Atrum Coal

Emerging metallurgical coal explorer

ASX Release

22 January 2019

Additional 201Mt JORC Resources defined for Elan Hard Coking Coal Project

HIGHLIGHTS

- **Palaris Australia Pty Ltd ("Palaris") reviewed the records and data of extensive historical exploration and updated the geological models for all Elan Coal project areas outside Elan South ("northern Elan tenements") to define JORC Resources and coal quality. The northern Elan tenements contain resource areas that have been historically called Savanna, Isolation, Isolation South, Isola and Wild Cat etc.**
- **A total JORC resource of 201Mt (39Mt Indicated and 162Mt Inferred) is estimated for the northern Elan tenements of Elan Coal. These resources are in addition to the recently announced 97Mt JORC resource estimate for Elan South (see ATU ASX release, 8 January 2019).**
- **Historical coal quality testing on core samples, as well as bulk sample testing on washability and coke oven tests, indicates strong potential for hard coking coal products with high coke stability from these areas.**
- **With total JORC resources of 298Mt (70Mt Indicated and 228Mt Inferred), the Elan Project is now confirmed to possess large, high quality hard coking coal deposits that warrant accelerated progression towards development.**
- **In particular, the potential for the Elan Project to deliver multiple hard coking coal mine operations is increasingly evident.**
- **Expanded exploration in key strategic areas of the Elan Project is now being planned for the 2019 field season.**

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Key Projects

Groundhog	Ownership:	100%
Elan	Ownership:	100%
Bowron River	Ownership:	100%

Atrum Coal Ltd ("**Atrum**" or the "**Company**") (**ASX: ATU**) is pleased to provide updated JORC resource estimates for areas of its 100%-owned Elan Hard Coking Coal Project in southwest Alberta, Canada ("**Elan Project**" or "**Elan**").

These updated estimates are for all project areas outside of Elan South (and referred to as the **"northern Elan tenements"**). They are therefore in addition to the recently updated JORC resource estimate for Elan South, which represents just one of the targeted development areas at Elan (refer Atrum ASX release, *Elan South Hard Coking Coal Resource Increased by 170% to 97Mt,* 8 January 2019).

Non-Executive Chairman, Charles Blixt, commented: *"We are very pleased to announce significant increases in the JORC resource estimates for the northern tenements of our Elan Hard Coking Coal Project. These updated estimates come right on the heels of our recently updated JORC resource estimate for Elan South, which was driven by a highly successful 2018 field program.*

"The updated JORC resource estimates for the northern Elan tenements were the result of our geological consultant, Palaris Australia, reviewing and modelling a large amount of data from decades of historical exploration campaigns within the properties. The combined 201Mt of Indicated and Inferred resources at the northern Elan tenements, in addition to the 97Mt of Indicated and Inferred resources at Elan South, confirm that the Elan Project holds substantial hard coking coal resources.

"We are equally excited by the results of the coal quality review on historical testwork programs – indicating the coal from the northern Elan tenements is capable of producing high saleable yield, low sulphur, hard coking coal. These results further validate Atrum's vision of developing the Elan Project into a multi-mine premium hard coking coal operation, with development of Elan South targeted first.

"Separately, detailed coal quality testing on Elan South core continues as planned and we are on track to release the full results upon completion in the coming weeks."

About the Elan Hard Coking Coal Project

The Elan Project is located in the Crowsnest Pass area of Alberta, Canada. It consists of several project areas which are known to contain shallow emplacements of high quality hard coking coal of the Mist Mountain Formation (Kootenay Group). The Elan Project has a significant areal footprint comprising 27 coal exploration tenements spread over a 50 x 20 km zone and totalling approximately 22,951 ha (229.5 square kilometres).

Less than 40km to the west of the Elan Project, Teck Resources Ltd operates five mines, also in the same Mist Mountain Formation, producing approximately 25 Mt per annum of predominantly hard coking coal for the global steel industry. The coal seams at Elan correspond directly to those horizons of the same Mist Mountain Formation found in the Teck Resources' hard coking coal mines, and have similar rank ranges.

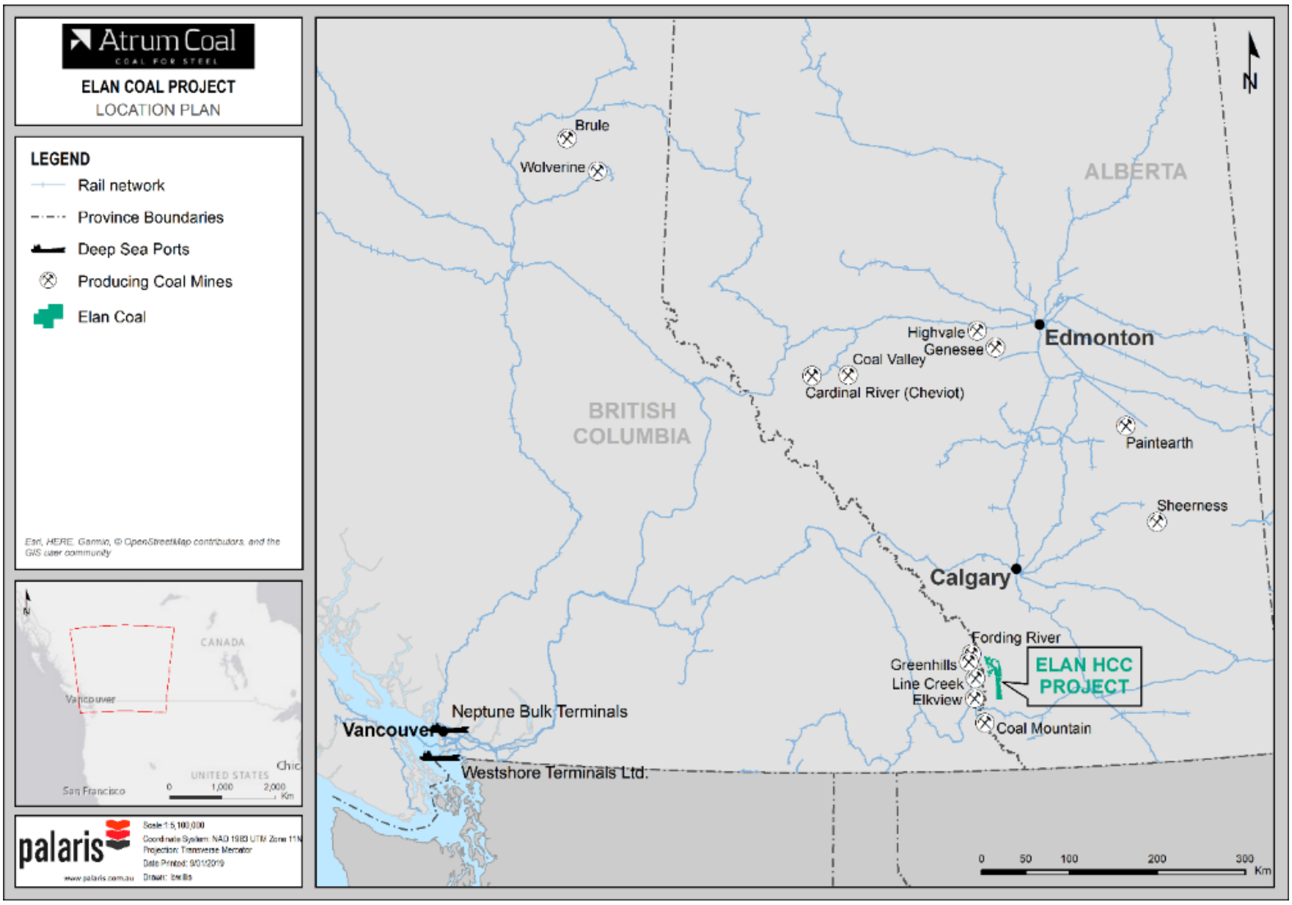

Figure 1: Location of the Elan Project

The southernmost area within the Elan Project is Atrum's flagship Elan South area. This is located approximately 13 km north of the townships of Coleman and Blairmore, where an existing rail line operated by Canadian Pacific Railway provides direct rail access to export terminals in Vancouver and Prince Rupert.

Elan South shares its southern boundary with Riversdale Resources' flagship Grassy Mountain Project, which is in the final permitting stage for a 4.5 Mtpa open cut operation producing hard coking coal. The current Grassy Mountain resource estimate totals 195 Mt, with 85 Mt Measured and 110 Mt Indicated classification (see Riversdale Resources' Annual Report 2018).

Australian company, Hancock Prospecting acquired 19.99% of Riversdale Resources in August 2018 for A$68.9 million cash. In September 2018 it then maintained that percentage equity holding by investing another A$30.4 million cash via anti-dilution rights. This total investment of A$99.3 million (for a 19.99% equity interest) effectively values Riversdale Resources at approximately A$500 million.

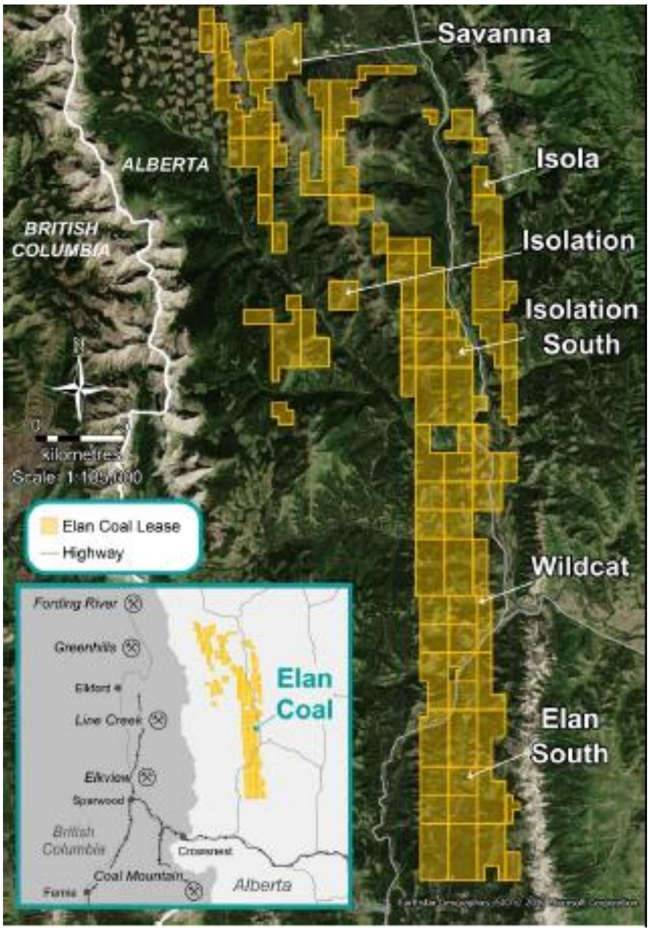

Figure 2: Location and project areas of the Elan Project

Historical Exploration at the Elan Project

Prior to Atrum's acquisition of the Elan Project, its prior owner, Elan Coal Ltd, and its consultant, Dahrouge Geological Consulting Ltd (**"Dahrouge"**), had collected and compiled a large amount of data on historical exploration work spanning five decades from the late 1940's to early 2000's. A resource estimate of 146.5Mt for the Elan Project (61.9Mt Indicated and 84.6Mt Inferred) was also estimated by Dahrouge in accordance with the Canadian National Standard of NI43-101, as reported by Atrum to the ASX on 23 August 2017.

