Section B
Geology & Geotechnical

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B GEOLOGY & GEOTECHNICAL

Coal Valley Resources Inc. (CVRI) has contracted MDH Engineered Solutions (MDH) to provide a geology report for the Robb Trend Project (Project). The report compiles information from various sources and previous technical reports into a summary of the current understanding of the geology in the Project area. The resulting report, *Robb Trend Project, Geological and Geotechnical Compilation Report*, February, 2012, is provided as Appendix 9.

CVRI has also contracted Norwest Corporation (Norwest) to undertake a mining study to identify a conceptual mining plan and resulting mining reserves. The geology and mining model utilized for this report was also utilized to report a series of variations in cut-off strip ratios and resulting reserves. The report is provided in Appendix 10.

CVRI, using the principles of the MDH and Norwest reports, developed a conceptual mine and development plan (Section C). Norwest, using the geology model developed for their conceptual mine report, assisted CVRI in calculating multiple strip ratio scenarios. The results of these scenarios are discussed in more detail in Section C.

The following information is provided only as a general discussion regarding basic elements of the Project geology. The MDH and Norwest reports should be referenced for more detailed descriptions of the Project geology and geotechnical information.

B.1 REGIONAL STRUCTURE

The Coal Valley Mine (CVM) is situated along the eastern edge of the Rocky Mountain Foothills physiographic region, approximately 100 km south of Edson, Alberta (Figure A.1-1). The foothills consist of a series of northwest to southeast striking folds and predominately shallow, west dipping thrust faults that developed 70 to 150 million years ago during the Cretaceous Period (Appendix 9, Figure 2.1). The pattern of deformation increases westward in complexity from the shallow, open Alberta Syncline at the start of the foothills, to the tightly folded and faulted strata immediately east of the Nikanassin Thrust at the base of the Rocky Mountains.

The CVM area is structurally complex, lying between and aligned with the Coalspur Anticline to the northeast and with the Lovett and Entrance Synclines to the southwest. The CVM is bounded on the southwest by the east dipping Mercoal thrust and the west dipping Beaver Dam thrust and to the northeast by the east dipping Pedley thrust. Numerous other similar thrust faults such as the Val d'Or thrust are also found.

The Pedley Thrust is located west of the Project and marks the eastern edge of the foothills region and divides the Entrance and Alberta Synclines. The Project is located on the western limb of the Alberta Syncline and will be exploiting the same coal seams as those found in the current and past mining areas. The Project is not as structurally complex as that in the previous mining area since it is situated on the outer edge of the foothills with no further low angle thrust faults identified to the east (Appendix 9, Figure 2.2).

Faults may be present in the Project, but are relatively uncommon and generally have displacements of less than 10 m. All strata within the Project area dip in a northeasterly direction

into the Alberta Syncline. Dips do vary along strike from 23° to 63°. In the Robb West area the average dip is 32°, near the center of the Robb East area the average dip is around 30° and towards the south end of the Robb East the dip is about 52°.

B.2 STRATIGRAPHY

The Project is underlain by a 1,400 to 2,000 m thick sequence of Upper Cretaceous to Tertiary (Lower Palaeocene) aged sediments belonging to the Sanders Group which is comprised of the Brazeau, Coalspur, and Paskapoo Formations (Appendix 9, Figure 2.3). The primary zone of interest is the coal zone located in the upper 250 m of the Coalspur Formation.

The Coalspur Formation is a succession of interbedded sandstone, siltstone, coal, bentonitic to carbonaceous mudstone, and true bentonite and tuff beds. The base of the formation is defined by the Upper Cretaceous Entrance Conglomerate, a tightly packed quartzite and chert pebble conglomerate in a sandy matrix. Usually the bed only consists of conglomerate, but in some places there are sandstone interbeds. The Coalspur Formation is up 600 m thick in the CVM and Project areas. The principle coal bearing sequence on the property containing all the mineable coal seams occurs over a stratigraphic interval of 180 m to 290 m, approximately 180 m above the Entrance Conglomerate.

Sandstone is the dominant lithology and ranges from coarse to crossbedded units with local pebble zones, to very fine-grained, planar-to-massive bedded units. Individual beds are up to 70 m thick, but more commonly occur as 10 to 30 m thick units. Siltstone and mudstone units consist of thin bedded to laminated layers containing plant remains, generally found disseminated throughout the beds.

The main coal seams identified within the Coalspur Formation at both the existing CVM and Project areas, in ascending order, are the Mynheer (Lower and Upper), Silkstone (Bourne and Wee), McPherson, McLeod, Arbour and Val d'Or seams. The coal is characterized by its hard dull, banded and cleated appearance with individual plies ranging from 5.0 cm to 2.0 m. The coal seams are commonly associated with numerous thin interbeds of carbonaceous mudstone, bentonite and tuff, and occasionally with sandstone and siltstone layers. Coal is characteristically hard on fresh and weathered surfaces, and has been found in many locations to be more resistant to erosion than the adjacent strata. The predominant cementing agent within the siltstones and sandstones of the upper succession are the bentonite mudstones (0% to 60% montmorillonite) or true bentonite beds (60% to 90% montmorillonite) which expands on hydration.

