	$5,553	$6,472	$4,665
- Alberta Coal Royalty	$0	$0	$0	$609	$261	$1,313	$1,578	$1,536	$1,594	$1,304	$9,101	$13,900	$19,987	$14,440	$18,449	$24,441	$24,816	$25,211	$25,905
= Cash flow after tax	($199,067)	($203,197)	($99,809)	($136,955)	($72,278)	$114,348	$149,381	$149,344	$152,968	$115,830	$78,632	$89,087	$121,124	$87,477	$110,146	$134,993	$145,582	$140,748	$148,845
+ Loan: Principal received	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Principal repayments	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Total cash flow	($199,067)	($203,197)	($99,809)	($136,955)	($72,278)	$114,348	$149,381	$149,344	$152,968	$115,830	$78,632	$89,087	$121,124	$87,477	$110,146	$134,993	$145,582	$140,748	$148,845
Cumulative	($199,067)	($402,265)	($502,074)	($639,029)	($711,307)	($596,959)	($447,579)	($298,235)	($145,266)	($29,437)	$49,195	$138,282	$259,406	$346,883	$457,028	$592,021	$737,603	$878,351	$1,027,196

	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Vista Product 1 Coal Mined ('000 tonnes)	10,251	10,129	9,747	10,076	9,973	9,977	9,920	9,892	10,110	10,306	8,067	8,885	4,187	-
Vista Product 2 Coal Mined ('000 tonnes)	1,214	1,298	1,459	1,297	1,359	1,363	1,352	1,321	1,306	1,245	2,634	1,847	672	-
Vista Product 1 Coal sales ('000 tonnes)	10,157	10,023	9,674	9,973	9,893	9,891	9,820	9,810	10,010	10,218	7,975	8,779	4,278	241
Vista Product 2 Coal sales ('000 tonnes)	1,207	1,292	1,454	1,300	1,357	1,362	1,350	1,322	1,305	1,247	2,573	1,868	704	51
Vista Product 1 Coal Price (US$ /tonne)	98.72	102.65	102.18	104.78	107.08	109.34	111.43	111.59	113.66	116.18	119.16	122.86	124.97	0.00
Vista Product 2 Coal Prices (US$ /tonne)	92.44	96.09	95.86	97.69	99.81	101.83	104.69	105.72	108.24	111.03	113.34	115.54	117.59	0.00
CASH FLOW ($'000)														
+ Revenue	$894,646	$942,127	$874,003	$910,854	$937,831	$964,813	$983,560	$982,715	$1,023,411	$1,065,868	$1,052,487	$1,081,262	$512,686	($8,103)
- Operating costs	$622,969	$675,640	$679,390	$663,243	$680,269	$676,171	$658,896	$607,132	$569,618	$565,087	$554,763	$579,159	$189,140	($76,000)
- Capital costs	$5,450	$1,450	$6,190	$1,785	$5,760	$6,843	$5,659	$4,814	$8,758	$4,654	$7.325	$1,,450	$5,450	$0
- Accounts receivable/payable	$3,265	$1,738	($5,753)	$3,692	$1,518	$2,386	$2,251	$2,058	$4,886	$3,676	($676)	$1,363	($30,704)	($62,613)
- Annual change to supplies and stores	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)
= Cash flow before taxes	$262,962	$263,299	$194,176	$242,134	$250,285	$279,412	$316,754	$368,711	$440,148	$492,451	$491,074	$499,291	$348,801	$135,509
Cumulative Cash Flow before Taxes & Royalties	$1,795,461	$2,058,760	$2,252,936	$2,495,069	$2,745,354	$3,024,766	$3,341,520	$3,710,231	$4,150,379	$4,642,830	$5,133,904	$5,633,195	$5,981,995	$5,768,704
- Income tax	$61,883	$61,103	$43,599	$55,829	$58,113	$65,228	$73,327	$86,713	$105,573	$116,783	$114,803	$114,865	$71,649	$10,747
- Project Specific Tanager royalty	$3,140	$4,151	$5,063	$6,755	$8,243	$8,844	$9,720	$3,857	$2,604	$3,301	$8,170	$13,760	$5,959	$0
- Alberta Coal Royalty	$31,766	$30,798	$22,340	$27,998	$29,565	$32,132	$37,295	$43,161	$53,126	$58,323	$57,951	$57,679	$36,430	$5,850
= Cash flow after tax	$169,313	$171,398	$128,236	$158,307	$162,606	$182,052	$206,132	$238,837	$281,449	$317,345	$318,319	$326,746	$240,722	$118,911
+ Loan: Principal received	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Principal repayments	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Total cash flow	$169,313	$171,398	$128,236	$158,307	$162,606	$182,052	$206,132	$238,837	$281,449	$317,345	$318,319	$326,746	$240,722	$118,911
Cumulative	$1,196,509	$1,367,907	$1,496,143	$1,654,450	$1,817,056	$1,999,109	$2,205,241	$2,444,078	$2,725,527	$3,042,872	$3,361,191	$3,687,937	$3,928,659	$3,806,848

DCF Rate of return (IRR)	13.4%
Payback years after start of production	7.9
Net present value @ 0%	$4,047,570
Net present value @ 5%	$1,148,263
Net present value @ 8%	$498,258

Table 22.2 Annual input data

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Year	**History**	**Year -2**	**Year -1**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Project year		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Construction year		**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Production year		**0**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10**	**10**	**10**	**10**	**10**
Price escalation		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cost escalation		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cdn $ per US $ - Base Case		1.11	1.11	1.05	1.10	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Escalation factors																		
Prices		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Costs		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Coal prices(Unescalated):																		
Vista Product 1 (US $/Tonne)		$72.91	$75.03	$78.67	$79.08	$75.01	$73.69	$77.88	$76.63	$78.03	$79.43	$80.06	$83.46	$87.09	$88.57	$91.17	$94.57	$94.99
Vista Product 2 (US $/Tonne)			$71.80	$75.28	$75.67	$71.78	$70.51	$74.52	$73.33	$74.67	$76.01	$76.61	$79.86	$83.34	$84.75	$87.24	$90.49	$90.90
Vista Product 1 (US $/Tonne) adjusted for CV				$75.93	$76.57	$73.50	$72.72	$77.14	$76.24	$77.56	$78.97	$79.66	$83.15	$86.66	$88.27	$91.03	$94.26	$94.81
Vista Product 2 (US $/Tonne) adjusted for CV					$70.60	$67.60	$68.20	$72.30	$71.20	$72.62	$73.89	$74.54	$77.66	$80.91	$82.53	$84.90	$88.05	$88.23
Rail transport and port costs Vista Product 1 (US $/tonne)		$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69
Rail transport and port costs Vista Product 2 (US $/tonne)		$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69
Vista Product 1 (US $/Tonne)			$0.00	$75.93	$76.57	$73.50	$72.72	$77.14	$76.24	$77.56	$78.97	$79.66	$83.15	$86.66	$88.27	$91.03	$94.26	$94.81
Vista Product 2 (US $/Tonne)			$0.00	$0.00	$70.60	$67.60	$68.20	$72.30	$71.20	$72.62	$73.89	$74.54	$77.66	$80.91	$82.53	$84.90	$88.05	$88.23
Taxes and royalty rates:																		
Federal income tax		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Provincial income tax		10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Provincial Coal Royalty (Gross Revenue)		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Provincial Coal Royalty (Net Revenue)		13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
Tanager Royalty (Gross sales)		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Note: Tanager Royalty on Hinton East and West Blocks only																		
Mined/processed tonnes, grades & recoveries:																		
Total Minable reserves																		
Val DÒr Seam Delivered ('000 RMT) - Base Case					1,867	1,539	8,568	10,116	10,692	10,416	10,069	10,710	10,976	11,038	10,585	10,977	11,288	11,591
McPherson Seam Delivered ('000 RMT) - Base Case				3,857	5,390	9,547	9,269	7,421	6,748	6,462	7,280	6,277	6,198	6,236	6270	6,081	5,964	5,892
Vista Product 1 (Val DÒr & McPherson) Delivered ('000 RMT)				3,857	7,257	11,086	17,837	17,537	17,440	16,878	17,349	16,987	17,174	17,274	16,855	17,058	17,252	17,483
Vista Product 2 (McLeod Seam) Delivered ('000 RMT) - Base Case				3	1,518	1,461	2,570	2,878	3,024	3,512	3,125	3,418	3,235	3,148	3530	3,337	3,133	2,931
Export Thermal Coal Produced Vista Product 1 - Base Case				2,014	4,240	6,170	10,106	10,164	10,153	9,789	10,019	9,832	9,923	10,109	9,766	9,880	9,940	10,104
Calorific Value (CV)				5,598	5,616	5,683	5,724	5,745	5,770	5,765	5,766	5,771	5,779	5,771	5,781	5,791	5,781	5,789
Export Thermal Coal Produced Vista Product 2 - Base Case				-	594	617	1,104	1,289	1,335	1,541	1,372	1,481	1,391	1,353	1,493	1,428	1,333	1,245
Calorific Value (CV)				-	5,178	5,227	5,368	5,385	5,389	5,398	5,395	5,400	5,397	5,388	5,405	5,401	5,400	5,387
Waste Stripping ('000 BCM)				11,858	27,414	51,125	60,849	74,082	72,441	75,918	87,381	100,294	101,063	101,399	118,888	118,156	114,893	115,389
Rehandled Waste Stripping ('000 BCM)																		
Total Vista Product 1 Coal Sold from Hinton East and West Bocks				-	-	1,091	2,092	1,356	2,191	1,901	2,367	1,960	3,260	1,299	3,552	3,206	4,256	5,045
Total Vista Product 2 Coal Sold from Hinton East and West Bocks				-	-	5	296	284	313	457	372	368	430	279	545	349	390	249
Operating costs ($ '000):																		
Coal Processing including supplies				$17,968	$40,846	$58,404	$94,991	$95,028	$95,256	$94,911	$95,302	$94,981	$95,000	$95,060	$94,888	$94,935	$94,888	$95,023
Mining Cost				$67,626	$121,506	$202,916	$258,848	$301,028	$295,957	$306,797	$343,581	$384,497	$386,959	$388,071	$443,666	$441,366	$430,940	$432,612
Contingency				$10,144	$18,226	$30,437	$38,827	$45,154	$44,394	$46,020	$51,537	$57,675	$58,044	$58,211	$66,550	$66,205	$64,641	$64,892
Coal Processing not including supplies		$0	$0	$12,641	$28,736	$41,089	$66,829	$66,855	$67,016	$66,773	$67,048	$66,822	$66,835	$66,878	$66,757	$66,790	$66,757	$66,852
Supplies transportation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Personnel transportation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interim Mine rehabilitation				$0	$357	$3,450	$2,724	$4,026	$1,966	$1,220	$1,461	$1,792	$3,949	$2,809	$2,817	$2,804	$2,792	$2,780
G. and A.				$7,260	$14,979	$17,765	$23,090	$22,942	$22,978	$22,819	$23,015	$22,843	$22,880	$22,907	$22,806	$22,845	$22,876	$22,819
Decommissioning/closure/reclamation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Year	**History**	**Year -2**	**Year -1**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Project year		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Construction year		**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Production year		**0**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10**	**10**	**10**	**10**	**10**
Personnel severance costs				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operating supplies, chemicals		$0	$0	$5,327	$12,110	$17,315	$28,162	$28,173	$28,240	$28,138	$28,254	$28,159	$28,164	$28,182	$28,131	$28,145	$28,131	$28,171
Sub Total Operating Costs		$0	$0	$102,997	$195,914	$312,972	$418,479	$468,178	$460,550	$471,767	$514,897	$561,787	$566,832	$567,059	$630,727	$628,155	$616,136	$618,126
Environmental bonding																		
Value of bond ($ '000)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cost of bond		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Working capital determinants:																		
Supplies inventory:																		
Operating supplies, chemicals and fuel			$0	$7,000	$0	$7,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Coal inventory days			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Accounts receivable days			30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Accounts payable days			15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Capital costs ($'000)																		
Site access																		
Site services		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine development		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine equipment		$2,996	$12,564	$8,797	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mill and other buildings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mill process and other equipment		$48,741	$43,078	$15,437	$183,480	$92,352	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plant ancillary		$113,730	$110,000	$36,650	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Load Out		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Utilities		$17,355	$11,457	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Processed fines/Tailings		$10,323	$6,683	$6,349	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
E.P.C.M.		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Site construction indirects/mobilization		$593	$196	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Owners costs		$0	$0	$16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Surface water management sustaining capital		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ground water management sustaining capital		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine sustaining capital		$0	$0	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300
Mill sustaining capital		$0	$0	$1,150	$1,150	$1,150	$1,150	$2,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150
Contingency		$0	$8,088	$12,132														
Total capital cost		$197,710	$198,197	$83,232	$184,930	$93,802	$1,450	$2,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450	$5,450	$1,450
Cumulative Capital Costs		$197,710	$395,907	$479,139	$664,069	$757,871	$759,321	$761,771	$767,221	$768,671	$774,121	$775,571	$781,021	$782,471	$787,921	$789,371	$794,821	$796,271
Salvage value		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Loan drawdown		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Loan repayment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Year	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 21**	**Year 22**	**Year 23**	**Year 24**	**Year25**	**Year 26**	**Year 27**	**Year 28**	**Year 29**	**Year 30**	**Year 30**	**Year 31**
Project year	**19**	**20**	**21**	**22**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**33**	**34**
Construction year	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Production year	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Price escalation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cost escalation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cdn $ per US $ - Base Case	1.11	1.11	1.11	1.11	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Escalation factors																
Prices	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Costs	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Coal prices(Unescalated):																
Vista Product 1 (US $/Tonne)	$96.16	$96.78	$99.24	$103.06	$102.64	$104.69	$106.79	$108.92	$102.64	$113.32	$115.59	$117.90	$120.26	$122.67	$125.12	$127.62
Vista Product 2 (US $/Tonne)	$92.02	$92.61	$94.96	$98.61	$98.22	$100.18	$102.19	$98.22	$104.23	$108.44	$110.61	$112.82	$115.08	$117.38	$119.73	$122.12
Vista Product 1 (US $/Tonne) adjusted for CV	$95.96	$96.59	$98.72	$102.65	$102.18	$104.78	$107.08	$109.34	$111.43	$111.59	$113.66	$116.18	$119.16	$122.86	$124.97	$0.00
Vista Product 2 (US $/Tonne) adjusted for CV	$89.59	$89.84	$92.44	$96.09	$95.86	$97.69	$99.81	$101.83	$104.69	$105.72	$108.24	$111.03	$113.34	$115.54	$117.59	$0.00
Rail transport and port costs Vista Product 1 (US $/tonne)	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69
Rail transport and port costs Vista Product 2 (US $/tonne)	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69	$33.69
Vista Product 1 (US $/Tonne)	$95.96	$96.59	$98.72	$102.65	$102.18	$104.78	$107.08	$109.34	$111.43	$111.59	$113.66	$116.18	$119.16	$122.86	$124.97	$0.00
Vista Product 2 (US $/Tonne)	$89.59	$89.84	$92.44	$96.09	$95.86	$97.69	$99.81	$101.83	$104.69	$105.72	$108.24	$111.03	$113.34	$115.54	$117.59	$0.00
Taxes and royalty rates:																
Federal income tax	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Provincial income tax	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Provincial Coal Royalty (Gross Revenue)	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Provincial Coal Royalty (Net Revenue)	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
Tanager Royalty (Gross sales)	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Note: Tanager Royalty on Hinton East and West Blocks only																
Mined/processed tonnes, grades & recoveries:																
Total Minable reserves																
Val DÒr Seam Delivered ('000 RMT) - Base Case	11,213	10,667	11,334	11,498	11,276	11,838	12,095	12,345	11,616	10,755	9,845	10,618	3,252	8,288	3,163	
McPherson Seam Delivered ('000 RMT) - Base Case	5,817	7,377	6,260	5,898	5,732	5,533	5,129	4,863	5,657	6,528	7,474	6,747	10,856	7,460	4,023	
Vista Product 1 (Val DÒr & McPherson) Delivered ('000 RMT)	17,030	18,044	17,594	17,396	17,008	17,371	17,224	17,208	17,273	17,283	17,319	17,365	14,108	15,748	7,186	
Vista Product 2 (McLeod Seam) Delivered ('000 RMT) - Base Case	3,387	2,352	2,836	3,059	3,392	3,052	3,162	3,199	3,166	3,108	3,103	2,994	6,477	4,631	1,597	
Export Thermal Coal Produced Vista Product 1 - Base Case	9,830	10,402	10,251	10,129	9,747	10,076	9,973	9,977	9,920	9,892	10,110	10,306	8,067	8,885	4,187	
Calorific Value (CV)	5,788	5,789	5,770	5,777	5,774	5,805	5,816	5,822	5,817	5,711	5,703	5,715	5,747	5,809	5,793	
Export Thermal Coal Produced Vista Product 2 - Base Case	1,416	1,007	1,214	1,298	1,459	1,297	1,359	1,363	1,352	1,321	1,306	1,245	2,634	1,847	672	
Calorific Value (CV)	5,404	5,384	5,403	5,408	5,417	5,412	5,421	5,422	5,465	5,411	5,431	5,462	5,466	5,463	5,451	
Waste Stripping ('000 BCM)	118,308	118,671	116,281	130,598	130,805	126,322	131,015	129,796	124,984	110,973	100,632	99,534	96,297	103,392	25,381	
Rehandled Waste Stripping ('000 BCM)																
Total Vista Product 1 Coal Sold from Hinton East and West Bocks	5,619	4,194	2,419	3,102	4,062	5,532	6,692	7,066	7,207	2,361	1,166	1,529	3,939	8,790	3,851	
Total Vista Product 2 Coal Sold from Hinton East and West Bocks	489	169	477	578	635	566	584	577	1,057	937	1,037	1,195	2,635	1,848	671	
Operating costs ($ '000):																
Coal Processing including supplies	$95,037	$94,939	$95,098	$95,214	$94,958	$95,065	$94,893	$94,991	$95,139	$94,916	$95,060	$94,767	$95,819	$94,860	$40,883	$0
Mining Cost	$441,920	$443,010	$435,505	$481,192	$481,676	$467,469	$482,301	$478,485	$463,257	$418,471	$385,628	$381,929	$372,338	$394,283	$108,832	$0
Contingency	$66,288	$66,451	$65,326	$72,179	$72,251	$70,120	$72,345	$71,773	$69,489	$62,771	$57,844	$57,289	$55,851	$59,142	$16,325	
Coal Processing not including supplies	$66,862	$66,793	$66,904	$66,986	$66,806	$66,881	$66,760	$66,829	$66,934	$66,776	$66,878	$66,672	$67,412	$66,737	$28,763	$0
Supplies transportation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Personnel transportation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interim Mine rehabilitation	$3,969	$4,019	$4,065	$4,117	$7,677	$7,683	$7,886	$8,080	$8,113	$8,072	$8,131	$8,192	$8,255	$8,255	$8,255	$0
G. and A.	$22,917	$23,084	$22,976	$22,938	$22,827	$22,905	$22,844	$22,844	$22,898	$22,902	$22,955	$22,909	$22,501	$22,618	$14,844	$2,000
Decommissioning/closure/reclamation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($78,000)
Personnel severance costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operating supplies, chemicals	$28,175	$28,146	$28,193	$28,228	$28,152	$28,184	$28,133	$28,162	$28,206	$28,140	$28,182	$28,095	$28,407	$28,123	$12,121	$0
Sub Total Operating Costs	$630,132	$631,504	$622,969	$675,640	$679,390	$663,243	$680,269	$676,171	$658,896	$607,132	$569,618	$565,087	$554,763	$579,159	$189,140	($76,000)