The data set was transferred to Atrum after the Elan Project acquisition. Palaris Australia (**"Palaris"**) was retained by Atrum to review, analyse and remodel the geological data in order to update the JORC resource estimates for the Elan Project. Most of the historical exploration occurred north of Elan South and the updated resource estimates in this release are for the northern Elan tenements (i.e. for all Elan Project areas outside of Elan South). The updated resources in this release are in addition to the recently updated Elan South resource (97Mt) that was released to the ASX by Atrum on 8 January 2019.

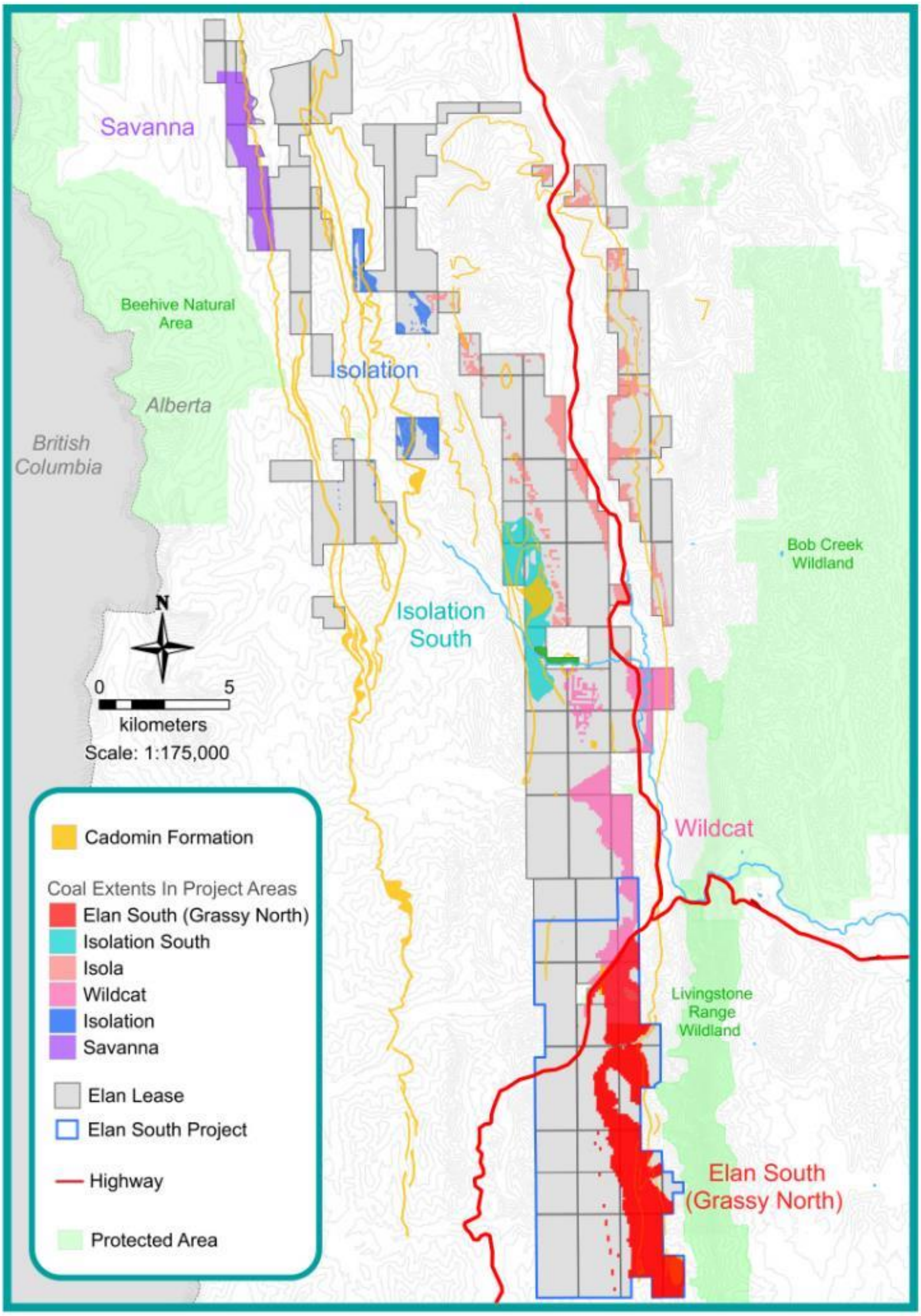

Figure 3: Elan Project areas - Mist Mountain Formation coal extent (from Dahrouge, 2013)

Historical exploration data available includes regional drilling and other exploration activities undertaken by numerous coal exploration companies between 1949 and 1976, and coal seam gas exploration in the early 2000's. Table 1 summarises the geological data, including nearly 220 drill holes on Elan Project properties with a total drilling extent of nearly 40,000m, available from the historical coal and gas exploration campaigns (as compiled by Dahrouge Geological Consulting Ltd of Canada in 2013).

Table 1. Summary of historical exploration campaigns

Project Area	Operator	Campaign Years	Cored holes	Open holes / Wells	Exploration Adits	Trenches	Mapping	Access Trails (km)
Isolation South, Wildcat	West Canadian Collieries	1949-1955	-	-	-	33	1:12000	Extensive
Isolation South	Scurry-Rainbow Oil Limited	1970	20	-	3	24	-	22.5
Savanna	Bralorne	1969-1972	8	57	5	15	1:4,800 ft	-
Savanna	CIGOL	1971	2	-	-	-	-	-
Isolation	CanPac	1969-71	76	5	6	76	1:12,000 / 1:2,400	~117.5
Isolation	Granby	1974-76	18	9		45	1:2,400	
Isola	CCL	1971	3	-	-	15	-	-
Isolation South	CONSOL	1976	-	-	-	-	1:12,000	-
Regional	CHE & Devon	1989	-	1	-	-	-	-
Regional	NEC	2001-2002	-	20	-	-	-	-

As shown in Table 1, this review has collected and compiled information from those 219 boreholes, 14 exploration adits driven into coal seams and 208 trenches, as well as extensive geological mapping and field surveys spanning more than 50 years by various companies. Some data points from directly adjacent properties were also included to enhance the geological understanding and modelling.

Most of the boreholes were completed with geophysical logging, analytical testing of core samples, including raw coal quality testing and clean coal testwork for washability, theoretical yield, maceral analysis, ash chemistry and coking properties. Bulk samples from the Savanna and Isolation deposits were subjected to pilot scale carbonisation testing. Historically, various deposits (Isolation South, Isolation and Savanna) were studied for open cut and underground mining operations, however these deposits would need to be further explored and evaluated in order to meet today's standards for mining studies.

Exploration Data

Geophysical logging was typically conducted on many of the historical exploration holes, and holes were usually logged in the open hole with logging tools typically including:

- natural gamma;
- caliper;
- density (long and short spaced density); and
- deviation/verticality.

Although not all the original hard copy logs were available, much of the drilling at the time was fully cored with detailed hardcopy geology logs. This provides greater confidence that the reported seam intervals have been recorded and correlated with a reliable level of accuracy.

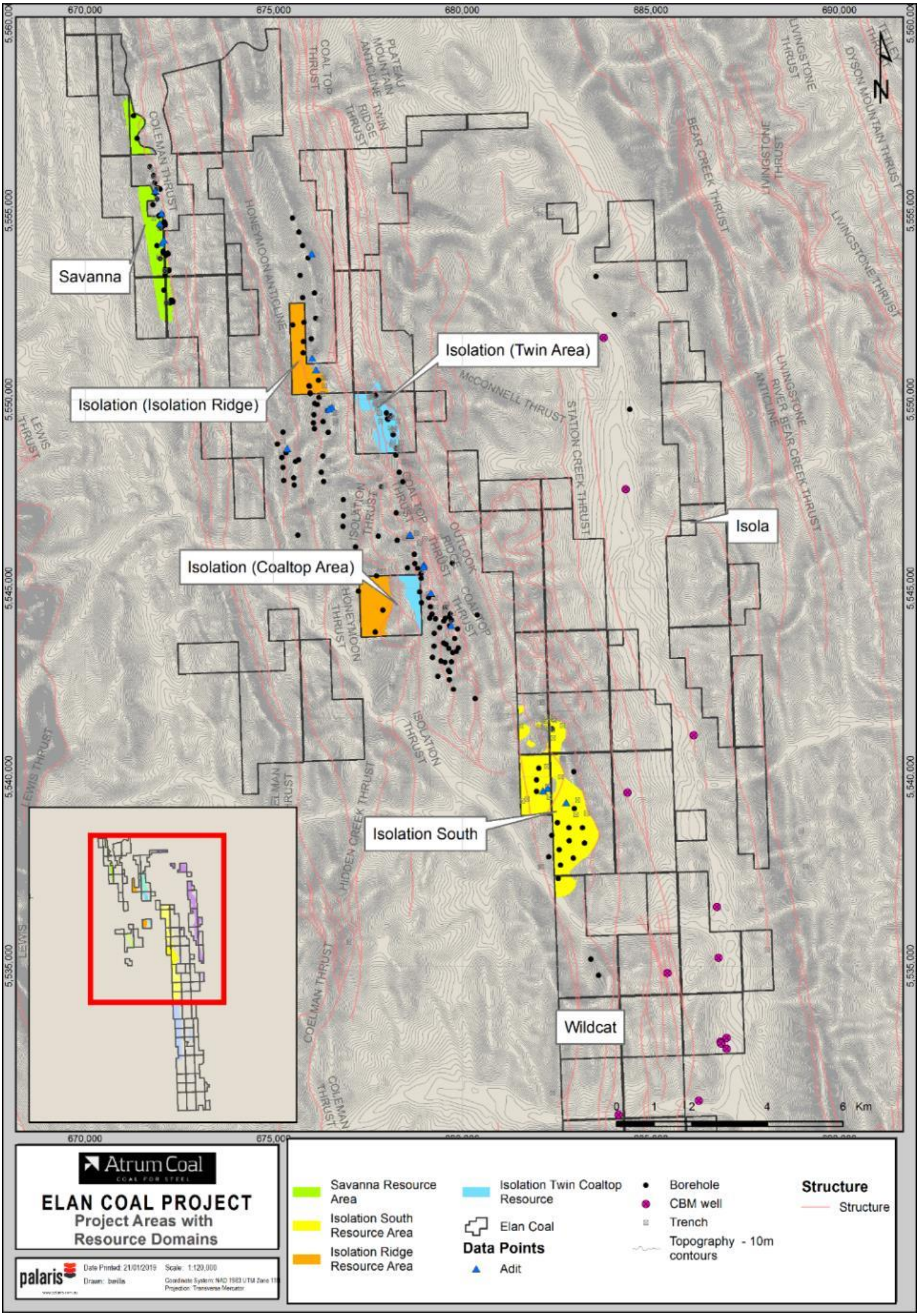

Figure 4: Northern Elan tenement exploration data points and recourse resource domains

All available historical exploration data within the project area was collated by Dahrouge for Elan Coal Ltd in 2013. Dahrouge encoded the vast amounts of historical geological data into digital format and reinterpreted the data set. This data was provided to Atrum once the Elan Project was acquired from Elan Coal Ltd in March 2018. Both Atrum and Palaris gratefully acknowledge the previous work undertaken by Dahrouge, as it was fundamental to the construction of geological models and these updated JORC resource estimates.