The main coal seams identified within the coal zone of the Project, in ascending order, are the Mynheer (lower and upper), Silkstone (Bourne and Wee), McPherson, McLeod, Arbour, and Val d'Or. The total stratigraphic interval included in the coal zone varies from approximately 180 to 220 m thick across Robb West and northern half of Robb East to 225 to 290 m thick across the southern half of Robb East. A representative geophysical log and the associated stratigraphic units of the coal zone is provided in Appendix 9, Figure 2.4. A description of each coal zone is provided in Appendix 9, Section 2.3.1.

B.3 LOCAL GEOLOGY

B.3.1 EXPLORATION ACTIVITIES

Over 730 drill holes have been drilled in the Project during different exploration programs (Appendix 9, Figures A1 to A5). CVRI is currently undertaking additional exploration work within the proposed Project mine permit areas. Spacing of drill hole lines range from 200 m at the east end to 500 m at the west end with 1,000 m spacing at the centre. Details of the exploration completed to date along with representative cross sections used in the evaluation are provided in Appendix 9.

The Project has been divided into four mine regions (Figure A.6-1)

- Robb West, west of Hwy 47;
- Robb Main, within easting mine grid of 6,000E to 20,000E;
- Robb Center, within easting mine grid of 20,000E to 30,000E; and
- Robb East, east of mine grid 30,000E to Pembina River.

B.3.1.1 Robb West

An underground mine and small surface mine were developed in the Robb West area during the early 1900's. Surface outcrops of the Val d'Or seam are available for inspection.

Initial exploration in the Robb West portion of the Project was undertaken during 1980 by North Canadian Oil Limited (NCO), the lease owner at the time. The 1980 program, in what was known as the Bryan Mountain area, resulted in 24 rotary drillholes with a total drill length of 2100 m. This included two 'core' holes through the main coal section. Holes were geophysically logged. Shell became the owner of these leases by taking over NCO holdings. No further exploration work was undertaken by Shell. CVRI has since purchased the Shell coal leases and CVRI has acquired the NCO exploration data and incorporated it into the current CVRI geology database. During this conversion the geophysical logs where reviewed and standardized to CVRI nomenclature. This work included separation of data for the Val d'Or and Arbour seams. CVRI has completed several piezometers within the Robb West area as part of a long term groundwater monitoring program. Future exploration will be undertaken in the area to further refine the reserve definition prior to mining.

B.3.1.2 Robb Main

An underground mine was developed in the Robb Main area during the early 1900's. Past trenches have exposed the Arbour Seam in the Embarras River valley.

The Robb Main portion of the Project was initially held by Denison Mines Incorporated (Denison) in the early 1980's. These leases were eventually acquired by Luscar Ltd., the predecessor of CVRI. Denison completed exploration and feasibility evaluations for the area under the project title of Coalspur Project, which neared the point of a major energy application during 1981.

This area represents a major part of the Project reserve. The coupling of the Val d'Or and Arbour Seam into a single mineable zone results in an attractive open pit scenario.

Denison acquired numerous other coal leases in the Hinton/Robb area in the 1960's and completed limited exploration programs in 1971 and 1973. A more extensive exploration program was completed during 1980-82. A portion of this effort was undertaken in the Robb Main area. A total of 55 drillholes had been completed in the area with the majority having been geophysically logged. A total of 322 coal samples were obtained during drilling. Bulk samples were also established by Denison for washability and coal blending analysis.

CVRI has complemented the Denison exploration work through additional drilling. This work has focused on both confirmation of the Denison findings and 'in-fill' drilling to further refine the definition of the seam continuity.

CVRI has development additional piezometers in the area for groundwater evaluation. A number of the original Denison piezometers have also been re-established.

B.3.1.3 Robb Centre and East

The exploration work in the remaining portion of the Project (Robb Center and Robb East) has been completed primarily by Luscar and CVRI over the past decades. More recently CVRI has begun an intensive in-fill program starting at the east end and progressing westward. A groundwater evaluation program has resulted in a series of piezometers being established at several cross-sections through the area.

B.3.2 PROJECT GEOLOGY

The geology of the Project has major similarities to the current CVM operating area. The geologic strata is essentially the same and overall structure is similar to many places in the existing mine. The area contains multiple coal seams oriented as moderate to steeply dipping monoclines.

Coal seams strike NW-SE with dips to the NE. Topography is moderate with steep ridges and flat bottomed valleys oriented parallel to the seam strike. The main Val d'Or Seam is often found on the top or slope of a ridge due to the stronger sandstones surrounding it. The lower seams, such as Mynheer are often located in valley floors of the base of slopes due to the more easily erodible strata in proximity to those seams. This is consistent with the existing mine areas at the CVM. The seams are generally consistent over long strike lengths. Shallow thrust faults cut through the area in sympathy with major thrust faults. Local over-thickening of seams may be found.

The Project is a long thin development area with a strike length of approximately 50 km. Over this length some 'depositional' variations can be noted from one end to the other. Thickness of coal seams and partings do vary to a minor degree as well as seam separations and interburden thickness.