		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Year		**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 21**	**Year 22**	**Year 23**	**Year 24**	**Year25**	**Year 26**	**Year 27**	**Year 28**	**Year 29**	**Year 30**	**Year 30**	**Year 31**
Project year		**19**	**20**	**21**	**22**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**33**	**34**
Construction year		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Production year		**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Environmental bonding																	
Value of bond ($ '000)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cost of bond		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Working capital determinants:																	
Supplies inventory:																	
Operating supplies, chemicals and fuel		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)
Coal inventory days		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Accounts receivable days		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Accounts payable days		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Capital costs ($'000)																	
Site access																	
Site services		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine development		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine equipment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mill and other buildings		$0	$0	$0	$0	$740	$335	$310	$5,393	$209	$3,364	$3,308	$3,204	$1,875	$0	$0	$0
Mill process and other equipment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plant ancillary		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Load Out		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Utilities		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Processed fines/Tailings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
E.P.C.M.		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Site construction indirects/mobilization		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Owners costs		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Surface water management sustaining capital		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ground water management sustaining capital		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mine sustaining capital		$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$0
Mill sustaining capital		$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$1,150	$5,150	$0
Contingency																	
Total capital cost		$5,450	$1,450	$5,450	$1,450	$6,190	$1,785	$5,760	$6,843	$5,659	$4,814	$8,758	$4,654	$7,325	$1,450	$5,450	$0
Cumulative Capital Costs		$801,721	$803,171	$808,621	$810,071	$816,261	$818,046	$823,806	$830,649	$836,308	$841,122	$849,880	$854,534	$861,859	$863,309	$868,759	$868,759
Salvage value		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Loan drawdown		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Loan repayment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing balances - needed in history column only																	

22.3 Fiscal terms/taxation

The exchange rate was assumed to be US $0.90 to Canadian $1.00 based on a projection of long term exchange rates.

Alberta Coal Royalties were expensed as 1% of the project Gross Revenue each year plus 13% of the Net Revenue after the capital payback period. The 13% is calculated on the Net Revenue after the Gross royalty is deducted. The project specific Tananger Royalty was applied as 1% of gross sales from the Hinton East and Hinton West claim blocks. All capital expenditures were assigned to their appropriate capital cost allowance pools and the pools were depreciated at the appropriate declining rate to arrive at the annual taxable income for the project.

Federal income taxes and Alberta income taxes were calculated at 15% and 10% of taxable income respectively.

No interest or financing costs were applied to this analysis.

22.4 Inflation

No inflation factor was applied to the analysis. The escalation of costs and revenues were assumed to be equal throughout the life of the project.

22.5 Deterministic result

The economic model for this project was used to calculate a point value or deterministic result based on the expected values of the input variables. A Monte Carlo or stochastic approach was also used to evaluate the impact of variability in some of the key input variables. Table 22.3 shows the results of the economic analysis.

Table 22.3 Capital and Operating Costs

Economic value	Value
Average annual export coal sales (000 t)	10,324
Average annual revenue($000)	$766,929
Total 5 year capital ($000)	$758,000
Annual operating cost ($000)	$537,256
NPV @ 8% ($000)	$498,000
Internal rate of return	13.4%
Payback period	7.9 years

The "average annual" figures are the arithmetic average of the respective figures for the life of the project. The supply cost of a project is that flat commodity price which reduces the net present value at a given discount rate to $0. In other words it is that commodity price for which the project rate of return is equal to the hurdle rate. In the case of the Vista project will have an 8% rate of return when the average LOM coal price is reduced to 92.1% of the base case coal price forecast.

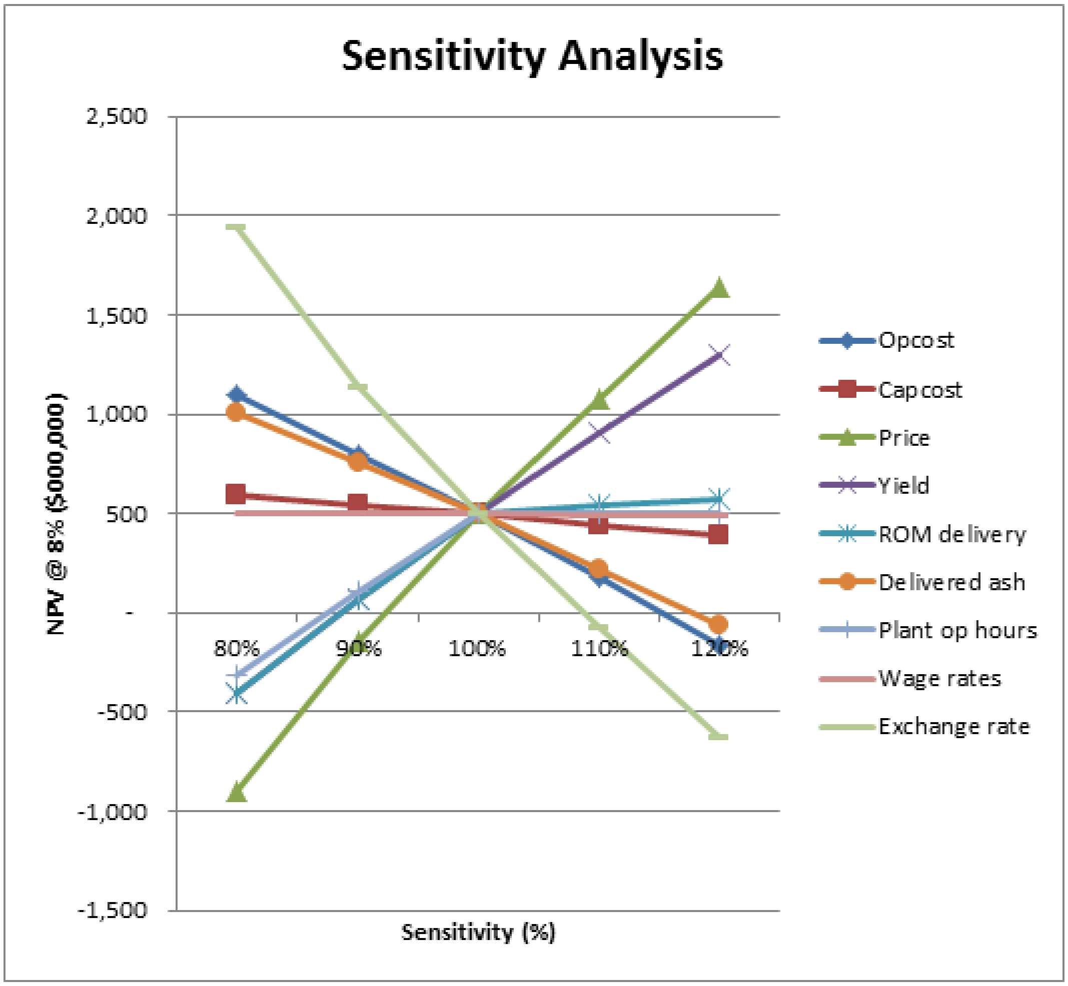
22.6 Sensitivity of changes to input parameters analysis

It is important to determine the sensitivity of the economic results to variations in input parameters in order to understand the conditions under which the project will not be economic. A deterministic sensitivity analysis was carried out by varying the input values and calculating a new net present value.

The results of this analysis are shown in Figure 22.1.

It is seen from this analysis that the project economic results are very sensitive to changes in the operating cost, plant operating hours, coal price and the US$ exchange rate.

Figure 22.1 Economic Sensitivity Results



22.7 Monte Carlo analysis

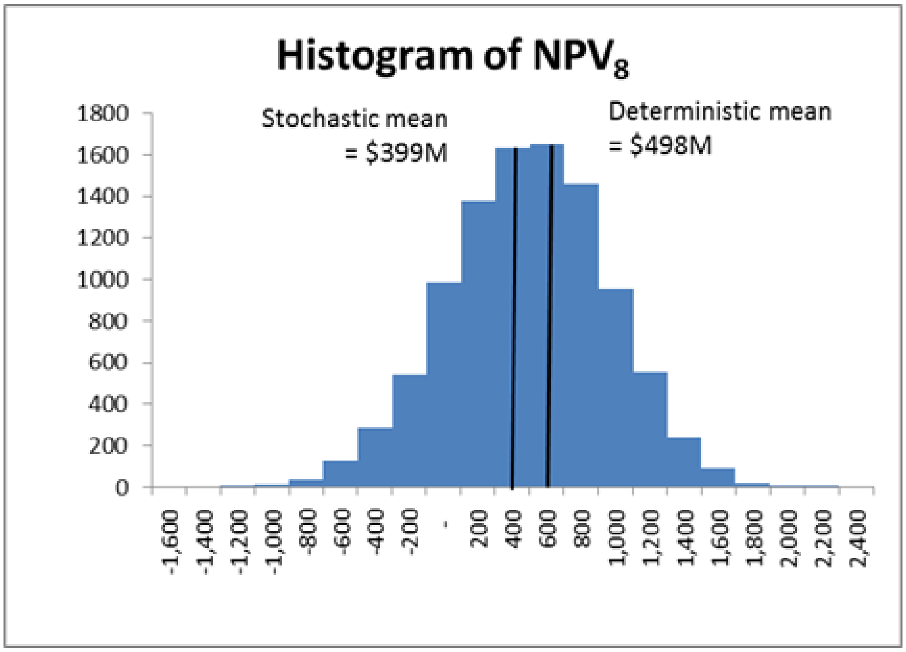
A Monte Carlo probabilistic assessment was made of the economic results to test the robustness of the project when key input variables are allowed to change simultaneously. Each of the selected input variables shown in Table 22.4 was defined by a triangular frequency distribution whose values were determined during an all-party discussion at a three day project workshop held during the Feasibility Study period.