Palaris reviewed the geological data files and imported the data into Dassault's Minex software borehole database (BHDB) to create new geological models that underpin the updated resource estimates. The process of reconstructing the geological models also further enhanced Palaris' and Atrum's understanding of the coal seam geology and structural characteristics of the northern Elan tenement areas.

Coal Quality

The coal seams at the Elan Project range from mid volatile bituminous to low volatile bituminous coals. Mean maximum vitrinite reflectance (Ro Max %) is a key indicator of rank and generally ranges from 1.20% to 1.50% in those samples tested from the northern Elan tenements, with occasional outliers, typically with an increase in rank towards the base of the sequence as expected.

Maceral analysis from clean coal composites of adit samples has demonstrated that the maceral composition of the coal seams is typical for the Mist Mountain Formations coal seams, which allows for production of individual seams or effective blending of different to create consistently high quality hard coking coals. This is similar to the common practice in the nearby Teck Elk Valley mines. Elan's coal seams correspond directly to those horizons of the Mist Mountain Formation that produce Teck's Hard Coking Coal Products (such as Teck Standard, Teck Premium and Teck Eagle).

Historical testing of core samples from the northern Elan tenements has typically produced clean coal with good coking properties with moderate to high FSI (up to 8), low total sulphur (0.20% to 0.60%) and low ash content (6% to 10% ad).

Historical coal and coke quality testing demonstrates that deposits in these areas have potential to produce premium mid-to-low volatile hard coking coal products with potential for high coke strength after reaction with CO_2 (**"CSR"**) values.

Appendix A contains more details in relation to the historical coal testwork conducted on deposits within the northern Elan tenements.

Updated JORC Resource Estimates for the northern Elan tenements

The updated JORC resource estimates (as at 31 December 2018) for the various areas of the northern Elan tenements total 201Mt, of which 39Mt is classified as Indicated and 162Mt as Inferred (see Figure 4 for areal/plan resource outlines).

As noted earlier, the Elan South JORC Resource estimate of 97 Mt (31 Mt Indicated and 66 Mt Inferred), as reported to the ASX on 8 January 2019, is in addition to these resource estimates. This means that the aggregate Elan Project JORC resource estimate is 298Mt (70Mt Indicated and 228Mt Inferred) as of 31 December 2018.

The resource estimates for the respective areas of the northern Elan tenements are summarised in Table 2 below. Detailed resource estimates on a seam-by-seam basis for each of these respective areas are presented in Appendix A.

Table 2. JORC resource estimates for respective areas of northern Elan tenements (at 31 December 2018)

Mine Area	Measured	Indicated	Inferred	Total
Savanna	-	-	30	30
Isolation South	-	39	81	120
Isolation – Isolation Ridge, Twin and Coaltop areas	-	-	51	51
Grand Total	**-**	**39**	**162**	**201**

Resources reported as million tonnes (Mt) in-situ and are exclusive of the Elan South area of the Elan Project.

Exploration Targets

Large areas of the northern Elan tenements remain underexplored. However, historical surface mapping shows vast areas with Kootenay Formation mapped at or near surface, including coal outcrops. Field mapping of Wildcat area during the 2018 exploration program has identified additional coal outcrops. Aside from estimating the coal resources contained in the northern Elan tenements, the Palaris review has assisted in identifying target areas that can be examined in future exploration campaigns by Atrum.

An Exploration Target range of 140 to 580Mt has been identified for the northern Elan tenements (see Table 3 and Figure 5). The potential quantity and quality of the Exploration Targets are conceptual in nature. Insufficient exploration has been undertaken to estimate a Mineral Resource and it is uncertain that further exploration will result in the estimation of a Mineral Resource.

Table 3. Exploration Target ranges for northern Elan tenements

Project	Exploration Target Range (Mt)	Strike Length km	Rank Range (R_o Max %)	Grade Range (raw ash %)
Isola	20 - 140	18 km	1.25 - 1.38	15 - 30
Wildcat	20 - 100	10 km	1.21 - 1.42	18 - 28
Isolation South	60 - 200	11.5 km	1.20 - 1.30	15 - 35
Savanna	30 - 90	5 km	1.25 - 1.28	9 - 22
Isolation (Twin Ridge)	10 - 50	3.5 km	1.30 - 1.45	13 - 25
TOTAL	**140 - 580**			

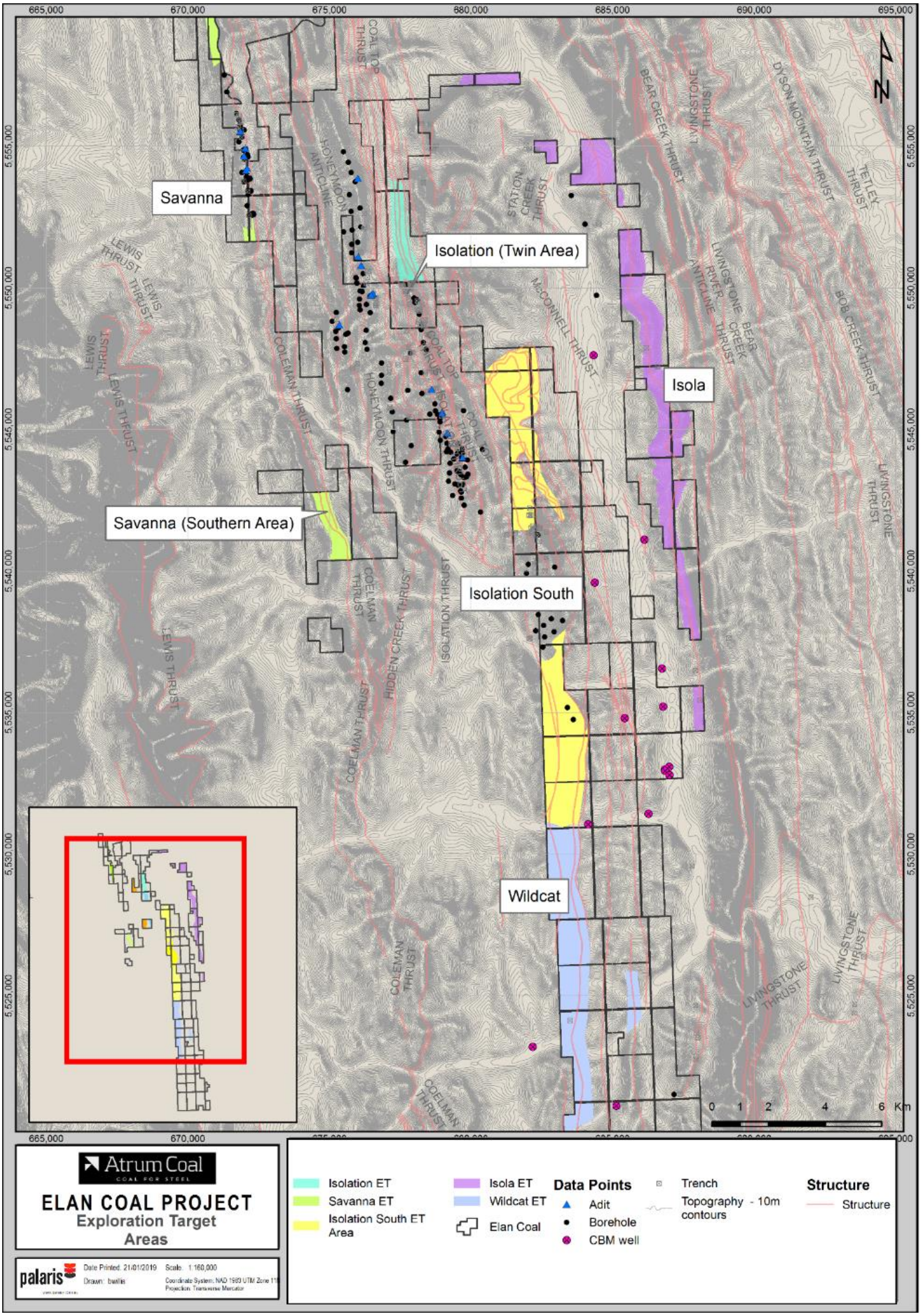

Figure 5: Northern Elan tenement exploration data points and Exploration Target domains

In addition, an Exploration Target of 70 to 320 Mt for Elan South was previously released (see Atrum ASX release on 8 January 2019). The Exploration Target for the entire Elan Project is therefore estimated at 210 to 900Mt (as at 31 December 2018).

Additional information in relation to the geology, target seams, resource estimates, coal sampling and coal quality testwork for the deposits in the northern Elan tenements is detailed in Appendix A.

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Appendix A: Additional resource estimate information for the northern Elan tenements

Elan Project Coal Geology

In the Elan Project areas, coal-bearing sedimentary sequences occur within the Mist Mountain Formation of the Late Jurassic to Early Cretaceous aged Kootenay Group. This was strongly deformed during the Late Cretaceous Laramide Orogeny, as typically seen in various mountain region coal mines in Western Canada. This deformation resulted in the development of north to northwest-trending folds and steeply dipping reverse faults. The Elan Project is located within the Rocky Mountain Thrust Belt, west of the Livingstone Thrust fault, and the Elan Project extent encompasses the north-trending, west-dipping, Coleman, McConnell and Isolation thrust sheets.