Major differences between the Project and the current mining area include the following:

- The Val d'Or and Arbour Seam complex. Within the western portion of the Project, these seams are found as a combined mineable zone. Toward the east portion of the Project, the Arbour seam becomes much thinner and is separated below the Val d'Or. In these circumstances the mineability of the Arbour Seam is much less certain. In the current mining area, the Arbour Seam is separated some distance below the Val d'Or Seam and is relatively 'dirty'. It has not been considered mineable due to its position and high ash content.
- Additional coal seams are found to be mineable in locations throughout the Project. These seams include McLeod and McPherson Seams which have not been recoverable in the current mine area. Where these seams become sufficiently thick and of good quality they are included in the mine reserve. Likewise the Silkstone Seams (Wee and Bourne) are considered mineable in some locations.
- The dip of the various seams varies significantly over the strike length of the Project. The dip of the strata holds a significant influence over the geotechnical capability of highwall and footwall material. Once the dip reaches specific limits the bedding dip in footwall materials becomes more influential in footwall design. Likewise, joint sets in the highwall reach more significant influence in bench face stability. Chart B.3-1 illustrates the variation of seam dip over the length of the Project.

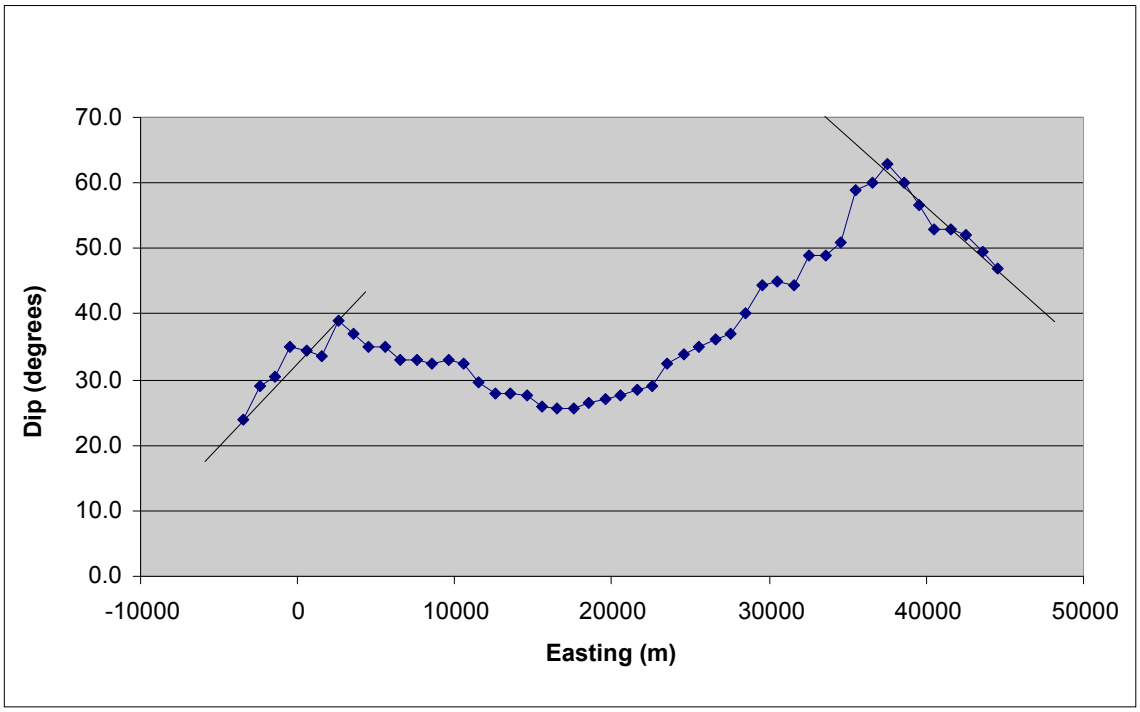


Chart B.3-1 Val d'Or Seam – True Seam Dip within the Project

B.4 HISTORICAL MINING ACTIVITIES

Two significant underground mines were operated in the Robb area during the early 1900s (Table B.4-1). These underground mines, shown in Appendix 9, Figure A1, operated within the Val d'Or Seam which is a main seam in the Project.

CVRI maintains a library of historic mine records for operations in the area. A few paper plans of the Lakeside and Bryan mines are available showing the general mining arrangement and extent of the mine development. Such drawings are often not of sufficient detail to accurately locate specific underground entries, rooms or pillars. They do however provide a reasonable demarcation of the underground development area. CVRI will retain these mine records for use during surface mining operations in the area. The plans will be utilized to identify zones of abandoned workings to establish safe working areas.