Table 22.4 Monte Carlo Factors

Input Factor	Basis	Probability that real value is less than…		
		10%	50%	90%
Opcost sensitivity	times base case	0.80	0.90	1.00
Capcost sensitivity	times base case	0.90	1.00	1.50
Price sensitivity	times base case	0.85	1.00	1.10
Yield sensitivity	times base case	0.85	1.00	1.05
ROM delivery	times base case	1.10	0.98	0.85
Loss/dilution	times base case	1.10	1.12	1.15
Delivered ash	times base case	0.97	1.00	1.09
Exchange rate	times base case	0.90	1.00	1.06
Plant Production	Mtpa	11.5	11.0	10.0
Plant operating hours	times base case	1.06	1.00	0.985
Wage rates	times base case	0.90	1.00	1.15
Thickener underflow	solids % density	0.40	0.35	0.25
Return water	% of available	0.35	0.40	0.50
Clean coal conveyor	Mtpa	15	13	11

The Monte Carlo Results are shown in Figure 22.2

Figure 22.2 Monte Carlo Results



From this analysis it can be seen that, on a risked basis, the median project NPV_8 drops from $489 million to $399 million and there is a 21% probability that the project will earn a negative net present value (rate of return is less than 8%).

22.8 Discussion of economic results

The deterministic assessment of the project indicates that it has an internal rate of return which is above the 8% risked project rate of return and the annual net cash flows are sufficient to meet the project's cash requirements.

The project economics are elastic in reference to changes in the exchange rate, coal price, operating cost and plant hours. The economic return is less sensitive to changes in the other variables.

The supply cost value of 92.1% of base case coal prices suggests that relatively small disturbances in coal markets may have dramatic impacts on the project economics and the project return can slip below the hurdle rate of eight percent. The Monte Carlo analysis is designed to test the sensitivity of the project economics under the assumption that it is difficult, if not impossible, to determine the important project input values with a high degree of accuracy.

It can be seen from this frequency distribution that the deterministic net present value is higher than the median Monte Carlo value which not surprising given that the frequency distributions of the variables which were chosen to be tested are all skewed towards having a higher probability of a more negative result. The important information to be derived from this analysis is that based on the assumptions herein, there is a 21% probability of the project not meeting the 8% hurdle rate.

By definition, Marketable Reserves must be sourced from Measured and Indicated Resources over which the mine plan has been cast and have been included into the technical and financial evaluation and resulted in an NPV greater than zero. The production estimates contained herein include projected production tonnes sourced entirely from Proven and Probable Marketable Reserves in line with NI43-101 requirements.

23 Adjacent Properties

Coal at the Vista coal property is within the Coalspur Formation of the Upper Cretaceous-Tertiary Saunders Group in west central Alberta. The Coalspur Formation continuously underlies the area from north of Hinton, south-eastward to Coal Valley, about 100 km away. In the Coal Valley area, the coal seams dip between 20° and 40°. Following the Coalspur trend to the northwest, the dip angle varies from 6° in the Hinton East area to 16° near the McLeod River.

Sherritt International Corp. (Sherritt) produced 3.7 Mt of thermal coal from its Coal Valley mine in 2008 which was publically disclosed in the Sherritt 2008 Annual Report. The majority of Sherritt's coal is sold on the world export market. An on-site processing plant crushes, cleans and dries the coal before it is shipped by rail to port. The seams mined at Coal Valley correlate to those at the Vista coal property, although seam terminology is different. Sherritt is applying to develop three more areas near Coal Valley: Mercoal West, Yellowhead Tower, and Robb Trend.

Sherritt also owns and operates the Obed Mountain Mine 25 km northeast of Hinton. The coal at Obed Mountain is in the Paskapoo Formation, which is lower rank and stratigraphically above the Coalspur Formation.

Per a Marketwired news release issued by Sherritt on December 24, 2013 it was announced that Westmoreland Coal Company ("Westmoreland") will acquire Sherritt's operating coal assets, currently described as the Prairie and Mountain Operations, for total consideration of $465 million. The $465 million is comprised of $312 million in cash and the assumption of capital leases presently valued at $153 million, subject to closing adjustments.

The parties are seeking to close the coal transaction in first-quarter 2014. It is being effected pursuant to a plan of arrangement, pursuant to the Business Corporations Act (Alberta). The transaction is subject to customary closing conditions and consents, including applicable Competition Bureau, Investment Canada Act and court approvals. Post-closing, Sherritt will continue to work with Westmoreland on the Obed Mountain Mine remediation plan, and will continue to meet all financial obligations resulting from the October Obed Mountain Mine containment pond breach.

The authors of this technical report have not verified the information in Sherritt's 2008 Annual Report and the information therein is not necessarily indicative of the mineralization on the Vista coal property. As well, no information derived from Coal Valley was used exclusively to derive design or costs for Vista.

24 Other Relevant Data and Information

24.1 Processed fines storage ponds design

24.1.1 Introduction

Fine particles generated from coal processing will be delivered as slurry to settling impoundments and allowed to settle out of suspension. The processed fines storage design includes two separate storage ponds outside of the pit, which are expected to collectively provide sufficient storage for the life of the Vista Mine.

24.1.2 Design criteria and assumptions

The dam safety design criteria for the processed fines storage ponds meet or exceed the requirements of the Canadian Dam Safety Guidelines (Canadian Dam Association (CDA), 2007) for a "very high" consequence category dam. Table 24.1 summarizes the impoundment storage requirements and dam safety criteria.

Table 24.1 Summary of design criteria

Pond Storage Capacity	
Average Settled Density of Processed Fines	0.65 t/m^3
Pond 1 Storage Requirements – Starter Dam	2 years of storage at BFS production rate (7 Mm^3 for solids and water)
Pond 1 Storage Requirements – Ultimate	Total Mine Licence Pit processed fines (min. 53 Mm^3 solids and water)
Pond 2 Storage Requirements – Ultimate	Remainder of processed fines from BFS Pit (150 Mm^3 solids and water)
Dam Foundation and Embankment Stability	
Analysis Scenario	**Min. Factor of Safety**
Starter Dam – after construction, before filling, undrained conditions	1.3
Starter Dam – filled to temporary FSL, drained conditions	1.5
Ultimate Dam – full pond level, drained conditions	1.5
Pseudostatic seismic analysis for all the three listed scenarios	1.0
Water Management	
Perimeter Runoff Interception Ditches	1:100 year peak flow
Pond Flood Capacity	72 hour Probable Maximum Flood (PMF),
Flood Routing Between End of Filling and Closure	Spillway structure to divert 72 hour PMF.
Closure	Dry upland structure with contouring and swales to divert runoff to natural drainage courses.

24.1.3 Processed fines laboratory testing

In the summer and fall of 2011, Coalspur produced simulated processed fines in a laboratory setting using rock core samples collected from the Vista pit area as the parent material. The rock core samples were subjected to a mechanical abrasion and filtering process. The properties and behaviour of the processed fines were characterized through a suite of geotechnical laboratory tests including particle size distribution, specific gravity, X-ray diffraction for mineral phase analysis, Atterberg limits, organic content, bench-top settling tests, large strain consolidation, and supernatant water quality.

The laboratory-simulated processed fines contained a high percentage of dispersive clay particles (probably montmorillonite) that resulted in poor settling behaviour. In most of the simulated samples, the fines remained in suspension unless flocculants were added. Even with the use of flocculants, the processed fines did not settle to the densities expected during the planning process. The highest settled density was observed in samples generated from Val d'Or coal samples (approximately 20% solids), while the lowest settled density was observed in samples generated from McLeod coal samples (approximately 7% settled densities).

In addition to the simulated samples, a bulk sample of thickener underflow was collected from the operational Coal Valley mine located approximately 40 km east of Vista. This sample was produced from coal mined from the Val d'Or coal seam, the same seam that will be mined at Vista. The Coal Valley sample was subjected to many of the same tests as the processed fines samples. The Coal Valley sample was coarser with particles up to 2 mm in diameter and approximately 16% of the sample was coarser than 0.25 mm diameter. In contrast, the Vista samples were screened at 0.25 mm and were therefore 100% finer than 0.25 mm. Despite this difference in gradation, the Coal Valley sample was similar to the Vista simulated sample in terms of mineral phases containing a high percentage of montmorillonite clay.

The Coal Valley thickener underflow sample, as received, contained approximately 30% solids, although Coal Valley representatives have reported that the thickener underflow generally contains 40 – 50% solids. In contrast to the simulated Vista samples, the Coal Valley sample settled to 48% solids without the addition of flocculants. Although the improved settling behaviour may be partially attributed to the coarser gradation of the Coal Valley sample, it is assumed that the laboratory simulation of Vista samples produced an excessive degree of clay dispersion which is not representative of expected conditions during operation. For this reason, the Coal Valley processed fines properties have been adopted for the design of the processed fines storage ponds.

The properties of the simulated Vista samples are considered worst case conditions. If the processed fines produced at Vista during the first few years of operation reflect these worst case characteristics, Coalspur will quickly implement alternative strategies for handling processed fines, including more aggressive flocculation, mechanical dewatering, and drying (thermal or solar).

Further laboratory test work is required to attempt to better simulate the Vista processed fines and to characterize the properties of these processed fines prior to mine operation.

24.1.4 Pond staging

Input parameters

Based on experience at other mines and in consultation with CPG and Mr. Bob Leach, Coalspur made recommendations about the values of pond staging parameters that should be used in the design. These parameter values have been summarized in Table 24.2.

Table 24.2 Processed fines storage pond staging parameters

Parameter	Value
% Solids of Thickener Underflow	30%
Water Recycle form Processed Fines Storage Pond	45% of water delivered in slurry
Delay in Water Recycle from Processed Fines Storage Pond	6 months after deposit

Processed fines storage Pond 1

The first of two processed fines storage ponds proposed for the Vista mine, is located approximately 7 km east of the plant site and is confined within the Mine Permit Area, as shown in Figure 24.1. The pond footprint is approximately 2.7 km north to south and 1.9 km west to east. The location of the pond was selected to take advantage of a natural valley while avoiding potential fish habitat.

The size of pond was based on the requirement to provide storage for all of the processed fines produced during the mining of the initial Mine Licence pit. Using the parameters above, this volume was estimated to be approximately 55 Mm^3. The characteristics of the Pond 1 alignment are summarized in Table 24.3.

Table 24.3 Characteristices of processed fines storage Pond 1

Parameter	Value
ultimate dam crest elevation	1260 m
maximum dam height	78 m
total volume of fill required for dam construction	44.2 Mm^3
total pond storage (with 2 m of freeboard)	55.9 Mm^3
total footprint of dam and pond	297 ha
dam side slopes	3H:1V
dam crest width	20 m (final) 30 m (working)
pond freeboard	2 m

Filling of the south half of Pond 1 is expected to begin in 2014 during trial processing but will ramp up in 2015 when real production is set to begin. It is anticipated that the south half of Pond 1 will be filled to El. 1225 by March 2016, at which time the processed fines slurry discharge pipe will be diverted to the north half of the pond. The entire pond is expected to be filled by April 2025 at which point processed fines will be diverted to Pond 2.

Processed fines storage Pond 2

Pond 2 will be constructed approximately 5 km northeast of the plant site in the location originally recommended in the PFS report (Wardrop, 2010). This location maximizes natural storage capacity while minimizing the dam fill requirements. Due to increased ore recovery estimates Pond 2 will be considerably larger than size of pond proposed in the PFS. The ultimate pond footprint is approximately 2.5 km north to south and 3.0 km west to east.

Pond 2 is designed to have a maximum dam crest elevation of 1319 m. However, unlike the full perimeter dam of Pond 1, Pond 2 is primarily confined by natural ground. Rather than a full perimeter dam, smaller isolated dams will be constructed to seal off natural drainage courses and depressions. A total of six individual dams are required: southeast dam (primary dam), southwest-A and southwest-B dams, northwest dam, north dam, and east dam.

The characteristics of the Pond 2 alignment are summarized in Table 24.4.

Table 24.4 Characteristics of processed fines storage Pond 2

Parameter	Value
Ultimate dam crest elevation	1319 m
Maximum dam height	73 m
Total volume of fill required for dam construction:	
southeast dam	10.8 Mm^3
Total pond storage (with 2 m of freeboard)	119 Mm^3
Total Footprint of Dams and Pond	733 ha
dam side slopes	3H:1V
dam crest width	20 m (final) 30 m (working)
pond freeboard	2 m

Filling of Pond 2 is expected to begin in May 2025 after filling Pond 1 and therefore construction of the southeast dam is expected to begin in the summer of 2024. Annual raises to the dams around Pond 2 will continue to 2043 with completion of mining and thus pond filling occurring in early 2044.

24.1.5 Dam design

General

The containment dams are designed as semi-homogeneous earthfill dams, which will be constructed out of local borrow materials, mine waste rock and coarse coal refuse (coarse reject).

Pond 1 dam design

The Pond 1 homogeneous earthfill starter dam will be constructed of compacted glacial till, with a sand and gravel toe blanket (fine filter) for drainage. The starter dam will be constructed with a crest width of 30 m and will be built to an elevation of 1227 m. At this elevation, the dam will not fully encircle the pond as the existing ground topography is higher than El 1227 m in places.

The Pond 1 starter dam will also require a toe blanket drain constructed of clean sand and gravel. This toe drain will be a maximum of 10 m wide, tapering off at the abutments such that the toe drain must remain downstream of the starter dam crest. The drain will be at least 0.5 m thick after placement and compaction. The sand and gravel used for the drain will be filter compatible with the glacial till used for starter dam construction.

The starter dam will be raised during operations with a downstream construction geometry and using the following material zones, listed in order from upstream to downstream:

- a 5 m wide glacial till core
- a 10 m wide fine filter (coarse reject)
- a 10 m wide coarse filter (select fine mine waste rock)
- the remainder as ROM waste rock.

All fill materials placed adjacent to each other must meet filter compatibility requirements. For the coarse filter (select mine waste rock) it is expected that this will require some screening of the material.

The total length of the final dam is 6188 m along the centreline and the maximum dam height is 78 m in the southeast corner. The dam slopes are 3H:1V, both upstream and downstream.

Pond 2 dam design

The impoundment of Pond 2 will be formed by the construction of 6 individual dams. Unlike the Pond 1 dam, the dams around Pond 2 will not be constructed with a homogenous glacial till starter dam. Instead, construction using zoned materials will begin from the ground up. The Pond 2 dams will have a 5 m wide, compacted clay core. However, due to the relatively small volume of fill required to construct the Pond 2 impoundment dams, the remainder of the dams will be constructed with coarse reject. This eliminates the requirement for fine select rockfill and run of mine rockfill as was recommended for the Pond 1 dams. As described above, the coarse reject material must be filter compatible with the glacial till used for core construction.

The use of coarse reject for the bulk of Pond 2 dams introduces uncertainty about the long-term phreatic surface within the dam embankment. While the ROM waste rock recommended for the bulk of the Pond 1 dam, is expected to have high permeability, the permeability of the coarse refuse is less certain. Therefore, to draw down the phreatic surface near the toe of the dam and reduce the potentially high exit gradients, a gravel toe drain is recommended for the Pond 2 dams. The Pond 2 toe drain will have a total thickness of 1 m. The width of the drain will vary based on the height of the dam and the construction schedule (i.e. when the drain is first required). The width of the toe drain at final construction will be at least 20% of the final dam width. The SE dam will require a much wider toe drain as the drain must be in place from the first year of construction on this dam (2024).