Tectonic deformation of the Mist Mountain Formation coal seams is a major factor that controls the areal extent, thickness variability, lateral continuity, and geometry of the shallow coal deposits at the Elan Project. The strata are characterized by broad upright-to-overturned concentric folds, cut and repeated by major-to-minor thrust and tear faults, and late extensional faults. Extensive shearing and structural thickening (and thinning) of coal seams is common in the deformed areas. The stratigraphic sequence at the Elan Project is dominated by the Fernie Group, the coal-bearing Kootenay Group and the overlying Blairmore Group. The Mist Mountain Formation at the Elan Project generally contains numerous seams and consists of a cyclic succession of carbonaceous sandstone, mudstone, siltstone, coal and conglomerate.

Mist Mountain Formation is directly overlain by the massive Cadomin Conglomerate which is a readily recognizable marker horizon throughout the area, often indicating the presence of coal a short distance below. The Cadomin Formation is typically represented by resistant, chert-pebble conglomerates and sandstones. The Cadomin Formation is overlain by continental deposits of interbedded dark mudstone, siltstone and sandstone of the Gladstone Formation (Blairmore Group). The Blairmore Group is often characterised by its colours, consisting of light greenish grey sandstones interbedded with grey, green and maroon shales.

Figures 6 to 8 show some typical cross sections of Elan Project coal seams in the Isolation South, Isolation and Savanna deposits (part of the northern Elan tenements).