Table B.4-1 Previous Mining in Area

Period	Company Name
Lakeside Mine (Mine No. 775)	
1918 - 20	Minehead Coal Company
1920 - 21	Alex Susnar
1921	Balkan Coal Company
1921 - 22	Alberta Standard Coal Company
1922 - 27	Balkan Coal Company Ltd.
1927 - 49	Lakeside Coal Company
1949 - 55	Abandoned
1955 - 57	Minehead Coal & Oil
1957	Abandoned
Reported Total Production = 899,473 tons	
Bryan Mine (Mine No. 1157)	
1924 - 39	Bryan Coal Co. Ltd.
1939	P. A. Robb
1939 - 41	Bryan Power & Coal Co. Ltd.
1941 - 50	Thirty-two Collieries Ltd.
1950 - 52	North Western Coal & Oil Ltd.
1952 - 63	Bryan Mountain Coal Co.
1963 - 66	King Coal Ltd.
1966	Abandoned
Reported Total Production = 604,447 tons	

B.4.1 LAKESIDE MINE

Mine #0775 was open from 1918 to 1957 and was owned by a variety of entities during that period. The longest ownership was by Lakeside Coal Ltd. which operated an underground mine from 1927-1949. The operation was located primarily on the eastern side of the Embarras River with a tipple on the western side of the valley directly on the main railway corridor. Minehead Coal owned the mine from 1955 to 1957 when it was closed and abandoned for the last time. Reported life of mine production is 899,473 tons.

The underground mine started near the river valley and eventually extended over 2 km to the east. A 'room and pillar' mining arrangement was established to draw coal down dip to mains running along strike. Various levels were developed over time with many air shafts (adits). Remnants of these adits are still evident as small local subsidence along the length of the mine. No surface facilities of these previous operations remain. Some evidence of small abandoned surface excavations can be found near Robb.

During the 20th century the Lakeside Mine lease area eventually came under the control of Denison Mines Corp (Denison). Denison publically proposed a new coal development, Coalspur Project[1], in the early 1980s, which was centered on the coal lease located east of Robb. The proposal was not executed and the coal leases were later acquired by Luscar Ltd, a predecessor of CVRI. These leases have now become part of the Project.

B.4.2 BRYAN MINE

Mine #1157 was located generally on the western side of the Embarras River at Robb. It also operated in the Val d'Or Seam but was separated from the Lakeside Mine operation. The tipple was located on a railway spur located to the west of the Lakeside Mine surface structures. The operation had several owners throughout the mine life of 1924 to 1966. King Coal Ltd. owned the operation from 1963 to 1966 but the site is best known as the Bryan Coal Mine (Bryan Mountain Coal Co. Ltd.). Reported total production from the mine is 604,447 tons.

The mine started with decline entries located west of the Lakeside operation. A similar 'room and pillar' mining method was established. The extent of the operation is not as deep or as lengthy as the Lakeside Mine. A second set of declines are evident during later development perhaps due to faulting in the main production drifts. In later years a small open pit operation was developed at the extreme western end of the mine where the Val d'Or seam came closer to surface. This pit, including the footwall exposure and overburden dump remains visible today.

No surface facilities remain. Small areas of subsidence can be found, some with evidence of ongoing underground coal fires. The Bryan Mine coal leases were controlled at various times by NCO, Crowsnest Resources and then Shell of Canada. CVRI recently acquired the remaining Shell leases in the Bryan Mine area. These leases have become part of the Project.

B.4.3 EFFECTS ON CURRENT MINE PROPOSAL

The presence of previous underground mining in the Project area confirms that significant coal seam thickness with attractive coal quality exists in the area. Through study of old mining

[1] Preliminary Disclosure to the Government of Alberta, Dentherm Resources Limited, May, 1981

records the general location and geologic structure of the coal measures can be identified to target further exploration activity. However, underground room and pillar mines typically exploited steeply dipping monocline structure which often limits surface mining resource potential.

Past practice and review of mining plans for the underground mines indicate that the old workings will have little impact on the quantity of coal which CVRI will recover by surface mining methods. The majority of the underground work is deeper than can be reached by surface means. Regardless, surface mining in vicinity of old workings can pose operating concerns related to safety of people and equipment. There are dangers of subsidence, noxious gases and potential for encountering burning coal. CVRI has worked through such areas previously and maintains 'codes of practice' for operating in such area. These procedures involve early identification of danger areas, anticipation of risks, and prescribed steps to minimize and eliminate risks.

CVRI anticipates that surface mining above and around abandoned underground workings can be accomplished safely and successfully.

B.5 GEOTECHNICAL ASSESSMENT

The Project is essentially an extension of the existing mine operations at the CVM which have historically been mined by surface methods since 1978. Exploration has defined the coal seams as laterally continuous on moderate to steeply dipping beds on the western limb of a monocline across the Project area with only minor faulting. This geological scenario will be less complex than the more highly faulted zones that were successfully mined at the CVM areas. The mining principles, methods and procedures already proven to be successful and safe at the CVM will continue to be applied for the pit developments of the Project. A geotechnical assessment has been conducted for the Project and is included in Appendix 9.

The mining blocks of the Project are located within the same geological terrain as at the existing CVM areas. Consequently, the geotechnical assessment involved comparing the local engineering geology of the Project to similar areas at the CVM.

B.5.1 COMPARISON TO CURRENT OPERATIONS

The potential slope failure types that are likely to occur in the Project area have been identified as the same type of slope failures previously encountered in the CVM area.

Evidence of faulting in the Project area is present in areas over the length of the Project area based on observations of cross-sections and confirmed by CVRI's recently completed drilling program.