Laboratory testing should be undertaken on the coarse reject material prior to dam construction. If the coarse reject is found to be fairly resistant to break-down by compaction and physical and chemical weathering, and if the hydraulic conductivity is sufficiently high to promote free drainage, then the Pond 2 gravel toe drain may not be required.

Construction requirements

Foundation preparation

Foundation preparation should be done in a staged approach proceeding dam construction by a year or less. The ground underlying the dam foundation will require clearing and grubbing of all vegetation. Timber of economic value will be harvested. All topsoil and organic soils will be stripped and stockpiled for use in reclamation. In addition, if any permeable sand layers exist at surface, this material should be excavated to the underlying till or other low permeability material across a 10 m wide strip under the dam foundation, beginning at the upstream toe. This will prevent excessive seepage from bypassing under the dam.

The ground under the pond itself should also be cleared of vegetation; however, grubbing and stripping of topsoil is not required. After vegetation clearing the surface soil should be disked and compacted to reduce the permeability of the soil and minimize infiltration of pond water into the ground.

Fill compaction

Materials used for dam construction will have varying compaction requirements depending on the material type, the purpose of the fill, and the location of fill within the dam.

Crest widths

The fill for dam construction is expected to be hauled using a fleet of 400-t Liebherr T282 haul trucks. These trucks have a width of approximately 10 m and thus the working dam crest width, including the starter dam, should be at least 30 m wide to allow for two-way haul traffic.

The final crest width of the dam will be 20 m, therefore it is recommended that smaller trucks such as Caterpillar 777 haul trucks or similar should be used to finish the upper 3 m of construction on the dams.

24.1.6 Dam slope stability analysis

General

Stability analysis was carried out using the limit equilibrium software SLOPE/W developed by Geoslope International Limited. The stratigraphy of the existing ground was estimated using borehole information from the 2011 field investigation.

Stability analyses were carried out for the starter dam and full height dam cases and used the following conditions:

- Both effective strength and total strength (using undrained shear strength in the foundation) analyses were carried out for the starter dam.
- Strength and pore pressure parameters used are summarised in Table 24.5.
- The pseudostatic seismic analysis used a 0.12g effective horizontal acceleration.

Table 24.5 Summary of geotechnical design parameters

Type of Material	Bulk Unit Weight (kN/m^3)	Static Drained Shear Strength		Static Undrained Shear Strength	
		Ø'	c'(kN/m^2)	Ø	c_u (kN/m^2)
Processed Fines	20	30	0		
Processed Fines (Liquifaction)	20			Tau/ Sigma ratio	0.1
Starter Dam (Till)	21	32	0	n/a	n/a
Till (Blanket layer)	21	32	0	n/a	n/a
Coarse Reject Rockfill (Blanket layer)	21	35	0	n/a	n/a
Fine Selected Rockfill (Blanket layer)	21	35	0	n/a	n/a
Drainage Blanket	21	37	0	n/a	n/a
Run of Mine, Overburden Fill	21	35	0	n/a	n/a
Foundation Material					
Undrained					
Silt (very stiff)	21	n/a	n/a	0	150
Clay (hard)	21	n/a	n/a	0	200
Drained					
Sand, compact	21	33	0		
Silt (very stiff)	21	30	0		
Clay (hard)	21	29	0		
Sand and Gravel – loose	21	30	0		
Sand Silt	21	30	0		
Gravel	21	35	0		
Bedrock		Impenetrable		Impenetrable	

Slope stability analysis results

The analyses indicate that the slip surfaces are stable with Factor of Safety (FoS) greater than 1.5. Under seismic loading, pseudostatic analyses indicated that the FoS is greater than 1.0.

Recommendations for improving stability analysis

Before proceeding to detailed design, it will be necessary to obtain more detailed geotechnical and hydrogeological information in the regions of the two processed fines storage ponds, in particular along the proposed alignment of the dams. It is recommended that sonic boreholes should be drilled along the proposed dam alignments to obtain geotechnical information from the surficial soils and determine the depth to bedrock. Coring of at least the upper 10 m of bedrock should be done in some locations to identify the rock type and assess the strength and integrity of the rock, with deeper core holes undertaken at critical locations where the proposed dam section is the highest. The test holes should be instrumented with a combination of standpipes and vibrating wire piezometers to determine groundwater conditions both before and during construction

24.1.7 Seepage analysis

Model set-up

Two-dimensional seepage analysis was carried out to provide an assessment of the seepage potential through the dam embankment and foundation. Analyses were conducted along selected cross-sections at the maximum dam height and average dam height. Seepage analyses were based on an assumed horizontal deposition of processed fines.

The stratigraphy of the existing ground was estimated using borehole information from the 2011 field investigation. Table 24.6 summarizes the input parameters in the seepage model. Hydrogeologic properties were either measured in the field, calculated from grain size distributions, or estimated from previous experience.

Table 24.6 Seepage analysis input parameters

Material Type	K_{sat} (m/s)	Anisotropy, K_x/K_y	VWC at Saturation
Processed Fines	1e-8	1	n/a (saturated only)
Compacted Till (Core and Starter Dam)	1e-7	5	0.23
Coarse Reject	1e-7	5	0.39
Fine Select Rockfill	1e-4	1	0.3
Run of Mine Rockfill	1e-4	1	0.3
Gravel Toe Drain	1e-4	1	0.3
Surficial Sand	1e-4	2	0.39
Silty/Sandy Till	5e-6	2	0.3
Clay Till	1.4e-7	2	0.42

One of the critical variables assessed in the seepage analysis was the effect of a surficial sand seam of unknown lateral extent and continuity. Analyses were conducted with and without the sand seam. This sand seam was modelled as 1 m thick for Pond 1 and 2 m thick for Pond 2 based on the limited borehole data available.

Pond 1 results

The general conclusions from the Pond 1analyses are that:

- Seepage rates do not vary much between starter dam stage and ultimate dam stage.
- Seepage rates are highest when the pond water is in direct contact with underlying soil, that is, before the processed fines solids have been deposited over the ground, reducing the infiltration capacity.
- The compacted till cut-off that is intended to interrupt any surficial sand layers is most effective at reducing initial seepage of pond water before the processed fines are deposited to seal off the ground surface.
- The high hydraulic conductivity of the waste rockfill prevents flow from seeping out the downstream face of the dam.
- A 2 m deep seepage interception ditch is recommended to intercept seepage but the effectiveness of the ditch will vary depending on topography.

Pond 1 has approximately 5000 m of “free” perimeter (i.e., excluding the portion of perimeter abutting the North Waste Dump). Assuming that the 1 m sand seam is laterally continuous across the entire pond, but will be intercepted downstream of the dam toe using a cutoff trench, and assuming that the perimeter seepage interception ditch will capture at least 90% of horizontal flows, the estimated seepage collection rate for the perimeter ditch is 25-35 L/s.

Pond 2 Results

The conclusions from analysis of Pond 2 are that:

- seepage rates do not vary much between early stages of construction and the ultimate dam stage
- seepage rates are similar between the main southeast dam and the north dam, and presumably the other dams
- the compacted till cut-off trench is intended to interrupt any surficial sand layers is not effective at reducing seepage during later stages of construction; however, based on analysis from Pond 1, this cut-off will be effective at reducing initial seepage when the pond water is in direct contact with the ground surface
- seepage from the gravel toe drain is unlikely, especially if a surficial sand layer is present
- A 2 m deep seepage interception ditch is recommended to intercept seepage but the effectiveness of the ditch will vary depending on topography.

The outside perimeter of the Pond 2 southeast dam is approximately 1200 m while the combined perimeter lengths at the downstream toe of the north and northwest dams are approximately 1600 m. The southwest dams have an outside toe perimeter of approximately 600 m. Assuming that the 1 m sand seam is laterally continuous across the entire pond, but will be cut-off at the dams using cut-off trenches, and assuming that the perimeter seepage interception ditches will capture at least 90% of horizontal flows, the estimated seepage collection rate for the perimeter ditch is 8 L/s at the southeast dam, 7 L/s for the north and northwest dams combined, and 3 L/s for the southwest dams.

24.1.8 Seepage collection

It is recommended that a downstream seepage interception system be installed to collect and return process-affected water to the processed fines storage pond. This collection system will consist of an unlined ditch excavated to the base of any permeable surficial soil layers. At a minimum, the ditch should be excavated 2 m below original ground, and should be reasonably close to the downstream toe of the dam. Downstream construction of the dam will result in advancement of the toe and therefore it will likely be necessary to re-excavate portions of the ditch several times over the life of the pond.

For Pond 1, the seepage interception ditches will drain into two sumps located in the topographic low points along the pond perimeter. The sumps will be excavated and lined with compacted impervious fill or a synthetic liner. All water collected in the sumps will be pumped back into Pond 1.

The seepage interception system for Pond 2 will require three sumps for ultimate construction; one for the southeast dam, one for the southwest dams and one for the north and northwest dams.

24.1.9 Geotechnical instrumentation

An instrumentation and monitoring plan will be required to assess performance of the processed fines impoundment dams and to provide adequate warning of problem conditions. The key objectives of instrumentation and monitoring plan are to monitor:

- deformation at a sufficiently close spacing to detect any significant dyke movement either in the fill or in the foundation
- pore pressures in each of the key materials to verify that the stress-induced pore pressures are within the design range
- pore pressure under the downstream part of the dyke to identify any areas of high pressure that might lead to instability.

Instrumentation benches will be provided approximately every 15 m vertically on the downstream sides of all external dykes. These benches will be about 7 m wide. Initially instrumentation lines will be spaced approximately 500 m apart along the dyke. Closer spaced sections may be adopted in critical areas identified in subsequent investigation programs. The instrumentation will include:

- 85 mm diameter slope inclinometer casing installed to various depths up to 100 m with an average depth of approximately 50 m below the original ground level to measure horizontal movements
- vibrating wire piezometers typically installed in the surficial till layers to measure foundation pore pressures
- survey monuments on the crest and downstream slopes to permit the measurement of horizontal and vertical movements at the surface.

Any instrumentation installed in the dam during the ongoing construction phase will require an extension as the dam is built higher, due to the downstream construction methodology. Inclinometers will be extended until they are shifted to the upstream slope of the dam. Prior to inundation by the pond, the inclinometers on the upstream slopes of the dams will be grouted and decommissioned.

24.1.10 Closure considerations

The ponds will be reclaimed as dry upland structures, and therefore, will not be permitted to continue storing water indefinitely. When each of the ponds has been constructed to its full design height, the water cap will be decanted from the ponds. An overflow structure will be installed in each of the ponds to allow drainage of any direct precipitation and runoff that is delivered to the pond area. The inlet of the overflow structures will be installed at approximately the top of the processed fines solids to prevent water from ponding above this. Once the processed fines have achieved sufficient consolidation and drying, reclamation activities can be undertaken, including placement of capping soil and contouring.

Based on the feasibility study mine plan production rates, Pond 1 will be filled after approximately 10.5 years. It is expected that Coalspur will continue to use Pond 1 for water supply until a sufficient clear water volume has accumulated in Pond 2, likely 6 months to one year. When all deposition and water return processes have switched to Pond 2, the overflow structure will be installed in Pond 1. A 1 m diameter, insulated HDPE pipe will be installed through the dam to permit discharge of runoff collected in the Pond 1 area. At the upstream end the pipe will be connected to an inlet structure in a collection pond adjacent to the dyke. The inlet invert elevation will be at or below the bottom of the pond, so that the pond will normally be dry. The dry pond promotes positive drainage of the adjacent surface, provides submergence which increases the capacity of the pipe system, and provides storage which reduces the frequency of flooding of the adjacent surface. The pipe inlet will also have a trash rack to prevent the pipe from clogging with debris. Where the pipe exits the dam on the downstream side, it will connect to a 1 m diameter half pipe of corrugated steel (i.e. ditch liner) that extends down the 3H:1V slope. At the downstream end, the corrugated steel half-pipe will be connected to an energy dissipation structure to slow down the high-velocity flow.

Similarly, when all deposition and water return activities have concluded at Pond 2, a rock-lined spillway will be constructed to passively maintain a maximum pond level. The spillway will be situated on the eastern edge of the pond, adjacent to the small East Dam, and will convey water eastward into a tributary of the McLeod River.

This water management plan is based on the assumption that the precipitation and runoff that is in contact with the processed fines will meet all water quality guidelines allowing direct discharge into the natural receiving stream. Given the low contact time, this does not seem unreasonable; however, Coalspur will be required to monitor water quality during overflow rain events. If exceedances are observed, impoundment and treatment of the water may be required prior to discharge.

24.2 Geotechnical assessment and hydrogeology

24.2.1 Objectives of assessments

The objectives of this geotechnical, hydrogeological and hydrological assessments are to:

- Determine and provide an understanding of superficial and bedrock quality, as well as rock mass structure related to pit highwall slope stability and the hydrogeological regime within the strata at the Coalpsur Vista property.
- Review the geotechnical conditions of the foundations for the PFSP, plant site, conveyors, load out area and other related infrastructure.

This assessment has been undertaken using existing geotechnical, hydrogeological and hydrology information at the Vista coal resource area, as well as new data derived from a field investigation program conducted in 2011.

24.2.2 Geology overview

Surficial geology

The near surface geology is composed of a ground moraine (till) with local post glacial alluvial, colluvial, and organic deposits overlying bedrock. The till consists predominantly of sand and silt, with varying proportions of clay and gravel to boulder size materials.

Bedrock geology

The Coalspur Vista site is located on the eastern margin of the outer foothills of the Rocky Mountain thrust belt. The rocks form part of a sequence of continental sediments from the Saunders Group that overlies the marine Wapiabi Formation of the Alberta Group (Table 24.7). The upper Cretaceous-Tertiary Saunders Group can be divided into the Brazeau, Coalspur and Paskapoo Formations. All three units include thin coal seams; however the Coalspur and Paskapoo formations also contain major coal deposits.

Table 24.7 Formation classification of the Saunders Group

Age	Group	Formation	Geology
Tertiary	Saunders Group	Paskapoo Formation	Continental alluvial plain deposits that include thick successions of poorly indurated mudstones and sandstones
Tertiary	Saunders Group	Coalspur Formation	Upper part; 300 m of inter-bedded sandstones, siltstones and carbonaceous to bentonitic mudstones and several thick coal zones
Upper Cretaceous	Saunders Group	Coalspur Formation	Lower part; Entrance Conglomerate ~275 m below the lower most coal zone
Upper Cretaceous	Saunders Group	Brazeau Formation	Deposited as part of cyclotherm sequence

Regional tectonics and structural geology

The Coalspur Formation at the Vista site is exposed in a subcrop along the erosional eastern margin of the Prairie Creek Anticline. This margin area is bounded to the west by the Pedley Fault, a major reverse thrust, which separates the folded and deformed start of the Foothills Belt from the undeformed Alberta Syncline strata.