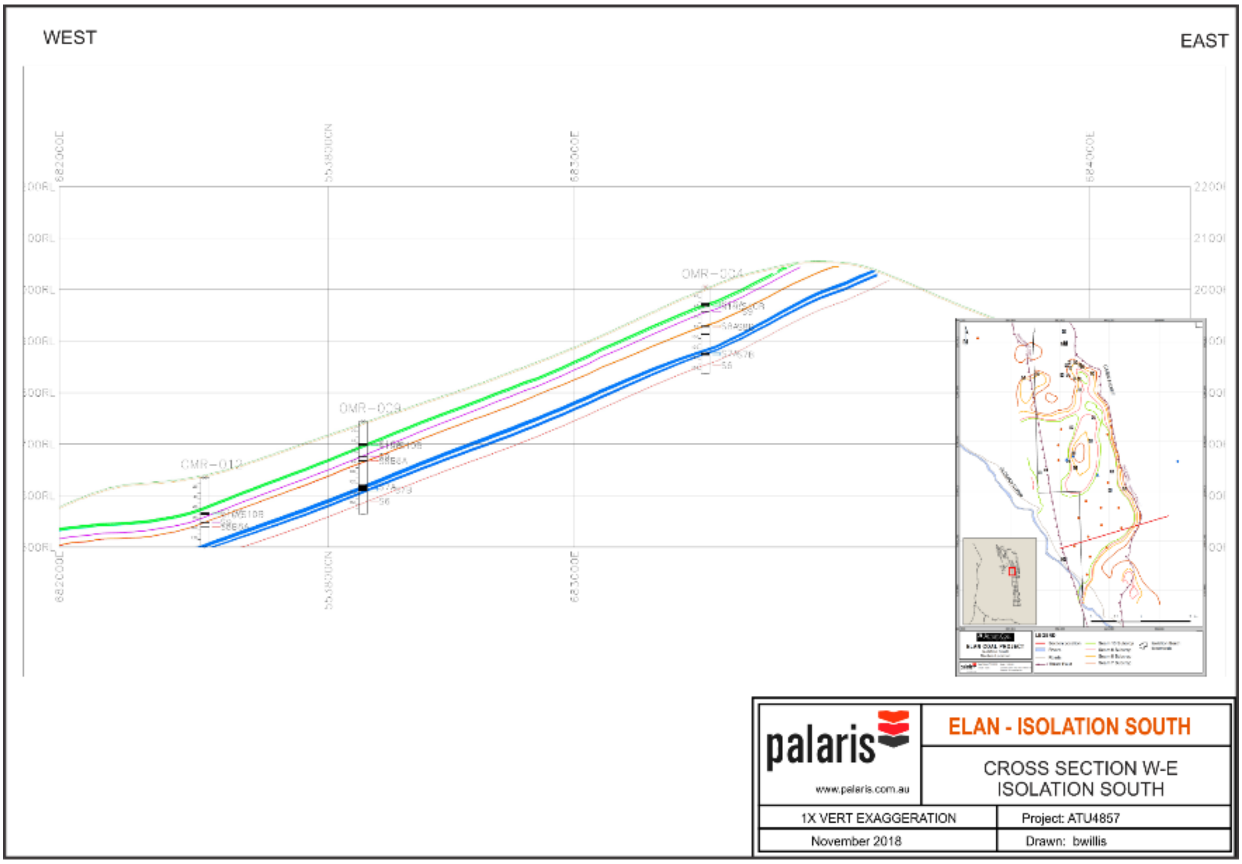

Figure 6: Isolation South W-E cross section

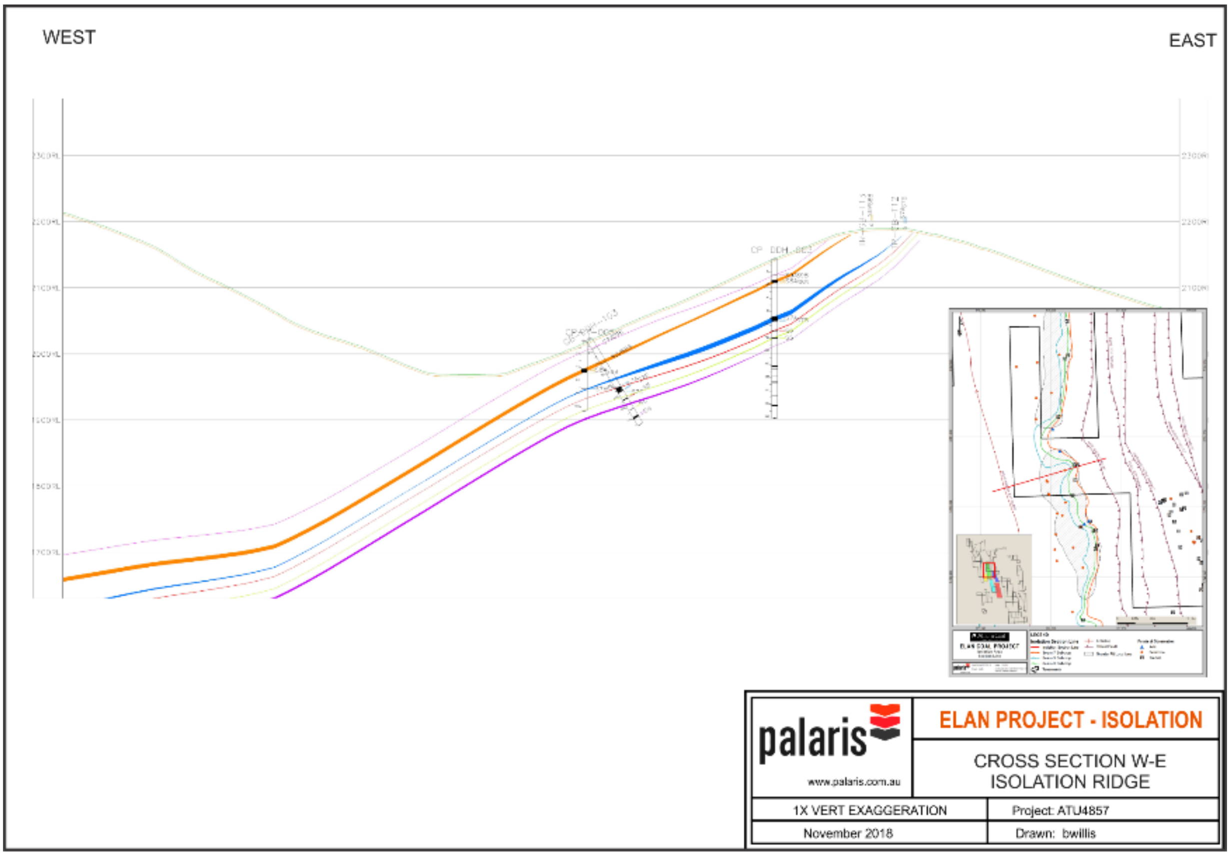

Figure 7: Isolation Ridge W-E cross section

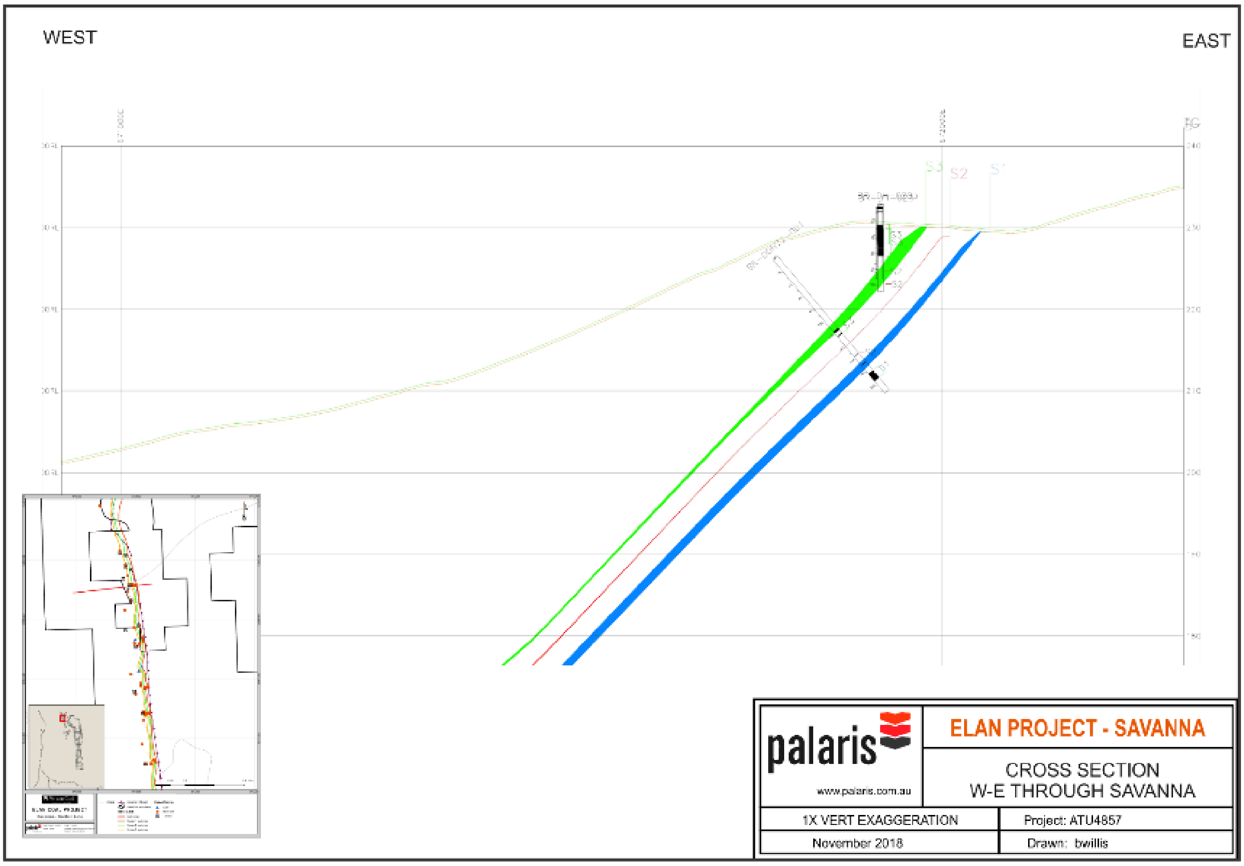

Figure 8. Savanna W-E cross section

Target Coal Seams

The target coal seams at the Elan Project are located within the Mist Mountain Member of the Kootenay Group, and are of Cretaceous age. The Mist Mountain coal seams are relatively continuous between major reverse faults, although the thickness and distribution of coal plies and rock partings within the coal seams is variable and changes often occur over relatively short distances.

The target seams of the Mist Mountain Formation (Kootenay Group) for the Elan Project are likely to be stratigraphic equivalents of each other in each of the project areas. However, as they were explored independently of each other, different naming conventions were applied by the exploring companies (see Table 4). Dahrouge adjusted the seam nomenclature into a system with S10 at the top and S1 at the base, however seams of the same name should not be considered equivalents.

Table 4. Coal seam naming conventions and target seam in each area

Modelled Seams	Seam Splits	Isolation (historical)	Savanna (historical)	Isolation (historical)
S10	S10A-S10C			1A-1B
S9	S9A-S9C	9		2
S8	S8A-S8C	8U-S8L		3
S7	S7A-S7C	7U-S7L		4
S6	S6A-S6C	6		5
S5	S5A-S5B	5		
S4	S4A-S4B	4		
S3	S3A-S3C	3	A	
S2	S2	2	B	
S1	S1	1	C	

Detailed Resource Estimates for Northern Elan Tenements

Detailed coal resources are tabulated according to deposit and area designations from the original explorations, with coal seam resource tonnes and thickness, raw and clean coal quality attributes in Tables 5 to 8 below.

Savanna contains an Inferred resource of 29 Mt that is limited by inclined seams and the geometry of the permit boundaries. Coal quality is very encouraging and further exploration is warranted.

Table 5. Savanna Coal Resources by seam with coal quality attributes

Class	Seam	Resource (Mt)	Thick (m)	ASH %	IM %	VM %	TS %	YLD @CF1.45	ASH @CF1.45	VM @ CF1.45	TS @ CF1.45	CSN @CF1.45
Inferred	S3	16	10.05	16.0	0.7	22.8	0.30	87.4	6.7	23.5	0.35	6.8
Inferred	S2	2	2.63	-	-	-	-	-	-	-	-	-
Inferred	S1	12	9.55	16.8	0.8	19.1	0.40	73.9	8.8	21.4	0.45	4.5
TOTAL		**30**										

All resources are reported as million tonnes (Mt) in-situ, some rounding errors may occur. All quality variable reported on air-dried basis and reflect average coal quality values from adit bulk sample tests.

Isolation South contains a significant resource (120 Mt) that occurs within Elan Project tenement boundaries, and with moderate coal seam dips that provide a significant area of coal potentially amenable to open cut mining. Resources are summarised according to seam contribution in Table 6, along with seam thickness and coal quality variables.

Table 6. Isolation South Resources by seam with coal quality attributes

Class	Seam	Resource (Mt)	Thick	ASH %	IM %	VM %	TS %	CSN	YLD CF1.50	ASH CF1.50	VM CF1.50	TS CF1.50	CSN CF1.50
Indicated	S10A	4	2.74	21.1	0.6	25.5	0.58	4.4	71.3	6.7	29.1	0.47	6.7
Indicated	S10B	2	1.36	24.6	0.6	24.4	0.51	4.1	66.3	6.8	28.8	0.4	7.1
Indicated	S8B	1	0.53	23.7	0.7	22.5	0.38	3.0	62.0	7.9	26.4	0.45	5.3
Indicated	S7A	19	8.2	27.9	0.6	22.6	0.37	1.3	56.7	9.9	24.7	0.32	3.0
Indicated	S7B	12	4.88	29.3	0.6	23.1	0.45	3.0	52.7	9.4	26.9	0.55	5.9
Inferred	S10A	4	2.17	19.0	0.6	25.8	0.55	3.5	70.9	6.3	27.7	0.33	6.3
Inferred	S10B	4	2.39	22.2	0.6	24.7	0.48	4.1	64.1	7.4	27.7	0.37	6.7
Inferred	S10C*	1	0.71	25.6	0.5	24.7	0.44	5.7	63.3	6.6	28.1	0.54	7.8
Inferred	S9*	7	1.55	55.9	0.4	15.1	0.13	0.5	33.8	10.1	23.4	0.21	2.0
Inferred	S8A*	6	1.37	20.4	0.7	24.3	0.19	4.0	60.7	7.6	26.3	0.21	7.5
Inferred	S8B	2	0.52	21.5	0.7	22.6	0.38	4.0	67.8	7.3	26.7	0.4	6.2
Inferred	S7A	35	8.41	24.8	0.5	23.2	0.33	1.9	59.8	9.4	25.0	0.28	3.1
Inferred	S7B	20	4.54	24.4	0.6	23.0	0.35	3.3	60.6	9.2	25.8	0.4	5.3
Inferred	S6	4	1.32	-	-	-	-	-	-	-	-	-	-
TOTAL		**120**											

All resources are reported as million tonnes (Mt) in-situ, some rounding errors may occur. All quality variables reported on air-dried basis from bore core analyses.

Isolation contains several smaller deposits with modestly sized resources that are limited by the geometry and size of Atrum's permits relative to areas of freehold mineral rights (not owned by the Crown) and are summarised in Tables 7 and 8.

Table 7. Isolation Ridge Resources by seam with coal quality attributes

Project Area	Class	Seam	Resource (Mt)	Thick	ASH %	IM %	VM %	TS %	CSN	ASH CF1.58	VM CF1.58	TS CF.58	CSN CF1.58
Isolation South	Inferred	S9A	<1	0.46	16.8	0.6	21.8	1.45	4.9	10.7	21.9	0.7	7.3
	Inferred	S9B	<1	0.41	13.2	0.7	22.7	1.44	5.3	9.9	21.8	0.7	8.0
	Inferred	S8A	5	2.70	28.9	0.6	20.3	0.59	6.0	9.0	22.6	0.6	7.2
	Inferred	S8B	2	1.04	27.9	0.5	20.4	0.60	5.9	9.4	22.3	0.7	7.6
	Inferred	S7A	3	1.49	26.2	0.4	18.3	0.62	6.7	8.8	21.5	0.6	8.8
	Inferred	S7B	2	1.20	25.5	0.4	18.3	0.60	6.6	9.0	21.6	0.7	8.8
	Inferred	S9A	<1	0.35	41.0	0.6	16.8	1.36	5.0	17.9	21.9	0.8	7.0
	Inferred	S9B	<1	0.35	39.4	0.6	17.6	1.38	4.6	17.7	21.9	0.8	6.1
	Inferred	S8A	3	1.81	20.9	0.4	17.4	0.59	6.1	7.2	19.0	0.7	7.1
	Inferred	S8B	3	2.17	20.7	0.4	17.3	0.59	6.1	7.2	19.0	0.7	7.1
	Inferred	S7A	5	3.96	15.5	0.4	16.5	0.53	4.8	8.5	17.3	0.6	5.1
	Inferred	S7B	2	1.94	14.2	0.4	17.4	0.54	5.4	7.8	18.1	0.6	6.8
	Inferred	S6	<1	0.88	21.5	0.4	17.4	0.68	1.5	9.6	18.3	0.6	1.5
	Inferred	S5	<1	0.68	18.5	0.3	18.5	0.65	7.0				
TOTAL			**26**										

All resources are reported as million tonnes (Mt) in-situ some rounding errors may occur. All quality variables reported on air-dried basis from bore core and adit analyses.

Table 8. Isolation (Twin and Coaltop) resources by seam with coal quality attributes

Project Area	Class	Seam	Resource (Mt)	Thick	ASH %	IM %	VM %	TS %	CSN	ASH %CF1.58	VM @CF1.58	TS @CF1.58	CSN @ CF1.58
Coaltop	Inferred	S9A	<1	0.67	17.9	0.7	18.6	0.69	4.2	7.4	22.4	0.62	6.5
Coaltop	Inferred	S9B	1	0.83	15.9	0.6	19.2	0.72	4.2	6.3	22.1	0.60	6.8
Coaltop	Inferred	S8A	1	1.57	20.7	0.6	17.4	0.55	6.5	7.7	20.3	0.54	6.4
Coaltop	Inferred	S8B	2	3.12	15.7	0.5	19.1	0.62	6.4	7.9	19.5	0.60	7.8
Coaltop	Inferred	S7A	4	6.71	16.4	0.4	19.0	0.50	5.2	7.8	19.8	0.55	7.5
Coaltop	Inferred	S7B	3	5.14	23.1	0.4	18.2	0.44	3.9	8.6	19.9	0.55	6.8
Twin	Inferred	S9A	<1	0.68	24.1	1.3	18.6	0.66	1.7	9.5	22.3	0.64	6.5
Twin	Inferred	S9B	<1	0.62	24.2	1.3	18.3	0.66	1.4	6.4	21.7	0.60	5.2
Twin	Inferred	S8A	2	3.52	17.1	0.5	17.8	0.48	2.5	9.9	17.9	0.41	3.5
Twin	Inferred	S8B	3	3.5	17.7	0.4	18.0	0.49	2.9	10.1	18.1	0.38	3.7
Twin	Inferred	S7A	5	3.97	14.4	0.6	19.2	0.48	3.8	9.1	19.4	0.55	4.2
Twin	Inferred	S7B	4	3.04	14.2	0.6	18.8	0.48	3.4	9.0	18.9	0.86	4.1
TOTAL			**25**										

All resources are reported as million tonnes (Mt) in-situ some rounding errors may occur. All quality variables reported on air-dried basis from bore core and adit analyses

Coal Quality Sampling and Testing

Core samples collected from typically 63mm cored boreholes were dispatched to ASTM accredited laboratories in Canada and the US for coal quality testing. Raw coal and clean coal composites were usually tested for proximate analysis, FSI and total sulphur (TS) and in some cases clean coal tests also included calorific value (BTU) and phosphate in P_2O_5.