The analysis of faulting is still preliminary, but due to the continuity of coal seams identified displacement from faulting is considered minor and dominantly found in the Robb East area. When compared with the existing the CVM, previous mapping and drilling data showed that there is little faulting evident in either Mercoal East or Mercoal West. The similar situation is expected in the Project area.

Structurally, Mercoal East and Mercoal West are situated over the western limb of the Entrance Syncline while the CVM and Yellowhead Tower are on the eastern limb of the same syncline. The Project is located further northeast, situated on a separate syncline.

B.6 RESERVES

B.6.1 COAL LEASES

The Project is a collection of various coal holdings now assembled into a long linear development area. As coal mining in the Coal Branch has a long history so do the various coal lease blocks now in the Project area. Figure B.6-1 illustrates the coal leases in relationship to the proposed mine permit boundary for the Project

Table B.6-1 provides a detailed listing of all coal leases within the Project area. CVRI directly holds several coal leases in the Robb West area. Leases previously held by Denison where purchased by Luscar (L-D) are in the Robb Main area. Separate Luscar (L) leases are located throughout the Robb Main-Center-East areas. Additional leases (CVI and L-CVI) are held by companies within a royalty arrangement to CVRI.

A number of peripheral leases are currently under application with Alberta Energy. In the Robb West area these lease applications have been filed. Applications are pending in the remainder of the Project area.

With reference to Figure B.6-1 the following observations are of note:

- A small 12 ha (30 ac) lease in Robb West is held by others. CVRI will negotiate with the lease holder for rights to mine the area.
- Mancal holds a Mine Permit that overlaps a portion of the west edge of the Project. While, CVRI does not intend to mine coal within this area, it is incorporated into the proposed Project Permit boundary for infrastructure development.

Table B.6-1 Coal Leases

Lease Number	Lease Holder	Area (ha)
Robb West		
130805896	CVRI	137.6
130805897	CVRI	170
130805898	CVRI	141.6
1310080700	CVRI	250.9
A13100404302	Application Pending	105.2
A13070117101	Application Pending	194.2
A13070117102	Application Pending	161.9
	Application - New	615.1
Subtotal		**1,776.5**
Robb Main		
1307060430	L-D	372.3
1307060431	L-D	356.1
1307060432	L-D	566.6
1308060421	L	48.6
1308060422	L	566.6
1308060423	L	210.4
1308060424	L-D	113.3
1399120007	L	129.5
1307090807	L-CVI	598.9
	Application	194.3
	Application - New	1,116.9
Subtotal		**4,273.5**

Lease Number	Lease Holder	Area (ha)
Robb Center		
1307090800	CVI	32.4
1307090801	CVI	145.7
1307100715	L	129.5
1307100718	L	242.8
1307100719	L	372.3
1302090016	L-CVI	388.5
1307090805	L-CVI	776.9
1307090807	L-CVI	113.3
	Application	809.3
	Application - New	437
Subtotal		**3,447.7**
Robb East		
1307090804	L-CVI	469.4
1308090610	L	210.4
1307100713	L	226.6
1307090805	L-CVI	485.7
	Application	356.1
	Application - New	356.1
Subtotal		**2,104.3**

Total	**11,602**

B.6.2 PRELIMINARY RESERVE EVALUATION

At an early stage, CVRI requested Norwest to develop a Project geologic model and develop a preliminary mine plan. Using the results of this plan, CVRI established a conceptual Project Mine Plan.

B.6.2.1 Norwest Conceptual Mine Plan

The Norwest preliminary mine plan report examines the relationship between the resource quantity and the FOB mine price through use of varying incremental strip ratios. The resulting report; *Robb Trend Conceptual Mining Study, Norwest Corporation*, November, 5, 2010, is provided as Appendix 10. The report reviews the influence of the market price for coal to the mining strip ratio and the resulting mine resource estimate. A 'base case' scenario utilizing a FOB Mine coal value of $60.00 per tonne is suggested as a reasonable basis for defining the conceptual mine plan. The report translates this price to a 'breakeven strip ratio' of 6:1 (BCM/RMT) as the relationship for determining the maximum mining depth and pit configuration.

B.6.2.2 Project Reserves

Norwest has supplied resource estimates for the Project based on the geology model developed for their technical reviews. Resource estimates for various strip ratios are useful to illustrate the relative 'sensitivity' of the Project to strip ratio, hence coal price. An important factor in evaluation of a project is the ability of the project operating costs to adjust to market fluctuations.

Table B.6-2 provides a tabulation of resource quantity varied by breakeven strip ratio as reported by Norwest. The accompanying graph illustrates the relationship that a higher strip ratio brings deeper pits and more coal reserves. This also reflects the ability of the Project to move the BESR as market values fluctuate.

These estimates indicate that the Project reserves ranges between 105 to 282 million RMT with respective cutoff ratios of 4:1 and 8:1 as a bracket around the target of 6:1.