The structure is a simple monocline, trending 300° northwest/southeast. The beds dip gently northeast from 6° in the western part of the site up to 15° at the McLeod River on the eastern boundary.

The prefeasibility report (Wardrop, 2011) did not identify any significant faulting at the property. However, glacial ice deformation has been observed locally along the subcrop margins of the coal zones.

24.2.3 Historical geotechnical assessment

Property exploration began in November 1981 with nine boreholes drilled, with one hole being cored. These holes were drilled to determine geological and coal resource extent for the area. The cored borehole consisted of selectively cored coal intervals to provide core material for initial coal quality test and classification of the potential resources.

Further drilling between January and March 1982 consisted of 45 rotary boreholes, eight rotary cored boreholes and three geotechnical cored boreholes. The rotary locations were planned to intersect the coal seams in an approximate 500 m grid spacing across the Hinton East property, with emphasis on areas with coal seams near the surface. Core boreholes were located to core specific seams and to obtain data from across the property. In February 1982, ten geotechnical boreholes were drilled and logged in the overburden including six infrastructure boreholes, with three geotechnical cored boreholes undertaken to evaluate bedrock in the pit area. The February 1982 ground investigation was undertaken by EBA Consulting on behalf of Esso Minerals Canada.

The feasibility study in 1984 undertaken by Esso Resources Canada Limited, for Associated Porcupine Mines Limited, concluded that the development of a 2 Mtpa clean coal combined truck/shovel and dragline mining operation was technically feasible, but not economically feasible.

24.2.4 Geotechnical assessment update

2011 field investigations

The 2011 Coalspur Vista site investigation was conducted from July 19th through November 13th and comprised three main components:

- bedrock drilling
- overburden drilling and test pit excavation
- field groundwater testing.

The investigation was conducted to collect hydrogeological and geotechnical information in support of several detailed design components for the Vista site, including:

- pit wall design
- infrastructure
- pond and dump foundations design
- pit dewatering
- water supply.

Figure 24.1 illustrates a general layout for the investigation program. The surficial component of the site investigation comprised the drilling of Sonic and Auger test holes and the excavation of test pits. Surficial geotechnical and hydrogeological information was required at several proposed facility locations including: Plant Site, Conveyor Corridor, Load Out Area, Fines Pond 1, North Waste Dump, Fines Pond 2, RAW Conveyor Alignment, and South Waste Dump locations. Facility locations and the general test hole layouts are illustrated in Figure 24.1, while Figure 24.2, Figure 24.3 and Figure 24.4 illustrate the proposed facility footprints and test hole layouts for the Plant site, Conveyor Corridor, and Load Out Area, respectively.

The surficial drilling program included:

- drilling of 16 Auger test holes
- drilling of 37 Sonic test holes
- excavation of 32 test pits
- installation of thirty five 50 mm diameter and four 25 mm diameter standpipe piezometers
- Collection of bagged soil samples for laboratory testing.

Figure 24.1 2011 site investigation – general layout of test holes

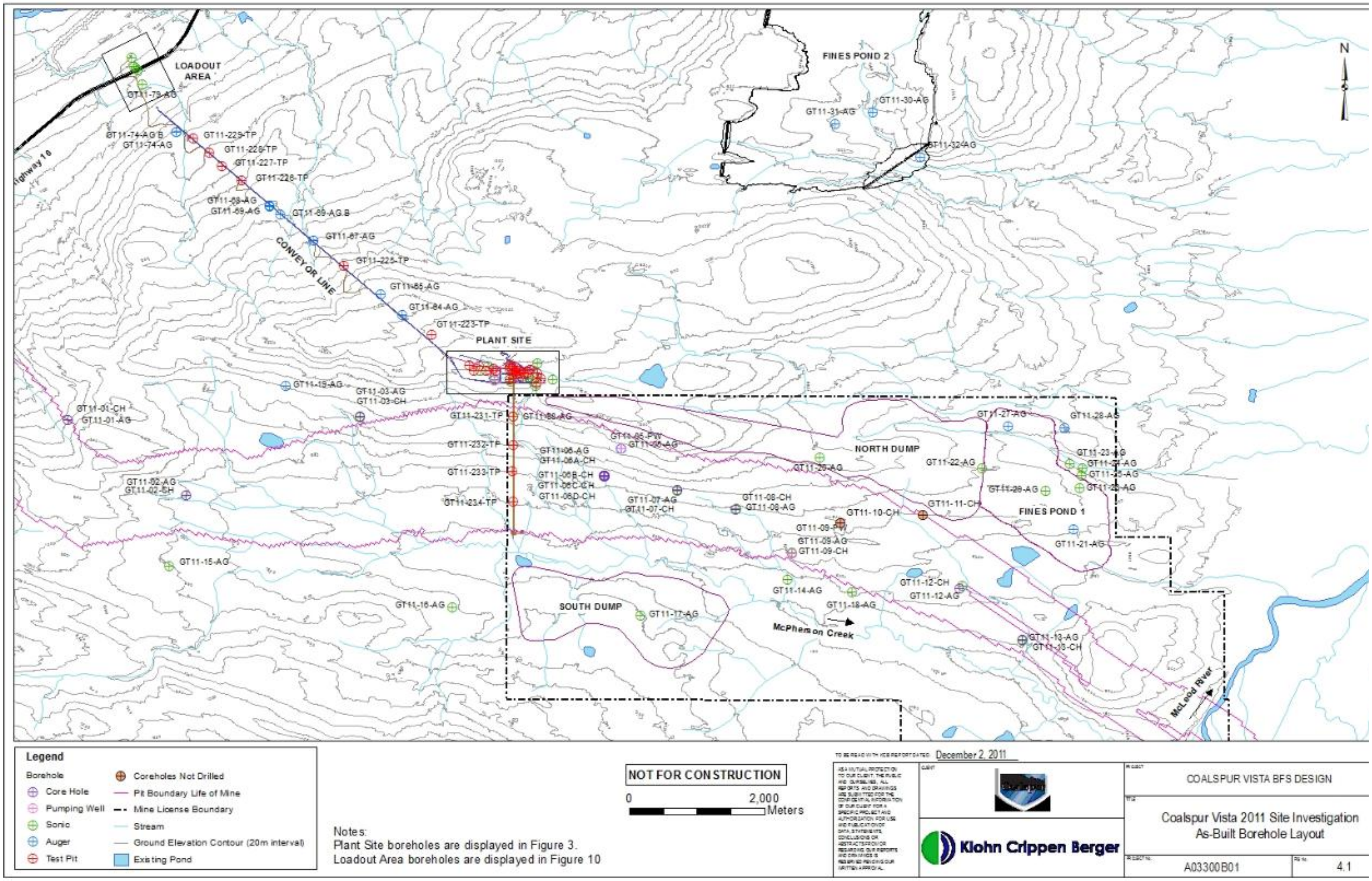


Figure 24.2 2011 site investigation – layout of plant site test holes

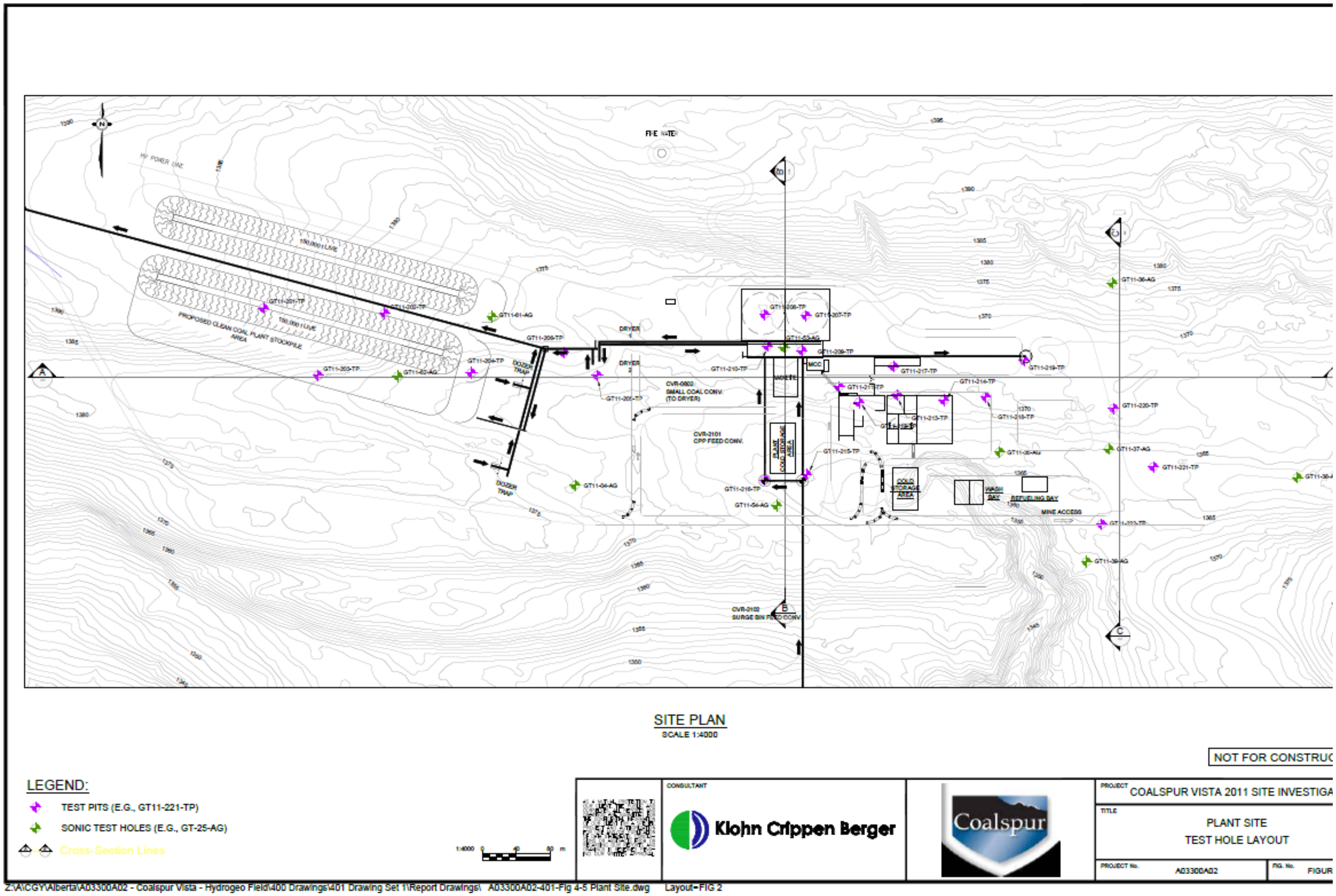


Figure 24.3 2011 site investigation – layout of conveyor corridor test holes

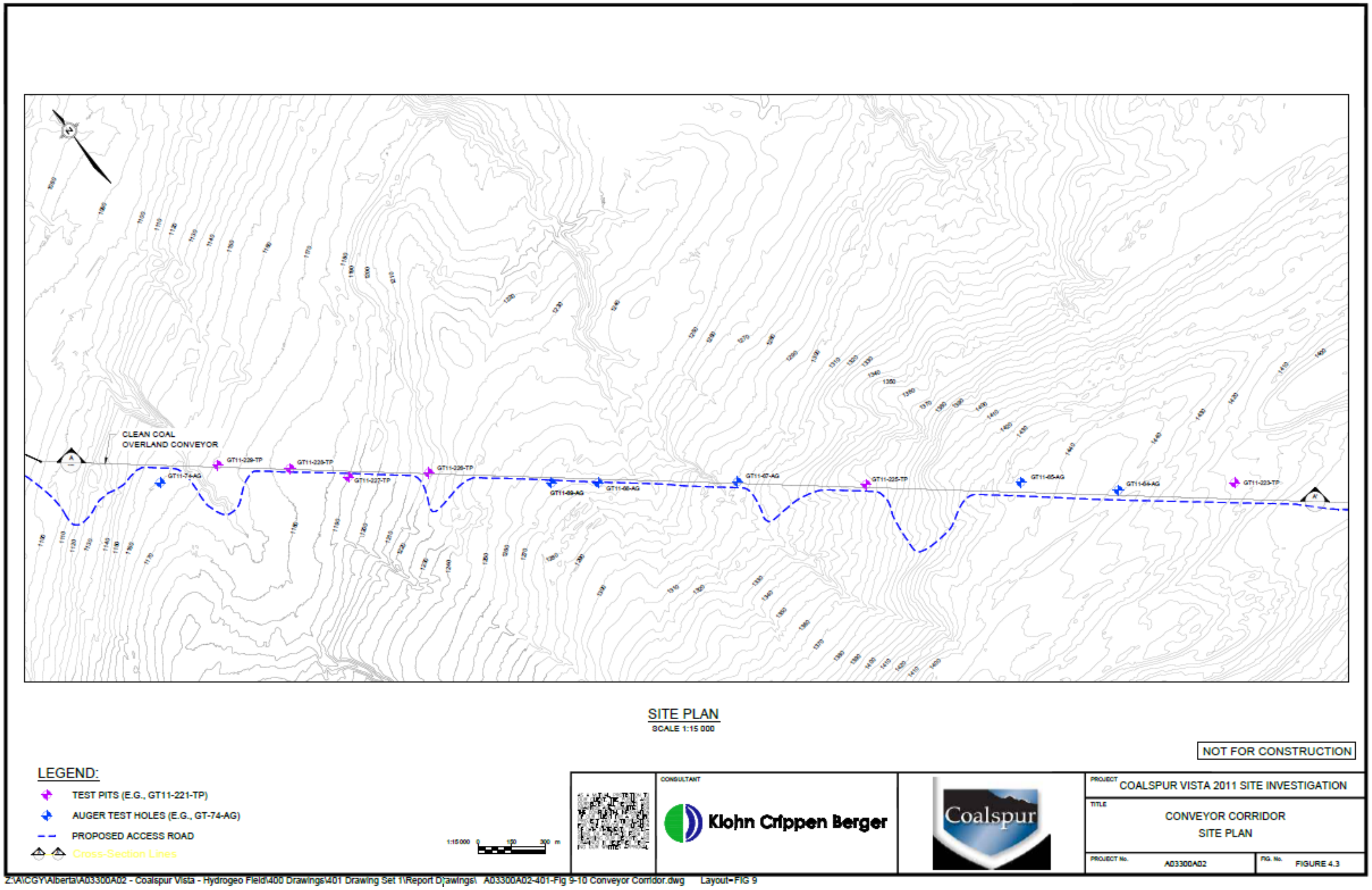
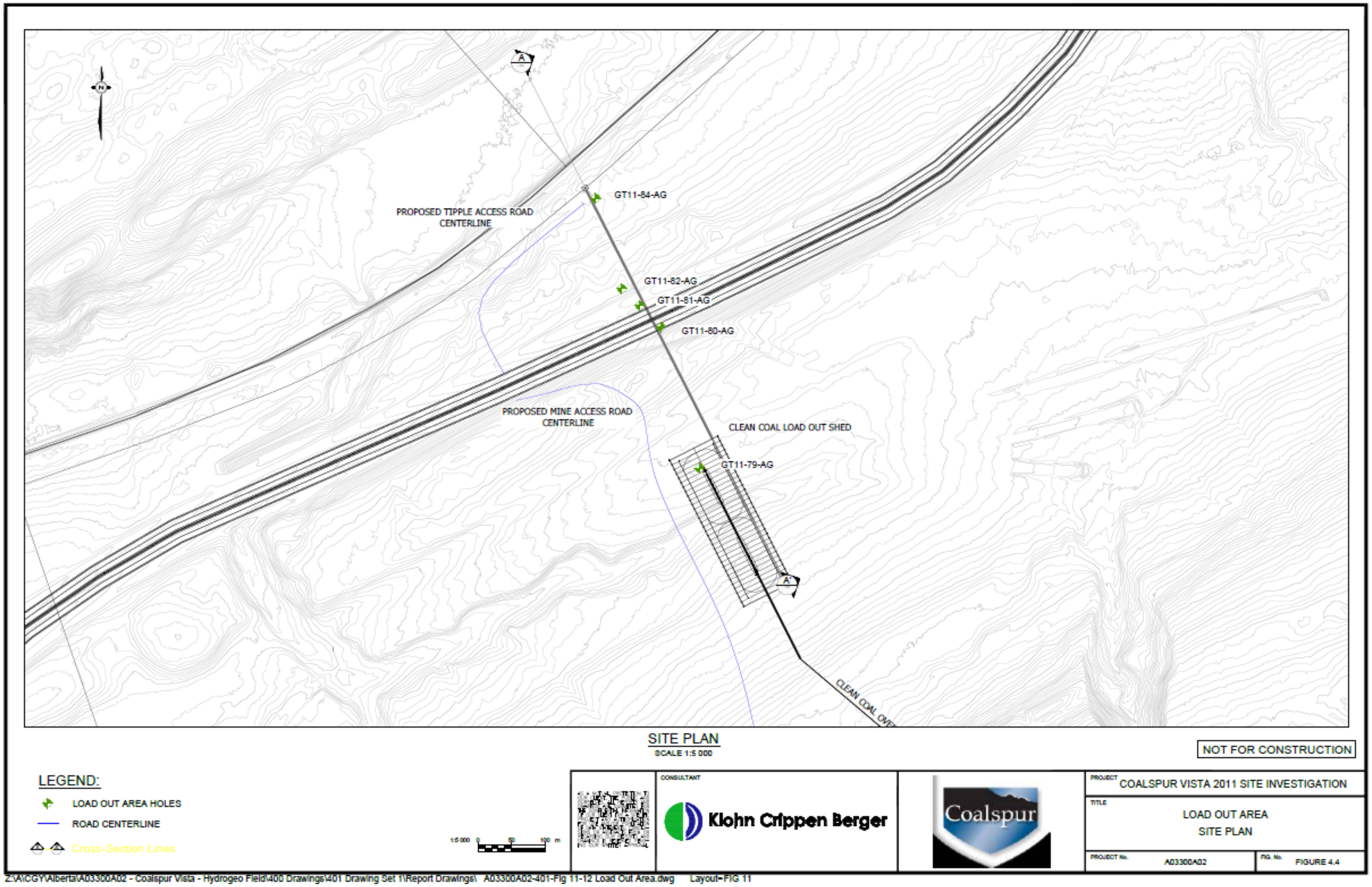