Sizing and float sink and other detailed washability and coke characterisation testwork was quite comprehensive on bulk/channel samples extracted from adits driven into coal seams in the Isolation South, Isolation and Savanna deposits.

Table 9. Summary of historical adits driven at Elan or directly adjacent to Elan

Deposit	Campaign Year	Operator	Total Adits	Adits (*Name Modified)	Total Metres
Isolation South	1970	Scurry	3	AD-SR-OMR01 to OMR03	151
Isolation	1969-1971	CanPac	6	AD-CP-01 to 06	426
Isolation	1974	Granby	5	AD-GB-74-01 to 05	212
Savanna	1970-1972	Bralorne	5	AD-BR-71-01 to AD-BR-71-02	270
Total			**19**		**1,059**

Table 10. Isolation South average raw quality parameters from cored drill holes (ad)

Seam	No. of Samples	ASH %	VM %	IM %	FC %	TS %	FSI (CSN)
S10A	11	20.1	26.0	0.6	53.4	0.57	4.2
S10B	10	25.6	24.2	0.6	49.6	0.43	4.3
S10C	1	25.6	24.7	0.5	49.6	0.44	5.7
S8A	1	20.4	24.3	0.7	54.7	0.19	4
S8B	7	20.0	23.0	0.7	56.5	0.34	3.5
S7A	13	28.9	22.3	0.6	48.3	0.30	1.6
S7B	12	27.9	22.7	0.6	49.0	0.43	3.1

Table 11. Isolation South average raw quality parameters from adits (ad)

Seam	Adit	ASH %	VM %	IM %	FC %	BTU/lb	TS %
S7	AD-SR-OMR01	22.4	24.3	0.6	52.8	11,235	0.60
S7	AD-SR-OMR01	26.8	22.4	0.6	50.2	10,600	0.61
S7	AD-SR-OMR01	21.4	23.6	0.3	54.7	11,550	0.75
S10	AD-SR-OMR02	16.0	26.3	0.5	57.3	12,255	0.94
S10	AD-SR-OMR03	15.2	24.5	1.4	58.9	11,730	0.72

Table 12. Savanna average raw quality parameters from adits (ad)

Seam	Adit	ASH %	VM %	IM %	FC %	TS %	FSI (CSN)
S3 (A)	AD-BR-70-01	16.8	22.7	0.6	60.0	0.14	-
S3 (A)	AD-BR-72-01	21.7	21.7	0.8	55.8	0.45	4.5
S3 (A)	AD-BR-71-02	9.5	24.0	-	70.0	0.31	-
S1 (C)	AD-BR-72-02	17.1	17.1	0.8	61.2	0.45	2.5
S1 (C)	AD-BR-71-01	16.6	21.0	-	70.0	0.35	-

Table 13. Isolation Ridge average raw quality parameters from cored drill holes (ad)

Seam	No. Samples:	ASH %	VM %	IM %	TS %	FSI (CSN)
S9	1	40.8	17.8	0.3	1.62	6
S8A	31	21.7	18.8	0.5	0.60	5.4
S8B	24	22.0	18.1	0.5	0.61	4.9
S7A	31	19.0	17.3	0.5	0.57	5.1
S7B	20	17.2	17.5	0.5	0.59	5.2
S6	1	21.5	17.4	0.4	0.68	1.5
S5	1	18.5	18.5	0.3	0.65	7

Table 14. Isolation average raw quality parameters from adits (ad)

Seam	Adit	Area	ASH %	VM %	IM %	FC %	TS %	BTU	FSI (CSN)
S8	AD-GB-74-01	Honeymoon	33.0	17.5	1.1	49.5	0.53	9,779	1.0
S7	AD-GB-74-02	Coaltop North	29.5	17.7	0.6	52.6	0.38	10,427	1.3
S7	AD-GB-74-03	Isolation South	15.4	18.0	0.6	66.4	0.44	12,961	1.8
S8	AD-GB-74-04	Coaltop South	16.9	20.6	0.7	62.3	0.37	12,524	4.2
S9	AD-GB-74-05	Isolation South	22.8	18.8	1.0	58.4	0.55	11,576	1.0
S8	AD-CP-01	Isolation North	16.6	19.5	0.8	63.2	0.70	12,462	5.7
S7	AD-CP-02	Isolation South	21.1	18.1	0.7	60.2	0.51	12,740	3.5
S7	AD-CP-03	Coaltop North	22.0	18.8	0.5	58.6	0.44	11,796	2.0
S8	AD-CP-03	Coaltop North	23.3	19.0	0.3	56.6	0.30	11,550	1.5
S8	AD-CP-04	Coaltop North	13.5	19.8	0.5	66.2	0.50	13,149	4.8
S7	AD-CP-05	Isolation North	13.7	17.4	0.5	68.4	0.76	13,063	4.8
S8	AD-CP-06	Outlook	19.5	19.0	0.8	60.7	0.58	11,828	2.8
S6	AD-CP-06	Outlook	19.4	19.8	0.6	60.8	0.49	12,149	4.3
S7	AD-CP-06	Outlook	19.1	20.2	0.4	60.9	0.50	12,328	5.0

Coal Rank and Maceral Content

Table 15 and 16 contain results of maceral analysis and vitrinite reflectance on adit samples from different areas of Isolation and Savanna.

Table 15. Isolation maceral analysis and vitrinite reflectance on adit samples

Area	ADIT	Sample No	Vitrinite	Semi-Fusinite (Reactive)	Total Reactives	Mineral Matter	Total Inerts	R_o Max %
Isolation North	AD-CP-01	Adit No. 1	75.4	2.3	77.7	4.4	22.4	1.53
Isolation North	AD-CP-01	Adit No. 1	66.9	12.4	79.3	5.0	20.7	1.45
Coaltop	AD-CP-03	Adit No. 3B	52.8	8.3	61.1	6.0	38.9	1.38
Coaltop	AD-CP-03	Adit No. 3A	56.5	14.7	71.2	4.7	28.8	1.33
Coaltop	AD-CP-04	Adit No. 4	64.0	6.0	70.0	4.1	30.0	1.42
Coaltop	AD-CP-04	Adit No. 4	63.5	12.5	76.0	4.7	24.1	1.33
Isolation North	AD-CP-05	Adit No. 5	73.3	4.2	77.5	5.4	22.6	1.53
Isolation North	AD-CP-05	Adit No. 5	70.1	10.0	80.1	5.1	20.0	1.42
Outlook	AD-CP-06	Adit No. 6A	64.6	11.1	75.7	4.7	24.4	1.22
Outlook	AD-CP-06	Adit No. 6B	53.3	15.6	68.9	5.1	31.0	1.21
Outlook	AD-CP-06	Adit No. 6C	58.6	12.0	70.6	4.8	29.4	1.27
Various		Blend	68.4	4.6	73.0	4.9	27.0	1.48

Table 16. Savanna maceral analysis and vitrinite reflectance on adit samples

Area	ADIT	Seam	Vitrinite	Semi-Fusinite (Reactive)	Total Reactives	Mineral Matter	Total Inerts	R_oMax %
Savanna	AD-BR-70-01	S3	53.8	16.8	70.6	4.5	29.4	1.26
Savanna	AD-BR-71-02	S3	68.0	6.5	74.5	4.1	25.6	1.25
Savanna	AD-BR-71-01	S1	56.9	9.2	66.1	4.9	33.9	1.28
Savanna	AD-BR-72-01	S3	59.3	12.2	71.5	4.0	28.6	1.27
Savanna	AD-BR-72-02	S1	60.1	10.0	70.1	5.0	29.9	1.28

Washability and Clean Coal Analyses

Historical testing has typically produced clean coal with good coking properties with moderate to high FSI (up to 8), low total sulphur (0.20% to 0.60%) and low ash content (6% to 10% ad), indicating low inherent ash in the coal.

Isolation South core samples were routinely tested at CF1.50 for theoretical yield and clean coal results. Average theoretical yields and quality variables are summarised in Table 17.

Table 17. Isolation South theoretical yield and clean coal parameters at CF1.50

Area	Seam	No. Samples	Yield %	ASH %	VM %	TS %	FSI (CSN)
Isolation South	S10A	9	72.0	6.6	28.9	0.43	6.5
Isolation South	S10B	8	62.8	7.2	28.6	0.36	7.1
Isolation South	S10C	1	63.3	6.6	28.1	0.54	7.8
Isolation South	S9	1	33.8	10.1	23.4	0.21	2.0
Isolation South	S8A	1	60.7	7.6	26.3	0.21	7.5
Isolation South	S8B	7	67.2	7.7	26.0	0.41	5.3
Isolation South	S7A	12	56.5	9.7	25.1	0.32	3.3
Isolation South	S7B	11	57.1	9.5	26.3	0.45	5.6

Savanna adit samples were washed in a pilot scale plant; yield and clean coal results indicate high theoretical yields and good product CSN with low ash and total sulphur (see Table 18).

Table 18. Savanna yield and clean coal results from adit bulk sample testing

Seam	Adit	YIELD	ASH %	VM %	FC %	BTU/lb	TS %	FSI (CSN)
S3 (A)	AD-BR-71-02	89.8	5.3	23.9	70.9	14,589	0.32	7.5
S3 (A)	AD-BR-70-01	85.0	7.9	23.2	68.3	14,290	0.18	6
S3 (A)	AD-BR-72-01	-	7.1	23.4	69.5	14,530	0.55	7
S1 (C)	AD-BR-71-01	73.9	8.9	21.0	70.1	14,070	0.38	3.5
S1 (C)	AD-BR-72-02	-	8.8	21.7	69.5	14,190	0.51	5.5

Bulk samples from adit sampling at Isolation Ridge and Coaltop areas were subjected to pilot scale processing and detailed testwork. The results indicate that a coking coal product could be produced with product ash content of ~8%, good coking properties (FSI of 7) and low total sulphur (0.50%).