Table B.6-2 Project Reserves (k RMT)

BESR	West	Main	Center	East	Total
4	26.739	52.397	8.344	17.974	105.454
6	55.502	88.833	15.005	30.709	190.049
8	74.591	141.772	22.134	43.320	281.817
10	100.090	200.811	30.695	56.282	387.878
12	129.132	274.861	40.161	69.663	513.817
14	144.573	305.693	52.611	85.450	588.327

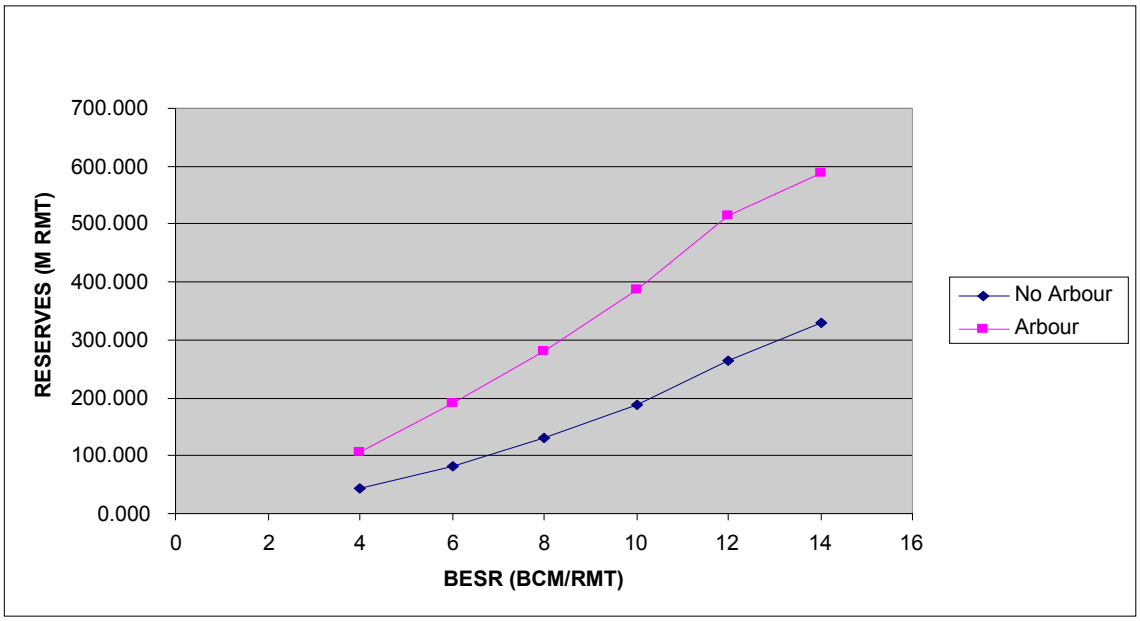


Chart B.6-2 Reserves vs. Ratio

B.6.2.3 Clean Coal Yield

As part of the conceptual mine study performed by Norwest an 'ash model' was developed with the geology model. This started with an ore-waste composite ash value for the drill holes to develop raw ash values for each seam. Contact dilution at each rock/coal contact was also incorporated to simulate a coal recovery process. Having calculated a seam ash value the specific gravity for the seam was then calculated. Both values where then utilized in the modeling process. This process takes into account both inclusion of small partings and dilution from surrounding rock contacts. Both cause the 'mass' of the recovered coal seam to increase and ash content to increase.

The 'coal' then hauled to the existing Coal Valley Mine Coal Processing Plant (Plant) has a higher ash content due to the added dilution. This directly relates to lower 'Plant yield' in response to the extra dilution added to the inherent in-seam ash content.

Norwest further developed a 'process yield' equation based on CVRI experience. Norwest concluded that "the resulting average yields averaged approximately 50% with individual blocks varying by as much as +/- 7% absolute from the average".

This conclusion is in line with CVRI assumptions for typical coal yields. In long term planning the company normally uses a yield of 50% for typical Val d'Or and Mynheer seams. CVRI would use lower yield values for instances where coal seams have been faulted or folded.

B.6.2.4 Mineable Reserves

Norwest has supplied a pit layout configuration (pit shell) for the Project based on the following parameters:

- based on the geology model previously developed (November, 2010);
- mining all the recoverable coal seams, including the Arbour Seam;
- utilizing a combination of dragline and benched pit mining methods; and
- utilizing a BESR of 6:1 BCM/RMT as a constant throughout the length of the Project.

CVRI has modified the pit areas to remove the portion located within the 'Robb Corridor'. This corridor corresponds to the buffer areas CVRI proposes to the east and west of the Hamlet of Robb (450m and 2050m respectively). The 'model' is also constrained on the west end by the end of the CVRI coal leases. The eastern constraint is the presence of the Pembina River which also includes a small buffer zone to accommodate anticipated setbacks from the river floodplain.

Table B.6-3 provides the CVRI estimate for the mineable reserves proposed for the Project. Based on a BESR of 6:1 the estimated mineable reserves in the Project are projected at 177.8 million tonnes. The majority of the reserves are found in the Robb Main and Robb West portion of the Project.