Figure 24.4 2011 site investigation – layout of load out area test holes



Z:\A\CGY\Alberta\A03300A02 - Coalspur Vista - Hydrogeo Field\400 Drawings\401 Drawing Set 1\Report Drawings\ A03300A02-401-Fig 11-12 Load Out Area.dwg Layout=FIG 11

The bedrock component of the site investigation comprised the drilling of rock core holes, rotary tri-cone test holes, in-situ testing during drilling, and the installation of instruments for hydrogeologic assessment. The bedrock drilling investigation comprised the following components:

- rotary coring of 10 test holes comprising continuous coring through bedrock formations, including detailed logging of rock core for geotechnical and hydrogeological assessment, and collection of core samples for laboratory testing
- installation of 46 vibrating wire piezometers in various bedrock units
- packer testing of bedrock units in select test holes
- rotary tri-cone drilling of six test holes, including three angled holes and three pumping well locations
- geophysical logging of 14 test holes
- installation of three pumping wells.

Overburden geotechnical characterization

Laboratory testing of soil samples comprising visual classification, moisture contents, Atterberg limits and grain size distribution including hydrometer tests were undertaken on the overburden material. Grain size analyses on till samples from all soil boreholes indicated approximately 55% to 60% of silt and clay. Atterberg limit test results indicated that the tills range from non-plastic to medium plastic. Characterization of specific site areas and related foundation recommendations are provided below.

Plant site

The subsurface materials in the plant site area generally consist of interbedded hard/dense sand, silt and clay tills with layers of gravel, cobbles and boulders. Bedrock elevations varied from about 13 m below ground level to below the depth of investigation of about 20 m. Shallow bedrock at about 2.5 m to 4.0 m deep was encountered on the west side of the plant site below the proposed clean coal stockpiles.

Water levels in the plant site area varied from about 2.5 m to 10 m below ground surface, with an average of about 6 m. A natural drainage channel is present in the southeast corner of the plant site area.

It is proposed that structures be founded on spread footings or mats due to the presence of boulders in the till that would make piling impractical.

Conveyor corridor

The subsurface materials in the conveyor corridor area between the plant site and the load out beside the highway were generally similar to those at the plant site with interbedded hard/dense sand, silt and clay tills with layers of gravel, cobbles and boulders. Bedrock elevations varied from ground surface to below the depth of excavation. A water level measured in test hole GT11-68 in the corridor indicated a water level of about 5.5 m below the ground surface.

It is proposed that the conveyor structures be skid mounted with ground anchors if needed.

Loadout

The subsurface materials in the loadout area generally consist of an upper layer of compact to dense sand and sand till up to 2.3 m thick overlying hard clay till. In most holes, the clay till extended below the hole depth of 20 m; however in test hole GT11-84, sandstone bedrock was encountered at a depth of 18.4 m. The clay till was described as silty with gravel and cobbles/boulders, and of medium plasticity.

Water levels in the loadout area varied from about 0.9 m to 1.7 m below ground surface; however, these readings were taken shortly after the completion of drilling and may not be representative of the groundwater regime.

Similar to the plant site, it is proposed that the bridge and loadout structures be founded on spread footings or mats due to the presence of boulders in the till that would make piling impractical.

Bedrock geotechnical characterization

Rock quality and rock fracture frequency

The modified Hoek-Brown failure criterion is used determine equivalent angles of friction and cohesive strengths for each rock mass and stress range based on the intact UCS strength, material constants, geological strength index, and disturbance factor. This approach has been adopted by KCB to calculate the estimated rock mass discontinuity shear strengths parameters for the Sandstone, Siltstone and Mudstone units. The shear strength parameters previously used for the glacial till, coal and bentonite in the previous studies are assumed and considered suitable.

Rock quality for the Hinton West, Hinton East and McLeod River blocks are summarised in Table 24.8 and Table 24.9.

Table 24.8 Rock quality for the Hinton West, Hinton East and McLeod River blocks

Rock Type	Rock Quality		
	KCB Data		
	Hinton West	Hinton East	McLeod River
Sandstone	Excellent	Excellent	Good to Excellent
Mudstone	Excellent	Good to Excellent	Fair to Excellent
Siltstone	Excellent	Excellent	Good to Excellent

Table 24.9 Comparison of rock quality designations between historical and KCB data

Rock Type	Rock Quality				
	KCB	Historical	KCB	Historical	KCB
	Hinton West	Hinton East	Hinton East	McLeod River	McLeod River
Sandstone	Excellent	Good	Excellent	Excellent	Good to Excellent
Mudstone	Excellent	Fair	Good to Excellent		Fair to Excellent
Siltstone	Excellent	Fair	Excellent		Good to Excellent

Unconfined compressive strengths

Uniaxial compressive strength (UCS) tests were undertaken on rock core samples representing each rock grade and for each rock type. The average UCS laboratory strength tests for each rock grade and rock type are summarised in Table 24.10.

These UCS laboratory test results have been compared for the average point load UCS values, which have been calculated based on a correlation factor of 23 for all rock types.

Table 24.10 Summary of laboratory UCS strength results

No of tests	Description	Rock Grade	ISRM Intact Rock Strength Classification	Laboratory UCS Results (MPa)			
				Min	Max	Average	SD
1	Mudstone	R1	Very weak			4.6	
10	Mudstone	R2	Weak	6.7	24.5	14.6	5.5
4	Mudstone	R3	Medium strong	25.6	37.6	30.2	5.6
1	Mudstone	R4	Strong			54.2	
7	Sandstone	R2	Weak	14.4	19.0	16.8	1.5
9	Sandstone	R3	Medium strong	25.4	46.6	37.1	8.3
3	Sandstone	R4	Strong	50.7	61.3	57.2	5.7
4	Siltstone	R2	Weak	10.6	20.9	16.5	4.5
3	Siltstone	R3	Medium strong	27.3	46.4	39.4	10.5
2	Siltstone	R4	Strong	50.9	63.7	57.3	9.0

809 UCS rock strengths were estimated from the point load tests. A good correlation was obtained between the average UCS laboratory results and the average UCS strengths from the point load tests results, for rock grades including and below R3 (medium strength rock), indicating that the factor of 23 is reasonable. The average UCS laboratory results for rock grades above R4 (strong rock) showed a lower average UCS laboratory strength, when compared with the average UCS correlated values from the point load test results, indicating that a correction factor of about 20 is more suitable for strong rock.

Geological strength index

The geological strength index (GSI) has been based on the review of historical evidence and the review of the KCB rock cores. A GSI value of 60 has been derived based on “Good, Rough slightly weathered” joint surface conditions and “Blocky - well interbedded undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets” for rock structure.

Rock mass discontinuity shear strength parameters

The rock mass discontinuity shear strength parameters using the Hoek-Brown failure criterion are shown in Table 24.11. The Material Index (mi) values and the modulus ratio (MR) are based on published information for similar rock material types. Experience in the design of slopes in very large open pit mines has shown that Hoek-Brown criterion for undisturbed in situ rock masses (D=0) results in rock mass properties that too optimistic. The effects of heavy blast damage as well as stress relief due to removal of overburden result in disturbance of the rock mass. It is considered that the "disturbed" rock mass using D=1 are more appropriate.

Table 24.11 Estimated rock mass discontinuity shear strength parameters

Description	Rock Grade	UCS (MPa)	Geological Strength Index (GSI)	Material Index (mi)	Disturb Factor (D)	Modulus Ratio (MR)	Cohesion (kPa)	Friction angle, Ø (degrees)
Sandstone	R2	16.8	60	17	1	275	650	26
Sandstone	R3	37.1	60	17	1	275	1500	26
Sandstone	R4	57.2	60	17	1	275	2300	26
Siltstone	R2	16.5	60	7	1	375	500	19
Siltstone	R3	39.4	60	7	1	375	1200	19
Siltstone	R4	57.3	60	7	1	375	1700	19
Mudstone	R1	4.6	60	4	1	250	100	15
Mudstone	R2	14.6	60	4	1	250	350	15
Mudstone	R3	30.2	60	4	1	250	700	15
Mudstone	R4	54.2	60	4	1	250	1300	15

Note: For Sandstone, Siltstone and Mudstone surface conditions are assumed to good and structure is very blocky (interlocked partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets), resulting in "GSI" of 60
For rock slopes, the disturbance factor is taken as 1.0 for all rock types

Table 24.12 shows the design parameters used in the slope stability analysis of the highwall mine slope.

Table 24.12 Design parameters for stability analyses

Material	Rock Grade	Strength Parameters			
		Intact Rock		Discontinuities	
		Friction (°)	Cohesion (kPa)	Friction (°)	Cohesion (kPa)
Glacial Till	n/a			n/a	n/a
Sandstone	R2	26	650	31	20
	R3	26	1500		
	R4	26	2300		
Siltstone	R2	19	500	20	50
	R3	19	1200		
	R4	19	1700		
Mudstone	R1	15	100	18	0
	R2	15	350		
	R3	15	700		
	R4	15	1300		
Coal	n/a	26	3.5	n/a	n/a
Bentonite	n/a	10	0	n/a	n/a

Highwall rock slope stability analysis

The minimum factor of safety, according to “Guidelines for Open Pit Slope Design” by John Read and Peter Stacey; is based on the accepted probability of failure (PoF), the characteristics of the potential instability and the quantity of material, and the cost caused by a potential instability. For slope stability assessments, the factor of safety used for open pit mines slopes is dependent on the operating environment. The values most frequently used range from 1.2 for non-critical slopes to 1.5 for slopes containing critical access ramps or infrastructure such as in-pit crushers.

A target minimum factor of safety of 1.2 has been used in the slope stability assessment. A target minimum factor of safety of 1.0 was adopted for pseudo-static seismic analyses. If the consequence of failure of the pit highwall is taken as medium or high, in the final design, the target minimum factor of safety of at least 1.3 should be used.

Using stratigraphic profiles developed from four boreholes located on the proposed highwall, four slope stability models were developed. A review of the 3D geological model developed for the assessment indicates all rock beds dip in northerly direction and into the highwall. The 3D model data suggests a 3° apparent dip would be the worst case scenario but 6° is considered to be true representation of the dip angle at each location.

For the slope stability models, geological profiles from the core logs were extrapolated in both directions, using an assumed bedding dip angle of 6°. The maximum depth of the mine was taken to include the excavation of the deepest coal seam based on the pit design parameters shown Table 24.13.

Table 24.13 Summary of pit design parameters

Description	Value
Overburden slope angle	2H:1V
Offset distance from top of highwall to toe of overburden slope (m)	7.5
Bench Heights (m)	20
Bench Width (m)	12
Back slope angles (°)	65
Approximate overall slope angle (°)	45
Dip angle of all strata into high wall (°)	6
Angle of shear strength of discontinuity in clockwise direction from horizontal (°)	6
Angle of shear strength of intact rock in anticlockwise direction from horizontal (°)	73

The assumed highwall for analysis comprises about ten 20 m high benches and includes the excavation of the lowest coal seam. As a strip is mined, the existing groundwater table in the highwall is drawn down by seepage into the pit. Seepage occurs through joints and fractures in the rock and coal, some of which occur naturally while others develop from stress relief due to excavation and subsequent expansion of the highwall toward the pit. The natural drawdown effect will increase the stability of the highwall by lowering pore pressures behind the excavated face and increasing effective shear strength. Active depressurization may be required to reduce groundwater pressures at the base of the coal mine and improve stability of the waste dump located at the bottom of the coal mine; this need can be determined through operational monitoring. The phreatic surface used in the stability models is derived from the 3D numerical groundwater modelling performed for the feasibility assessment. The modelled surface for when the coal mine has reached its maximum depth in the year 2044 is used.