Table 19. Isolation adit sample pilot scale yield and clean coal properties

Area	Adit	RAW ASH %	YIELD	ASH %	VM %	FC %	TS %	FSI (CSN)
Isolation	Adit No. 1	13.2	88.5	8.2	21.2	70.0	0.60	7
Coaltop	Adit No. 3A	21.1	53.3	8.1	19.8	71.5	0.40	4
Coaltop	Adit No. 4	14.1	83.3	8.1	20.6	70.7	0.50	7.5
Isolation	Adit No. 5	15.2	77.7	8.4	18.9	72.3	0.60	7
Coaltop	Adit No. 6A	22.6	57.6	7.7	20.9	70.4	0.60	7.5
Coaltop	Adit No. 6B	20.0	63.1	8.2	20.4	70.7	0.50	7
Coaltop	Adit No. 6C	18.1	71.9	8.1	20.8	70.4	0.50	6.5

Potential Product

Historical coke characterisation testing at Savanna and Isolation demonstrates that these deposits have potential to produce premium mid-to-low volatile hard coking coal products with potential for high coke strength after reaction with CO_2 (**"CSR"**) values, as exemplified by the high JIS coke stability numbers in Tables 20 and 21. Prior to the modern-day CSR tests, tumbler tests were a common measure of the resistance of cold coke to abrasion and impact, and included ASTM Stability and the Japanese JIS Drum test.

Table 20. Savanna carbonisation testwork results

Adit Bulk Sample	AD-BR-70-01	AD-BR-72-01	AD-BR-72-02
Seam	**S3**	**S3**	**S1**
FSI (CSN)	6.5	7	5.5
Rank	1.26	1.27	1.28
Maximum Fluidity (ddpm)	3.8	20.5	3.4
Contraction %	24	26	23
JIS Drum 15mm sieve-30 Rev	91.5	95	92.2
Coke Yield	79.1	77	76

Isolation adit samples returned very encouraging results from coke oven tests, with ASTM and JIS tumbler tests both producing some high results for stability and hardness (Table 21).

Table 21. Isolation carbonisation testwork results

Adit	AD-CP-01	AD-CP-03A	AD-CP-04	AD-CP-05	AD-CP-06A	AD-CP-06B	AD-CP-06C
Seam	S8	S7A	S7A	S7A	S7A	S7A	S7B
FSI (CSN)	7	4	7.5	7	7.5	7	6.5
Rank	1.45	1.33	1.33	1.42	1.22	1.21	1.27
Maximum Fluidity (ddpm)	4	2.9	8	2.5	80	65	9.2
JIS Drum 15mm sieve - 30 Rev		86.5	92.1	90.9	94.3	93.4	92.6
Coke Yield	79.9	76.9	77.5	75.4	76.5	78.5	77.7

Competent Persons Statement

Exploration Results

The information in this document that relates to Exploration Results of Elan Coal project is based on, and fairly represents, information and supporting documentation prepared by Mr Brad Willis, who is a Member of the Australasian Institute of Mining and Metallurgy (#205328) and is a full-time employee of Palaris Australia Pty Ltd.

Mr Willis has read and understands the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Exploration Targets, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition). Mr. Willis is a Competent Person as defined by the JORC Code, 2012 Edition, having twenty years' experience that is relevant to the style of mineralisation and type of deposit described in this document.

Neither Mr. Willis nor Palaris Australia Pty Ltd has any material interest or entitlement, direct or indirect, in the securities of Atrum or any companies associated with Atrum. Fees for the preparation of this report are on a time and materials basis. Mr. Willis has visited the Elan project site with Atrum coal personnel in September 2018 during the 2018 Elan South exploration program.

The JORC Code (2012) Table 1 – Reporting of Exploration Results

Checklist of Assessment and Reporting Criteria

Sampling Techniques and Data

Criteria	JORC Code explanation	Commentary
Sampling techniques	▪ *Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.* ▪ *Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.* ▪ *Aspects of the determination of mineralisation that are Material to the Public Report.*	▪ This report relies on sampling from historical exploration work undertaken by various companies. ▪ Samples were taken from cored drill holes and bulk samples from adits ▪ Cored drill holes are used to collect HQ size core samples, which were logged and sampled for coal quality testwork ▪ Core recoveries were recorded and cumulative tallies kept ▪ It is recognised that historical data, coupled with lack of electronic geophysical logs makes it more difficult to determine if stated core recoveries are accurate
Drilling techniques	▪ *Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).*	▪ HQ size diamond cored drilling was typically undertaken ▪ Many of the historical boreholes were geophysically logged to total depth in the open hole, but many logs are not available for reference ▪ Detail on efforts to maximise core recovery have not been provided, and coring likely used the double tube core barrel method
Drill sample recovery	▪ *Method of recording and assessing core and chip sample recoveries and results assessed.* ▪ *Measures taken to maximise sample recovery and ensure representative nature of the samples.* ▪ *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.*	▪ Core recoveries were recorded during historical drilling campaigns ▪ Samples were weighed at the testing laboratory and compared against calculated volumetric recovery. ▪ Boreholes were mostly geophysically logged to ensure recovered core lengths are representative of the full seam ▪ The core recoveries are generally reasonable except where the coal is heavily fractured or near fault zones ▪ The coal has a high HGI and can be heavily fractured; core losses are likely to result in losses of fines and / or vitrinite rich material
Logging	▪ *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation,*	▪ Core samples were logged recording lithology, sedimentary features and in rare cases defects, but not to modern standards ▪ Much of the historical logging was undertaken pre-

Criteria	JORC Code explanation	Commentary
	mining studies and metallurgical studies. ▪ *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.* ▪ *The total length and percentage of the relevant intersections logged.*	dating metric measurement, and depths were converted from imperial measurements ▪ Boreholes were usually logged with geophysical sondes including density, caliper and gamma ▪ There are no records of core sample photographs ▪ Adits and trenches were logged and sketched, and are available in historical exploration reports
Sub-sampling techniques and sample preparation	▪ *If core, whether cut or sawn and whether quarter, half or all core taken.* ▪ *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.* ▪ *For all sample types, the nature, quality and appropriateness of the sample preparation technique.* ▪ *Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.* ▪ *Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.* ▪ *Whether sample sizes are appropriate to the grain size of the material being sampled.*	▪ Different testing protocols were used between various companies and also for core and bulk samples ▪ Core samples on a ply basis were often crushed to –60 mesh and tested for proximate analysis. Ply samples were composited and screened, in some cases (CanPac) the -200 mesh material was discarded. Clean coal composites were usually tested at 1.45 RD, 1.50 RD or 1.58 RD ▪ The bulk adit samples were usually tested for raw coal, float sink testing by size fraction including two stage froth flotation on fines. ▪ Sub-sampling was common for bulk sample testing. There is no way to ensure that sub-sampling techniques used ensured each sample was representative
Quality of assay data and laboratory tests	▪ *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.* ▪ *For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.* ▪ *Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.*	▪ Testwork is undertaken by nationally accredited laboratories, generally to ASTM standards ▪ Raw coal quality testing was fairly primitive and involved proximate analyses, TS and FSI. RD was not tested. ▪ Similarly, the testwork completed on clean coal composites was fairly basic compared to today's standards ▪ Sizing and float sink testing undertaken on adit bulk samples was fairly comprehensive
Verification of sampling and assaying	▪ *The verification of significant intersections by either independent or alternative company personnel.* ▪ *The use of twinned holes.* ▪ *Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.* ▪ *Discuss any adjustment to assay data.*	▪ Geological data is collected in line with each company's exploration procedures and guidelines, although fairly basic compared to modern data acquisition techniques ▪ Sample interval depths and thicknesses are as measured by the field geologist, and in some cases adjusted to align with geophysical log depths ▪ It is not known what levels of data checking and verification were used during the historical campaigns. ▪ All data has been encoded, collated and cross checked by Dahrouge Geological Consulting, and later by Palaris
Location of data points	▪ *Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.* ▪ *Specification of the grid system used.* ▪ *Quality and adequacy of topographic control.*	▪ The surveyed locations of boreholes, trenches and adits have been sourced from historical exploration reports ▪ In many cases, borehole co-ordinates were surveyed in local co-ordinate systems, and were later converted to grid co-ordinates. Checks have been made by georeferencing historical borehole plans to ensure they are plotting in the correct locations ▪ The co-ordinate system is UTM projected grid NAD83 Zone 11N ▪ The topographical surface is sourced from SRTM survey and has a reasonable correlation with borehole collars
Data spacing and distribution	▪ *Data spacing for reporting of Exploration Results.* ▪ *Whether the data spacing and distribution is sufficient to establish the degree of*	▪ The majority of sites have a HQ cored borehole through seams, and are point of observation for coal quality determination ▪ Grade continuity is quite variable between data points. The borehole spacings used and

Criteria	JORC Code explanation	Commentary
	geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. ▪ *Whether sample compositing has been applied.*	rationalisation of resource classification polygons has defined resources with geological confidence are mostly Inferred status and reflects the level of confidence of historical borehole data ▪ The Indicated resource areas in Isolation South may be suitable for conceptual mine planning ▪ Sample compositing is undertaken in the geological model, weighted by thickness (constant RD of 1.40 was applied due to the absence of RD data). Seam compositing requires 60% linear recovery as specified in the Minex BHDB settings
Orientation of data in relation to geological structure	▪ *Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.* ▪ *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	▪ Boreholes have been drilled either vertically or inclined ▪ Inclined boreholes are used in areas where dipping seams exist, in order to intersect the seams closer to their true thickness ▪ There is no borehole deviation data available for historical boreholes – it is assumed that boreholes do not deviate from their inclination and azimuth at the collar ▪ Boreholes tend to be accumulated near the sub-crop zones but occasional boreholes are located in the down dip zones in order to provide 3D representation. ▪ Trend surfaces are used in modelling to ensure consistent seam dips occur
Sample security	▪ *The measures taken to ensure sample security.*	▪ Core was sampled, labelled and bagged before being submitted to the testing laboratories ▪ Laboratory records provided include sample identification numbers and weighed sample mass ▪ As the exploration was undertaken a long time ago, it is difficult to confirm whether measures to ensure sample security represented best practice by today's standards
Audits or reviews	▪ *The results of any audits or reviews of sampling techniques and data.*	▪ Generally the sampling techniques excluded potentially removable partings greater than 1ft thick ▪ There are no historical reviews or audits of the sampling or coal quality data ▪ It is recognised that the historical data may not have the same level of accuracy relative to modern practices and this is reflected in the resource classification

Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	▪ *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.* ▪ *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*	▪ The coal leases were granted to Elan Coal Ltd in 2012/13, Elan Coal was acquired by Atrum Coal in March 2018. Coal Lease agreements provide the right to exclusively explore the land within the boundaries of the lease and are granted for a term of 15 years (with an option to extend at expiry) ▪ The Property falls within the Rocky Mountain Forest Reserve, which is managed by the Alberta Government ▪ The project is located in an area that has been classified as Category 2 in accordance with the Coal Development Policy for Alberta. Surface mining is not traditionally considered in Category 2 areas either because it is an area where infrastructure is inadequate to support mining activities or it is an area associated with high environmental sensitivity
Exploration by other parties	▪ *Acknowledgment and appraisal of exploration by other parties.*	▪ This announcement provides an overview of exploration work undertaken by other parties

Criteria	JORC Code explanation	Commentary
Geology	▪ *Deposit type, geological setting and style of mineralisation.*	▪ This announcement provides an overview of regional and local geology, and stratigraphy
Drill hole Information	▪ *A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:* o *easting and northing of the drill hole collar* o *elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar* o *dip and azimuth of the hole* o *down hole length and interception depth* o *hole length.*	▪ Given the vast volumes of geological data incorporated into three geological models, it was determined that the borehole collars, seam intercepts, coal quality data etc would not be included in the Appendices.
Data aggregation methods	▪ *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.* ▪ *Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.* ▪ *The assumptions used for any reporting of metal equivalent values should be clearly stated.*	▪ No cut-off grades were applied to the resource estimate, as coal seams of the Mist Mountains always require processing in southern BC and Alberta ▪ Coal quality values accompanying the resource estimate are composited using thickness and density, and coal quality variables are weighted against resource tonnes when estimating the resource
Relationship between mineralisation widths and intercept lengths	▪ *These relationships are particularly important in the reporting of Exploration Results.* ▪ *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.* ▪ *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').*	▪ Discrepancies between apparent and true dip are not considered an issue as this is factored in by the modelling software ▪ The absence of electronic deviation survey data is likely to introduce inaccuracy where boreholes deviate from their original inclination and azimuth down hole ▪ Some seam intersections in boreholes show evidence of fault thickening. Fault thickened borehole intersections are generally manually adjusted so as not to overstate coal resources
Diagrams	▪ *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	▪ Borehole locations, cross sections, seam floor structure maps are provided in this announcement
Balanced reporting	▪ *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	▪ Average coal quality values is provided on a seam by seam basis, and coal quality (weighted by tonnes) is included with the resource estimate in this announcement ▪ The coal quality results are within the range of expected values for Mist Mountain Formation coals
Other substantive exploration data	▪ *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	▪ Geophysical surveys (i.e. gravity, magnetic or seismic) have not been undertaken at Elan but will likely be utilised in future programs ▪ Bulk sampling from adits has been undertaken for washability testwork and coke oven testing ▪ No geotechnical and geochemical testing of overburden or inter-burden material has been undertaken at this stage ▪ Metallurgical test results are presented in Section 5.2 of this report
Further work	▪ *The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).* ▪ *Diagrams clearly highlighting the areas*	▪ Exploration programs and annual budgets are designed and managed by Atrum Coal. The 2018 drilling program has focused on Elan South, which is the focus of a separate report ▪ Atrum intends to commence exploration in some of

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	of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	the other Lean project areas in 2019, once a drilling program has been designed ▪ Exploration Targets have been identified and are presented in this announcement

Estimation and Reporting of Mineral Resources

Criteria	JORC Code explanation	Commentary
Database integrity	▪ *Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.* ▪ *Data validation procedures used.*	▪ Geological data was collated by Dahrouge, who undertook validation checks on each hole before they were finalised ▪ Geological data has been cross checked by Palaris and used in the construction of geological models ▪ Historical data is relied upon and assumes that the original acquisition and management of data is sound ▪ Borehole seam profiles with lithology, seam intervals and coal quality results are produced to check validity of data ▪ Coal quality data points are checked for outliers and any potential anomalies are omitted
Site visits	▪ *Comment on any site visits undertaken by the Competent Person and the outcome of those visits.* ▪ *If no site visits have been undertaken indicate why this is the case.*	▪ The Competent Person has undertaken a site visit to the Elan project in September, 2018 to inspect some of the historical areas (Isolation South and Wildcat), and inspect current drilling progress at Elan South ▪ The visits have been in relation to exploration assistance, geological modelling, and assisting with data QA/QC for model updates, and JORC resource estimates
Geological interpretation	▪ *Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.* ▪ *Nature of the data used and of any assumptions made.* ▪ *The effect, if any, of alternative interpretations on Mineral Resource estimation.* ▪ *The use of geology in guiding and controlling Mineral Resource estimation.* ▪ *The factors affecting continuity both of grade and geology.*	▪ Confidence in the geological data is considered moderate, based on the age of historical data and structural complexity ▪ Coal seam correlations cannot be cross checked by geophysical logging and identifying characteristic signatures, which increases the chance of miscorrelation. ▪ The age and level of inaccuracy that could be introduced by using historical exploration data is factored in to the resource classification ▪ Control of the coal seams at depth is limited in some parts of the structural models where there is a paucity of data, but trend surfaces have been used to avoid inaccurate distribution of shallow coal seams
Dimensions	▪ *The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.*	▪ With a strike length exceeding 35km, the bedding strikes roughly north – south along well defined ridgelines and controlled by westerly dipping thrust faults. ▪ The coal seams of the Mist Mountain Formation dip towards the west with dips ranging from 10 to 55 degrees, with local variations controlled by structural elements ▪ The upper limit of the resource is the limit of weathering surface (BHWE-3), which is the topographical surface minus 3 metres ▪ The lower limit is maximum depth of 250m, although coal resources are generally within the 0 – 150m depth range
Estimation and modelling techniques	▪ *The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.* ▪ *The availability of check estimates,*	▪ Geovia Minex (version 6.5.2) software was used to create structural and coal quality grids, which are based on 25m mesh (grid cell) size with a scan distance of 2,000 metres. ▪ Resource classification was undertaken using a maximum spacing of 500 and 1000m between boreholes for Indicated and Inferred resources respectively (250 and 500m radii) ▪ There is very little extrapolated resources beyond the furthest boreholes located in the western down-dip areas ▪ Grade cut-offs were not applied globally as blending

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	previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data. ▪ *The assumptions made regarding recovery of by-products.* ▪ *Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).* ▪ *In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.* ▪ *Any assumptions behind modelling of selective mining units.* ▪ *Any assumptions about correlation between variables.* ▪ *Description of how the geological interpretation was used to control the resource estimates.* ▪ *Discussion of basis for using or not using grade cutting or capping.* ▪ *The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.*	and / or coal beneficiation would be used consistent with Teck's mines in the Elk Valley, BC ▪ A regression between raw ash (ad) and laboratory tested apparent relative density (ARD) has been used to estimate ARD from lab tested raw ash values. The ARD is assumed to be largely representative of in-situ RD (ARD tests are undertaken on intact core samples and are typically lower than values returned for 'true' relative density tests on crushed core samples ▪ The estimate has been internally audited and deemed reproducible
Moisture	▪ *Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.*	▪ All quality parameters are reported on an air-dried basis unless stated otherwise
Cut-off parameters	▪ *The basis of the adopted cut-off grade(s) or quality parameters applied.*	▪ Grade cut-offs were not applied globally as blending and / or coal processing would be used to manage product quality attributes
Mining factors or assumptions	▪ *Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.*	▪ The potential mining method used is considered to be open cut, although underground mining was common in the Crownest Pass for many years ▪ Open cut resources are limited by a minimum 0.3m seam thickness, between the base of weathering and 250m depth ▪ Open cut resources have not been limited by stripping ratios ▪ No surface constraints have been used to limit or constrain the extent of the resource estimate – many of the environmentally sensitive areas were excluded from the granted coal agreements. ▪ Coal resources are defined in areas of ridgeline / elevated topography and are generally distanced from rivers and streams ▪ Mining losses and dilution has not been factored in to the resource estimate
Metallurgical factors or assumptions	▪ *The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.*	▪ This announcement provides an explanation of processing, clean coal quality and potential product types. ▪ The primary product is expected to be a mid to low volatile hard coking coal suitable for the export market. ▪ Some volumes of secondary thermal or PCI product may also be suitable for the export market
Environmental factors or assumptions	▪ *Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the*	▪ The Elan project is considered to be an early stage exploration project and therefore no conceptual mining studies have been undertaken ▪ Environmentally sensitive areas will need to be considered upon commencement of mine planning or studies

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	potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	▪ Any coal mine development would need to go through the process of preparing an Environmental Impact Assessment (EIS) and submission of an application to the Alberta Energy Regulator (AER) under the Environmental Protection and Enhancement Act (EPEA) and Canadian Environmental Assessment Act 2012 (CEAA).
Bulk density	▪ *Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.* ▪ *The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.* ▪ *Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.*	▪ All coal quality parameters are reported on an air-dried basis unless otherwise stated ▪ A regression between raw ash (ad) and laboratory tested ARD (air-dried) has been used to estimate ARD from raw ash. The ARD is assumed to be largely representative of in-situ RD ▪ Bulk density assumptions have not been made
Classification	▪ *The basis for the classification of the Mineral Resources into varying confidence categories.* ▪ *Whether appropriate account has been taken of all relevant factors (i.e. relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).* ▪ *Whether the result appropriately reflects the Competent Person's view of the deposit.*	▪ The resource polygons were rationalised according to the distribution and variability in coal quality data points, and the classification downgraded if coal quality data was sparse or highly variable. ▪ Any extrapolated coal typically exists down-dip to the west of existing data points. ▪ The factors used in the rationalisation and determination of final resource classification polygons included: age and reliability of the historical data, consideration of 3D representivity and removal of isolated points of observation, quantity and location of coal quality data points, variability shown in continuity and grade, and likelihood of the coal seams being mined ▪ In the view of the Competent Person, the current resource classification reflects the moderate level of confidence within the deposit, highlighting that historical data has been relied upon, and that the Inferred resource areas require further exploration to improve the level of geological confidence
Audits or reviews	▪ *The results of any audits or reviews of Mineral Resource estimates.*	▪ Resource estimates were undertaken in three passes to ensure repeatability, with previous versions saved for reference ▪ The resource estimate has been internally peer reviewed
Discussion of relative accuracy/ confidence	▪ *Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.* ▪ *The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to*	▪ The drill spacing is relatively tight along the seam outcrop zones and supported by trench and adit measurements. ▪ The level of confidence in the exploration and data acquisition is moderate based on the age of the exploration data, although the large quantity of cored boreholes, geophysical logging and coal quality testwork improves confidence

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	technical and economic evaluation. Documentation should include assumptions made and the procedures used. ▪ *These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.*	