Table B.6-3 Mineable Reserves

SEAM	Coal (k RMT)				
	WEST	MAIN	CENTER	EAST	TOTAL
VLDU	3,397	7,555	803	3,823	15,578
VLD	8,462	27,910	5,873	18,812	61,057
ARBO	13,678	36,725	6,512	2,877	59,792
MCLD	359	2,322	-	-	2,681
MCPU	2,108	1,430	-	-	3,538
MCPM	10,246	3,323	16	689	14,274
MCPL	-	2,833	53	26	2,912
WEE	-	518	185	977	1,680
BOUR	-	-	-	60	60
MYNU	2,562	7,348	1,788	3,305	15,003
MYNL	-	778	-	451	1,229
Total	**40,812**	**90,742**	**15,230**	**31,020**	**177,804**
Waste (kBCM)	145,622	291,087	55,708	98,947	591,362
Ratio (BCM/tonne)	3.57	3.21	3.66	3.19	3.33

This reserve calculation includes recovery of multiple coal seams found within the Project. As shown in Table B.6-3, the vast majority of the reserve is obtained from the Val d'Or/Arbour complex and the Mynheer Seams.

B.6.3 MINE PLAN ELEMENTS

B.6.3.1 Overburden Removal

Pit development in the Project involves excavation of overburden covering the coal reserves. Draglines and excavators load this material for movement from the various pits. Sequencing of various pits and benches within specific pits assists in placing much of this material as 'in-pit' backfill. Maximizing 'in-pit' backfill is important so as to minimize disturbance of extra land outside the pit footprint and in refilling open pits so assist reclamation of the final terrain.

The pit design process has estimated that 591.4 million BCM of material will be excavated throughout the life of the Project. As this material is mined the volume of material is increased due to breakage of the mass. A typical swell factor of 25% is anticipated thus resulting in a waste disposal volume of approximately 739.3 million m^3 of material.

The conceptual mine plan developed by CVRI and presented within the application illustrates the general placement of this material as either external dumps or in-pit backfill.

B.6.3.2 Pit and Dump Design

CVRI has developed a conceptual mining plan for the Project generally based on 'pit shells' developed by Norwest (see Appendix 10). This plan includes pits designated for dragline mining and others as backhoe/truck operations. In the planning a development sequence was established so that appropriate dump areas could be outlined. In this sequence external dumps are required for early pits and upper benches of large backhoe/truck pits. As mining progresses an increasingly larger portion of the overburden could be accommodated as backfill to nearby mined out pits. The result is a preliminary but feasible mining layout and sequence.

B.6.3.3 Dragline Pits

The large walking dragline currently in use at the CVM is expected to be moved into the Project area. It is also assumed that this machine, or a similar machine, would be available for the entire mine life of the Project. Within the Project this mining method is best applied to shallow, narrow and linear monocline pits. As the dragline is the lowest cost mining method any coal resources that could be reached by the machine would be reserved to the dragline mining method.

The dragline would be utilized to strip the overburden and spoil to either or both sides of the cut. The uncovered coal would then be recovered by other equipment. In this approach a single linear cut is developed as the dragline advances in a specific direction.

In the Project, the conceptual dragline pits are primarily based on the Mynheer Seam in Robb Center and East. Some sections of the Val d'Or pit in Robb Center could also be considered for dragline application. General pit design for dragline operations would involve the following parameters:

- pit depth is limited by the digging depth of the dragline which is typically 40 m;
- the footwall of the pit would be formed by the footwall of the seam uncovered;
- the hanging wall can be excavated at approximately 60 to 65 degrees and a small safety bench is normally established at the weathered bedrock contact height; and
- spoil is handled by the dragline to both sides of the cut as required; rehandle is possible to move material further from the pit rim.

The majority of the reserves in Project area would require open pit mining as they are beyond the capacity of the dragline. This mining method involves development of multiple horizontal benches to progressively remove the overburden and uncover the dipping coal seams. Large equipment is used to excavate the overburden and off-highway trucks are used to remove the waste material to nearby disposal dumps. CVRI utilizes various hydraulic excavators to dig and load both the rock and coal at the CVM. A large truck fleet comprised of end-dump trucks with payload capacity of 190 ton is used at the CVM.

General pit design parameters would include the following:

- highwall angles are established with an interslope angle of 45 degrees, with final pit walls subject to stability analysis;
- bench heights of 15 m with face angle of 60 to 65 degrees, double or triple benching would be considered for establishing safety benches on highwalls;
- pit footwall would be the footwall of the bottom seam recovered; and
- long term haul roads width would be approximately 30 m with maximum grade of 5%.