The slope stability analyses undertaken on the simplified stratigraphic cross sections at the core hole locations analyzed demonstrate that the pit slope highwall can be excavated as per the proposed design with an acceptable factor of safety due to the very high cross bedding strengths of the bedrock formations.

Footwall stability

The stability of the footwall is governed by the orientation of the discontinuities. At Coalspur, the main structure controlling footwall stability is the bedding plane. Bedding orientation, shear strength properties, and groundwater conditions are the key parameters in the stability of the footwall. Bentonite layers are associated with the coal seam sequences and, as with the highwall, the presence of these weak bentonite layers within the footwall is of significance for stability and these should be removed as far as practical.

The main modes of footwall instability are shear and buckling. Due to the shallow dip angle of the bedding planes, a potential failure is expected to be in the form of sliding and shear towards the high wall toe. Manalta (1981) assessed the footwall stability against buckling and estimated the height of the footwall before failure can be initiated in the footwall. Manalta concluded that for the gentle footwall slopes at Coalspur, any failure due to buckling will be in the form of gradual sliding towards the toe resulting in operational issues rather than a safety concern.

Groundwater control is critical in stabilizing footwall slopes. In the presence of high pore water pressure in the footwall, the factor of safety against potential failure modes could significantly decrease. Footwall dewatering is required to minimize the potential footwall instabilities. This is normally controlled by pumping from in-pit sumps.

Based on the current mine design, stability analyses were conducted for the footwall area with the following assumptions:

- The pit floor slopes at 10° into the highwall.
- All bentonitic material is removed from the pit floor prior to spoil placement (i.e. no weak materials exist on the pit floor at the end of mining).
- The spoil material has a friction angle of 30° with a cohesion value of 10 kPa.
- The dragline sits on a 30 m wide spoil bench about 25 m above the pit floor with a 35° slope to the toe.
- A small degree of groundwater recharge has occurred in the spoil pile.

The analyses indicated that the calculated factor of safety was greater than 1.1 for this condition.

Dump design criteria

There will be opportunities to backfill the pit with waste rock when exposed final pit floor becomes available from mining. Until then, waste rock will be placed on waste dumps located on the north and south sides of the pit.

On the north side of the pit, the toe of the dump will be offset from the pit crest by a minimum distance of 200 m. Waste dumps located on the south side will be offset from McPherson Creek by a minimum distance of 100 m. These offset distances are preliminary, and may be adjusted upon further geotechnical evaluations in future studies.

The waste dump design parameters are summarised in Table 24.14.

Table 24.14 Waste dump slope parameters

Description	Parameters
Overall Active Dump Slope, External Dumps	35˚
Final Slope, Backfilled Dumps	35˚
Final Overall Reclaimed Slope, External Dumps	2:1
Min. Offset Distance – Pit Crest to Dump	200 m
Min. Offset Distance – Dump Toe to McPherson Creek	100 m

Several sites have been considered for waste rock placement. End dumping will result in 35° to 37° slopes which is the angle of repose of the fill and will be reclaimed to 27° (2H:1V slope). Dump stability is strongly dependent on proper drainage of the dump and requires placement of a drainage blanket made of a coarse, free draining material at the base of the dump. The drainage blanket can be achieved by natural segregation coarser material through end dumping.

In addition, the strength of the foundation soil should be taken into account in designing the maximum height of the subsequent lifts. Foundation soil failure could occur as a result of:

- excessive high loading in one lift
- rapid loading between subsequent lifts without allowing sufficient time for excess pore pressure to dissipate
- lack of proper drainage of the fill material resulting in excess pore pressure build up in the foundation soil
- formation of freeze-thaw interface as a result of thawing of frozen ground on which waste rock has been dumped over winter time.

Previous design studies suggested a maximum vertical height for any lift of 25 m and maximum total dump height of 60 m from crest of dump to toe (at soil foundation). Also, a minimum height of 15 m has been considered to ensure segregation of the basal coarse materials from the fill as a drainage blanket at the base of the dump.

Proper drainage and sufficient time between subsequent fills (minimum 6 months) must be implemented to allow dissipation of excess pore pressure from the fill and to ensure stability of the waste dump. No poor quality waste rock or bentonite or bentonitic rock materials should be placed as the drainage blanket material at the base of the dump.

Deformation monitoring should be implemented in the waste rock dump to assess dump performance during and after construction.

The current waste rock dump design employed in this study adheres to the requirements as have been recommended in the previous investigations. Based on the current level of knowledge and understanding about waste dump foundation conditions, the design criteria as employed in the current mine design is considered acceptable at this stage. Further site investigations are however, required to confirm the geotechnical characteristics of the waste rock dump soil foundations for detailed level design studies.

24.2.5 Hydrogeology assessment

Surficial hydrogeology

The surficial hydrogeological component of the site investigation included the installation of 39 standpipe piezometers, development of installed piezometers, and in-situ hydraulic conductivity testing of 18 piezometers. The majority of the standpipes were screened in various types of glacial till with some installed in bedrock units and isolated gravel units. The glacial till encountered across the site was heterogeneous and ranged in hydraulic conductivity from 3.77×10^{-9} to 2.17×10^{-4} m/s.

Glacial till is the predominant soil unit present across the Vista site, consisting of interbedded compact to hard sand, silt, and clay tills with layers of gravel, cobbles, and boulders. Bedrock depths vary across the site with rafted bedrock units common. The regional surficial geology consists mainly of an upper layer of muskeg, ranging from 0.1 m to 0.5 m thick underlain by glacial till and bedrock.

No significant surficial aquifer systems were identified during the investigation. Sand and gravel units encountered were infrequent and discontinuous across the investigated areas. Groundwater in these units appears to be confined and the water levels measured are not indicative of the regional groundwater table. The major site-wide surficial water bearing unit was identified as the glacial till unit, with minor perched and confined units observed. The heterogeneous nature of glacial till unit creates an aquifer system that does not appear to be laterally extensive or continuous, leading to variability in the water table.

Surficial groundwater flow direction in the McLeod River Block area was determined to be towards the southeast. The flow direction follows the topography which slopes towards McPherson Creek, in the southeast. This flow direction is also consistent with the findings of the Manalta, 1981 investigation, which is based on the interpretation of resistivity logs. In the western part of the project area, the groundwater flow in the overburden is towards the west, southwest and south directions. The water table is generally about 5 m below ground level except at the upland areas in the northwest and the southeast areas of McLeod River Block where the water table is found at approximately 12 to 17 mbgs. The groundwater flow system commonly exhibits topographical control in the overburden.

Bedrock hydrogeology

Previous studies (Wardrop, 2011) indicated two distinct groundwater flow systems within the lease area. The first is a deep, regional flow system found at depths of greater than 150 m. The second system is of local extent and is characterized by shallow groundwater flow (usually less than 150 m deep) through fractured sandstones and coal. This appears to be confirmed by a pumping test carried out at GT11-04-PW, installed in the sandstone formation between 50 m and 80 m below ground level. This sandstone appears to belong to the Paskapoo Formation. Groundwater flow in the sandstone appears to be mainly controlled by a fracture system, as indicated by extensive oxidation of fractures found in the core samples. Drawdown was not observed in any of the overburden wells during pumping of GT11-04-PW suggesting limited hydraulic connectivity of bedrock formation with the overburden. No drawdown was observed in the core holes located within a radius of 2 km. Drilling and hydraulic testing results of GT11-05-PW and GT11-09-MW indicated low permeability in the McPherson coal seam and the sandstone between the McLeod and McPherson coal seams.

The inferred groundwater flow in most of the formations – Paskapoo sandstone, Val d'Or coal seam, McLeod coal seam, sandstone unit between McLeod and McPherson and McPherson coal seam is generally towards the east and southeast in the project area, with some localalised west and north components. The measured groundwater elevations in the above formations range from 1083 masl to 1330 masl. Based on the packer testing, the hydraulic conductivity of bedrock formations ranges between $1.10\text{x}10^{-8}$ to $1.60\text{x}10^{-6}$ m/sec. Transmissivity of sandstone aquifer in bedrock was calculated from pumping test and is in the order of 84 m^2/day. The Storage coefficient was measured as $8.3\text{x}10^{-5}$. The pumping test well yield of 320 L/min appears to be sustainable over a period of 50 years ignoring the potential effects of unknown boundary conditions.

Based on the current study and previous information, the sandstone of Paskapoo formation and Val d'Or coal seams should be the main targeted formations for dewatering design. The results of the 2011 site investigation suggest that the upper sandstone units in the Vista area represent a potential water supply source for the planned mine operation.

Groundwater modelling

In support of the geotechnical and hydrogeological design components, a 3D numerical groundwater model was constructed for the Vista Project. The finite element numerical modelling code FEFLOW was selected to simulate the groundwater environment and mine dewatering requirements, with the 15 layer MINCOM hydrostratigraphic model providing the basis for layer discretization in the FEFLOW model.

The model domain boundaries are the Athabasca River to the west and the McLeod River to the east, beyond Coalspur Formation subcrop beneath till cover to the south, and a northern boundary down dip, 6 km to 12 km beyond the mine area. This domain was used for development of the MINCOM stratigraphic modelling and the subsequent numerical model domain.

Scenarios simulating the development of the open pit mine, the consequent inflows to the pit, and the resulting drawdown in the various aquifers, were run for nine time-steps of mine development, starting in 2015 and ending in 2044.

Model results show that pit inflows begin at about 25 l/s and increases fairly steadily to around 200 l/s by year 2023. After this, a period of relative stability is evident to 2035, when pit inflow again increases to about 250 l/s by 2040, and to marginally more than 300 l/s at the end of mining. These results compare favourably with data from other existing operations in the region.

Limitations of the modelling include:

- limited groundwater level data to confirm the northern model boundary conditions.
- Model topography does not include the construction of waste rock stockpiles, PFSPs and water storage ponds, which may affect local groundwater levels and recharge conditions.
- The sparse distribution of groundwater level monitoring data outside the pit area limits the accuracy of the groundwater model and the dewatering estimates.
- The model does not include consideration of developing additional groundwater supplies for ore processing. Any additional groundwater withdrawal within the model domain is likely to impact pit inflow estimates.

24.2.6 Regional hydrology

General

The climate at the Vista Coal project site is continental, with most runoff occurring during the spring snowmelt. Temperatures typically range between the mean daily maximum temperature in July of 21.5°C and the mean daily minimum temperature in January of -16.3°C. The extreme maximum observed historical temperature was 33°C recorded in September 1988, and the extreme minimum was -45.5°C in February 1989.

Mean annual precipitation is 637 mm, consisting of 454 mm of rainfall and 200 cm of snowfall. On average, there are 122 days with measurable precipitation per year. The greatest observed daily rainfall depth was 87.6 mm, recorded in August 1969.

Rainfall

The nearest Environment Canada climate station with published Intensity-Duration-Frequency (IDF) values is Edson A (Station no. 3062244; elevation 927 m). Site IDF values were estimated to be 10% higher than at Edson A because the site is at a higher elevation and closer to the mountains. Resulting IDF estimates for the site are shown in Table 24.15.

Table 24.15 IDF estimates for the vista coal site

Duration	Return Period (years)						PMP
	2	5	10	25	50	100	
	Rainfall Depth (mm)						
5 min	7.6	10.8	12.9	15.4	17.4	19.3	69.2
10 min	11.1	14.7	17.2	20.1	22.4	24.6	88.6
15 min	13.6	17.6	20.2	23.5	26.0	28.5	102
30 min	16.3	21.1	24.3	28.4	31.5	34.4	124
1 h	18.5	24.3	28.3	33.2	37.0	40.6	146
2 h	21.7	29.2	34.1	40.4	45.1	49.7	179
6 h	28.8	35.5	39.9	45.5	49.7	53.8	193
12 h	38.5	48.5	55.2	63.6	69.9	76.0	273
24 h	51.5	64.9	73.8	85.0	93.4	101.6	366
2 day							553
3 day							631

Probable maximum precipitation (PMP)

The site Probable Maximum Precipitation (PMP) was estimated as the average of Environment Canada PMP estimates for two nearby climate stations, Entrance and Robb RS. PMP estimates for durations less than 24 hours were obtained by extending the IDF values for Edson A by the ratio of the 1-day PMP to the 24-hour, 1:100 year rainfall. PMP estimates for the site are included in Table 24.15.

Runoff

Water yield

Monthly runoff from natural land in the project area was estimated by transposing historical streamflow data from the Water Survey of Canada (WSC) station Wampus Creek near Hinton (Station no. 07AF003). The transposition was based on the station catchment area of 25.9 km^2 and a mean annual runoff depth at the project site estimated to be 182 mm based on other regional data and on preliminary results of site-specific hydrometric monitoring.

24.2.7 Instrumentation and management

Pit and dump slope monitoring

Slope monitoring instrumentation should be installed around the crest of the pit prior to and during excavation of the high wall. Instrumentation should include the following:

- prisms
- slope wireline extensometers and inclinometers.

The focus of the instrumentation program should be along the pit high wall at the crest and along lower benches, endwalls, and footwall.

Overburden groundwater monitoring

It is recommended that nested piezometers are installed in boreholes along the pit high wall within 50 m of the advancing crest and at the footwall to monitor the effectiveness of the dewatering program in place. The boreholes should be inclined towards the pit, sub-parallel to pit walls. Each borehole should be completed with three transducers installed throughout the length of the borehole to provide information about pore water pressure behind the pit high wall.

An instrumentation and monitoring plan will be required to assess performance of the processed fines impoundment dams and to provide adequate warning of problem conditions. The key objectives of instrumentation and monitoring plan are to monitor:

- deformation at a sufficiently close spacing to detect any significant dyke movement either in the fill or in the foundation
- pore pressures in each of the key materials to verify that the stress-induced pore pressures are within the design range
- pore pressure under the downstream part of the dyke to identify any areas of high pressure that might lead to instability.

Instrumentation benches will be provided approximately every 15 m vertically on the downstream sides of all external dykes. These benches will be about 7 m wide. Initially instrumentation lines will be spaced approximately 500 m apart along the dyke. Closer spaced sections may be adopted in critical areas identified in subsequent investigation programs. The instrumentation will include:

- 85 mm diameter slope inclinometer casing installed to various depths up to 100 m with an average depth of approximately 50 m below the original ground level to measure horizontal movements
- vibrating wire piezometers typically installed in the surficial till layers to measure foundation pore pressures
- survey monuments on the crest and downstream slopes to permit the measurement of horizontal and vertical movements at the surface.