B.6.3.4 Dumps

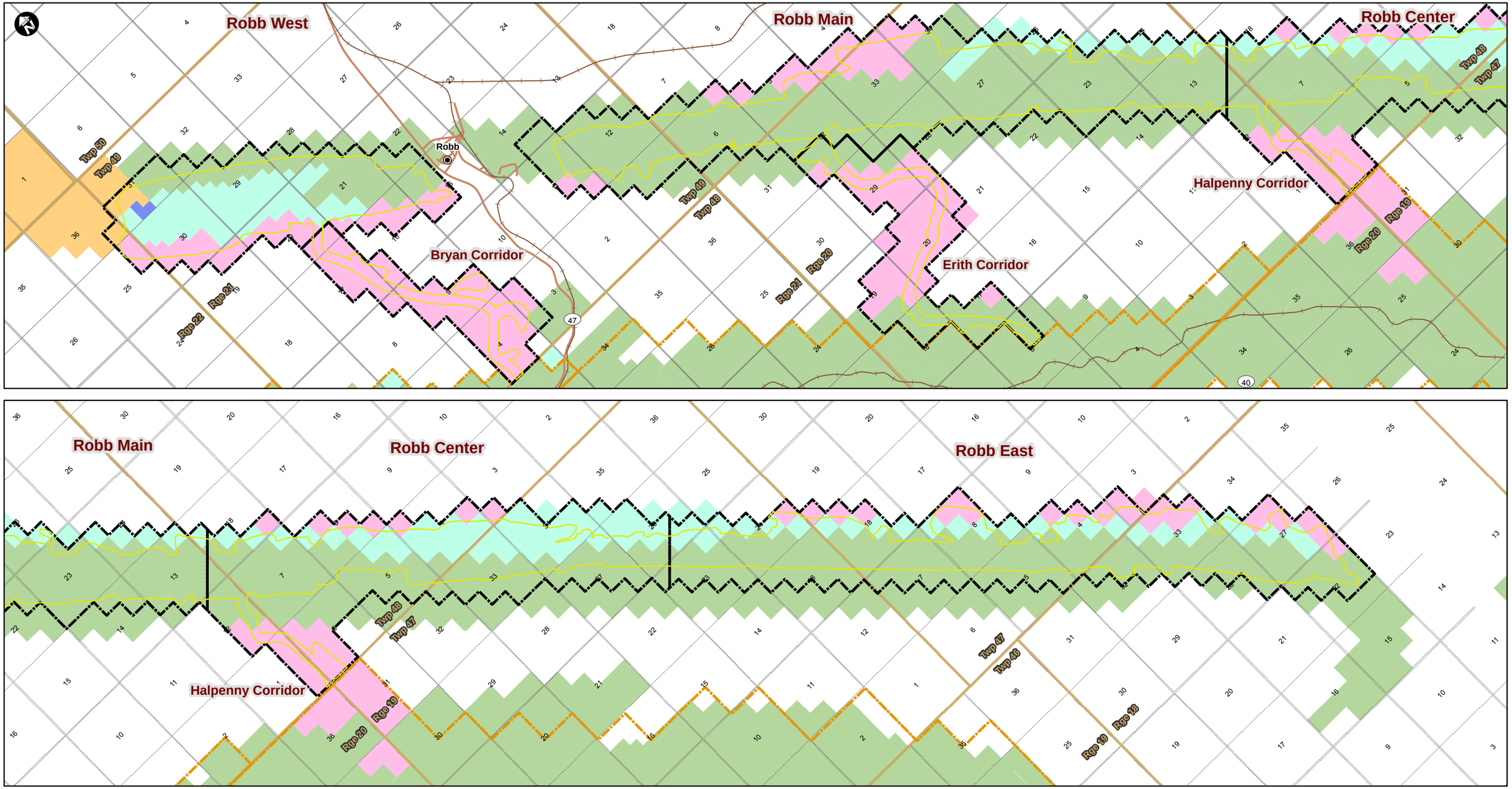
Overburden dumps are routinely developed for end-dumping from elevated positions. The favored terrain is dumping from the top of a ridge into a sloping hillside. Alternatively dumps can be constructed in a 'bottom up' sequence. In these cases multiple 'lifts' of limited height are built to progressively higher elevations. Thus a 'layer cake' structure is formed. This option is often utilized where the dump foundation is steeply sloped or unfavorable ground conditions are found. General parameters for dump design would include:

- locating dumps where volume of material can be maximized and haul distance minimized, with valley fills or dumps on slopes favored and all dumps designs subject to stability analysis;
- limiting lift heights to approximately 30 m when lifts are utilized;
- the angle of repose for rock overburden is approximately 37 degrees; and
- maximum haul road grades are 5%.

B.6.3.5 Material Characteristics

Table B.6-4 provides typical material densities and other factors utilized in preliminary planning.

Table B.6-4 Material Characteristics				
(Assumptions for Mine Design Purposes)				
Material		Density (MT/BCM)	Yield	Swell
Soil		1.60		25%
Till		1.70		25%
Rock		2.20		25%
Coal*				
	Val d'Or	1.58	50%	
	Arbour	1.64	45%	
	McLeod	1.67	43%	
	McPherson	1.62	47%	
	Silkstone	1.56	52%	
	Mynheer	1.56	52%	
Plant Reject				
	Tailings	0.82		
	Coarse Reject	1.85		
Footnote				
	Based on Norwest 'ash model' results			



Legend

- Lease Applications Pending - CVRI
- Lease Requested - CVRI
- Lease Applications - Others
- Lease - CVRI
- Lease - Mancal
- Proposed Robb Trend Mine Permit Boundary
- Proposed Footprint
- Existing Mine Permit Boundary

0 0.75 1.5 3
Kilometres

REF: CVRI, Robb Trend Project Extents 2B.dwg, Feb 7, 2011.

PROJECT:
Coal Valley Mine
Robb Trend Project

TITLE:
Coal Leases

DRAWN:	PS/JG
CHECKED:	KY
DATE:	Mar 29/12
PROJECT:	08-041

FIGURE: **B.6-1**