Any instrumentation installed in the dam during the ongoing construction phase will require an extension as the dam is built higher, due to the downstream construction methodology. Inclinometers will be extended until they are shifted to the upstream slope of the dam. Prior to inundation by the pond, the inclinometers on the upstream slopes of the dams will be grouted and decommissioned.

24.2.8 Residual risks and mitigation

Processed fines storage ponds

The preliminary PFSP slope stability analyses based on the current level of knowledge and understanding of the dyke foundation conditions and using the design criteria employed in the current mine design is considered acceptable at this stage. Further site investigations are, however, required to confirm the geotechnical characteristics of the PFSP for detailed level design studies.

Highwall assessment

Current limitations of the slope stability analyses conducted include:

- No kinematic analysis of local bench stability or highwall stability has been undertaken to date.
- No Direct shear testing along fracture and bedding planes has been currently undertaken and needs to be undertaken for the local highwall and bench stability calculations.
- Insufficient rock core hole test holes have been undertaken in the highwall to cover the full length of the coal mine opencast highwall. There are areas where no rock core test holes have been undertaken in back of highwall. This is especially important in areas where significant bentonite layers have been encountered elsewhere, such as in rock core test holes GT11-06A-CH, GT11-07-CH and GT11-08-CH, which found bentonite layers as follows:

  GT11-06A-CH Depth 57.2 to 59.1 m bgs, 1.9 m thickness

  GT11-07-CH Lots of small thicknesses of bentonite , interbedded between coal seams, between 47.6 to 54.9 m bgs.

  GT11-07-CH has a bentonitic layer between 60.5 to 64.4 m bgs (Thickness of 3.9 m)

  GT11-08-CH has a bentonitic layer between 32.0 to 35.8 m bgs (Thickness of 3.8 m)

- Most rock core test holes were drilled vertically, which biases the results of the bedding and fractures. It also biased against finding sub vertical and vertical orthogonal sets. The 2011 KCB data and historical data have some conflicting information, with regards to fracture and bedding orientations.
- The northwest pit area advances along a different aspect to the rest of the pit and in a direction that may result in the highwall orientation being coincident with regional structural features. Pit stability analyses have not been conducted for this portion of the pit and data on structural geology and geotechnical characteristics for this area are limited. The resultant risk is that the pit slope angles may need to be shallower due to the regional faulting angles.

The recommendations for further drilling are:

- Further drilling of inclined rock core test holes through the highwall along the whole length of the proposed opencast highwall, with all rock core holes to be geophysically surveyed to check orientation and to be ATV surveyed to confirm the fractures joints and bedding inclination and orientation.
- Comprehensive review and assessment of geological model
- Further UCS and triaxial rock core testing

Groundwater supply

Given that water supply is a critical issue to the mine, further investigation is warranted given the uncertainties associated with fractured rock hydrogeology. The following actions are recommended:

- Installation of five pumping wells in the upper sandstone in locations expected to serve as permanent water supply wells. The wells would be installed at intervals spaced several hundred metres apart to test the spatial variability of the upper sandstone unit.
- A staggered series of pumping tests to determine the well yields, flow boundaries and effects of overlapping drawdown. A 30 day period is recommended for the testing period.

25 Interpretation and Conclusions

On the basis of the results of the feasibility study and this review of the additional work completed to date it is concluded that:

- The Vista Coal Project has sufficient (quantity and quality) open pit Coal Resources to yield 11.5 Mtpa of saleable thermal coal products to the international coal market at full production, with a mine life of 30 years.
- There are sufficient *Proved* Coal Reserves to cover the capital investment payout period of 7.9 years.
- The project, with all related infrastructure requirements included, is technically and economically feasible.
- Sensitivities to the project design assumptions indicate that the project economics are robust, however the project is most sensitive to coal price and exchange assumptions
- The revised operating and contracting strategy has significantly de risked the project to capital and operating cost exposure
- With the continued refinement of the operating philosophy a more detailed mine plan be completed to evaluate alternative mining systems and fully evaluate the cost benefit of draglines. Conventional truck shovel terrace style mining may potentially allow more rapid reclamation, smaller out of pit waste dumps, more flexible mining for product optimisation, and ultimately reduce mining costs

26 Recommendations

The following recommendations are for refinement and optimisation during detailed design. The conclusions of this technical report are not contingent upon positive results of the recommendations below.

It is recommended that:

- a comprehensive plan to address the AER recommendations and conditions is formulated
- a more detailed mine plan be completed to evaluate alternative mining systems to draglines that may potentially allow more rapid reclamation, smaller out of pit waste dumps, more flexible mining for product optimisation, and reduce mining costs
- further work to characterize the properties of the processed fines for the Vista Mine should be undertaken
- belt press filters be progressed to reduce or eliminate the need for tailings ponds
- further fines flotation tests are carried out to support the decision not to install a flotation circuit
- the down dip seam quality data trending from drilling carried out in 2011 be confirmed and incorporated in modelling
- the understanding of the hydrogeological conditions in the Vista mine should be upgraded particularly in the area of the CHPP centreline alignment, and sonic boreholes should be drilled along the proposed dam alignments to obtain geotechnical information from the surficial soils and determine the depth to bedrock
- a groundwater management plan should be instituted prior to construction to understand and design the system
- evaluation of additional clean coal storage facility be continued as contingency

27 References

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28 Certificates of Qualified Persons

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QUALIFIED PERSON'S CONSENT FORM

Pursuant to the requirements of National Instrument 43-101
Part 8.3 (Consents of Qualified Persons)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

David Lawrence,

(*Insert full name(s)*)

confirm that I am the Qualified Person for the Report and:

- I have read and understood the requirements of the National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI43-101) and Form 43-101 F1 *Technical Report*.
- I am a Qualified Person as defined by the Instrument, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the *Australian Institute of Mining and Metallurgy*.
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Coal Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[David Lawrence]	28 March 2014
Signature of Competent Person:	Date:
Australian Institute of Mining and Metallurgy	**104237**
Professional Membership: *(insert organisation name)*	Membership Number:
[Luisa Perez]	Luisa Perez, Vancouver Canada
Signature of Witness:	Print Witness Name and Residence: e.g. town/suburb

COMPETENT PERSON'S CONSENT FORM

Pursuant to the requirements of ASX Listing Rules 5.6, 5.22 and 5.24 and
Clause 8 of the JORC Code 2004 Edition (Written Consent Statement and
Clause 9 of the JORC Code 2012 Edition (Written Consent Statement)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

David Lawrence

(*Insert full name(s)*)

confirm that I am the Competent Person for the Report and:

- I have read and understood the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).
- I am a Competent Person as defined by the JORC Code, 2012 Edition, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a Member or Fellow of *The Australasian Institute of Mining and Metallurgy* or the *Australian Institute of Geoscientists* or a 'Recognised Professional Organisation' (RPO) included in a list promulgated by ASX from time to time.
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[David Lawrence]	28 March 2014
Signature of Competent Person:	Date:
Australian Institute of Mining and Metallurgy	**104237**
Professional Membership: *(insert organisation name)*	Membership Number:
[Luisa Perez]	Luisa Perez, Vancouver Canada
Signature of Witness:	Print Witness Name and Residence: (eg town/suburb)

QUALIFIED PERSON'S CONSENT FORM

Pursuant to the requirements of National Instrument 43-101
Part 8.3 (Consents of Qualified Persons)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

Grant van Heerden,

(*Insert full name(s)*)

confirm that I am the Qualified Person for the Report and:

- I have read and understood the requirements of the National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI43-101) and Form 43-101 F1 *Technical Report*.
- I am a Qualified Person as defined by the Instrument, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the *Geological society of South Africa* and I am a Registered Professional Geologist, *Pr.Sci*.Nat., with the *South African Council for Natural Scientific Professions*, registration number 400076/03.
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Coal Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Exploration Results and Mineral Resources.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Grant Van Heerden]	28 MARCH 2014
Signature of Competent Person:	Date:
Geological Society of South Africa **South African Council for Natural Scientific Professions**	**964585** **400076/03**
Professional Membership: *(insert organisation name)*	Membership Number:
Signature of Witness:	Print Witness Name and Residence: e.g. town/suburb

COMPETENT PERSON'S CONSENT FORM

Pursuant to the requirements of ASX Listing Rules 5.6, 5.22 and 5.24 and Clause 8 of the JORC Code 2004 Edition (Written Consent Statement and Clause 9 of the JORC Code 2012 Edition (Written Consent Statement)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

Grant van Heerden,

(Insert full name(s))

confirm that I am the Competent Person for the Report and:

- The information pertaining to this report was first disclosed under the JORC Code 2004. It has been not been updated since to comply with JORC Code 2012 on the basis that the information has not materially changed since it was last reported.
- I have read and understood the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).
- I am a Competent Person as defined by the JORC Code, 2012 Edition, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the Geological Society of South Africa and I am a Registered Professional Geologist, Pr.Sci.Nat., with the South African Council for Natural Scientific Professions, registration number 400076/03 (each a 'Recognised Professional Organisation (RPO) included in a list promulgated by ASX from time to time).
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Grant Van Heerden]	28 MARCH 2014
Signature of Competent Person:	Date:
Geological Society of South Africa **South African Council for Natural Scientific Professions**	**964585** **400076/03**
Professional Membership: *(insert organisation name)*	Membership Number:
Signature of Witness:	Print Witness Name and Residence: (eg town/suburb)

QUALIFIED PERSON'S CONSENT FORM

Pursuant to the requirements of National Instrument 43-101
Part 8.3 (Consents of Qualified Persons)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

Ross Broadly,

(*Insert full name(s)*)

confirm that I am the Qualified Person for the Report and:

- I have read and understood the requirements of the National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI43-101) and Form 43-101 F1 *Technical Report*.
- I am a Qualified Person as defined by the Instrument, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the *Australian Institute of Mining and Metallurgy*.
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Coal Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Ross Broadley]	28 March 2014
Signature of Competent Person:	Date:
Australian Institute of Mining and Metallurgy	**107241**
Professional Membership: *(insert organisation name)*	Membership Number:
[Nina McGranth]	Nina McGranth, Brisbane Australia
Signature of Witness:	Print Witness Name and Residence: e.g. town/suburb

COMPETENT PERSON'S CONSENT FORM

Pursuant to the requirements of ASX Listing Rules 5.6, 5.22 and 5.24 and
Clause 8 of the JORC Code 2004 Edition (Written Consent Statement and
Clause 9 of the JORC Code 2012 Edition (Written Consent Statement)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

Ross Broadley

(*Insert full name(s)*)

confirm that I am the Competent Person for the Report and:

- The information pertaining to this report was first disclosed under the JORC Code 2004. It has been not been updated since to comply with JORC Code 2014 on the basis that the information has not materially changed since it was last reported.
- I have read and understood the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).
- I am a Competent Person as defined by the JORC Code, 2012 Edition, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a Member or Fellow of *The Australasian Institute of Mining and Metallurgy* or the *Australian Institute of Geoscientists* or a 'Recognised Professional Organisation' (RPO) included in a list promulgated by ASX from time to time.
- I have reviewed the Report to which this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Ross Broadley]	28 March 2014
Signature of Competent Person:	Date:
Australian Institute of Mining and Metallurgy	**107241**
Professional Membership: *(insert organisation name)*	Membership Number:
[Nina McGrath]	Nina McGrant, Brisbane Australia
Signature of Witness:	Print Witness Name and Residence: (eg town/suburb)

QUALIFIED PERSON'S CONSENT FORM

Pursuant to the requirements of National Instrument 43-101
Part 8.3 (Consents of Qualified Persons)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

March 2014

(Date of Report)

STATEMENT

I,

Paul Raymond Franklin,

(*Insert full name(s)*)

confirm that I am the Qualified Person for the Report and:

- I have read and understood the requirements of the National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI43-101) and Form 43-101 F1 *Technical Report*.
- I am a Qualified Person as defined by the Instrument, having five years experience that is relevant to the style of mineralisation and type of deposit described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the *Association of Professional Engineers of Saskatchewan*.
- I have reviewed the relevant Sections 21 and 22 of the Report to witch this Consent Statement applies.

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Coal Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Paul Raymond Franklin]	March 28, 2014
Signature of Competent Person:	Date:
Association of Professional Engineers of Saskatchewan	**04998**
Professional Membership: *(insert organisation name)*	Membership Number:
[Mark Dahlem]	Mark Dahlem Saskatoon, Saskatchewan
Signature of Witness:	Print Witness Name and Residence: e.g. town/suburb

COMPETENT PERSON'S CONSENT FORM

Pursuant to the requirements of ASX Listing Rules 5.6, 5.22 and 5.24 and
Clause 8 of the JORC Code 2004 Edition (Written Consent Statement and
Clause 9 of the JORC Code 2012 Edition (Written Consent Statement)

Report name

Vista Coal Project NI43-101 Independent Technical Report

(*Insert name or heading of Report to be publicly released*) ('Report')

Coalspur Mines Limited

(*Insert name of company releasing the Report)*

Vista Coal Project

(Insert name of the deposit to which the Report refers)

If there is insufficient space, complete the following sheet and sign it in the same manner as this original sheet.

March 2014

(Date of Report)

STATEMENT

I/Paul Raymond Franklin,

(*Insert full name(s)*)

confirm that I am the Competent Person for the Report and:

- I have read and understood the requirements of the National Instrument 43-101 *Standards Disclosure for Mineral Projects* (NI43-101) and Form 43-101 F1 *Technical Report*.
- I am a Qualified Person as defined by the Instrument, having five years experience that is relevant to the sections 21 and 22 as described in the Report, and to the activity for which I am accepting responsibility.
- I am a member in good standing of the Association of Professional Engineers of Saskatchewan.
- I have reviewed the relevant Sections 21 and 22 of the Report to which this Consent Statement applies.
-

I am a full time employee of

Snowden Mining Industry Consultants Pty Ltd

(Insert company name)

and have been engaged by

Coalspur Mines Limited

(Insert company name)

to prepare the documentation for

the Vista Project

(Insert deposit name)

on which the Report is based, for the period ended

March 2014

(Insert date of Resource/Reserve statement)

I have disclosed to the reporting company the full nature of the relationship between myself and the company, including any issue that could be perceived by investors as a conflict of interest.

I verify that the Report is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

CONSENT

I consent to the release of the Report and this Consent Statement by the directors of:

Coalspur Mines Limited

(Insert reporting company name)

[Paul Raymond Franklin]

Signature of Competent Person:

March 28, 2014

Date:

Association of Professional Engineers of Saskatchewan

Professional Membership:
(insert organisation name)

04998

Membership Number:

[Mark Dahlem]

Signature of Witness:

Mark Dahlem
Saskatoon, Saskatchewan

Print Witness Name and Residence:
(eg town/suburb)