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7.0 ANALYSIS OF FEASIBLE ALTERNATIVES

Key points

- The combination of open cut and underground mining is the most economical mine plan due to the surface constraints within the exploration license area;
- The length and orientation of the longwall panels were designed to have no impact on the Hunter River alluvium and to provide sufficient area outside the subsidence zone for the Bowmans Creek diversion;
- All saleable coal will be transported off site via rail;
- The adopted method of reject disposal was considered the most cost effective and safe for this mine operation; and
- There would be a significant loss in potential employment and economic benefits if the Ashton Project was not to go ahead.

7.1 Mining Method

Open cut mining maximises the recovery of those coal reserves at relatively shallow depth and of varying thickness. The limitations of open cut mining are that there is an economic limit to the quantity of overburden that can be moved to recover the coal resource (thus limiting the depth to which coal may be recovered), and the challenge of ameliorating the environmental impact of extensive ground disturbance.

The north eastern reserves within EL4918 and the Mine Extension Area are suited to open cut mining due to the relatively shallow depth of cover to the first coal bearing seams. Open cut mining of the reserves within this area provides the most economical method. The physically constrained area of the open cut, would not lend itself to underground mining techniques, as there would be insufficient recovery of coal to make it economically viable. Highwall mining of the thicker seams allows for additional recovery of coal and therefore adds to the economic viability of the open cut.

The operation of draglines or large rope shovels are not feasible within the open cut. This is due to the limited strike length and the narrow confined pit. Hydraulic excavators are suited to this style of pit and the thickness of interburdens prevalent in the Ashton Open Cut.

The geology of the area to the south of the New England Highway contains four coal seams that are suitable for extraction by underground mining. A combination of constant seam thickness, good roof

and floor conditions, low gas make and the lack of any significant geological structure or intrusions means that longwall mining methods can be adopted. Traditional "board and pillar" extraction of coal was considered, however, this resulted in the loss of a significant amount of the available coal reserves due to the poorer recoveries associated with this mining method.

A combination of open cut mining and underground longwall mining is considered to provide the most economical method of maximising the recovery of the coal resources in the license area.

7.2 Mine Plan

A number of variations to the proposed open cut mine plan were considered during the development of the Ashton Coal Project. All plans considered the mining of coal from the "envelope" of the resource north of the highway. All of the mining layouts were constrained by tenement boundaries, the location of existing public utilities, safety considerations and the surface area required for the coal handling and preparation plant

The coal seams subcrop on the eastern portion of the license area south of the New England Highway and consideration was given to mining these subcrops along and west of the north south trending ridgeline. This option was discounted due to potential environmental impacts.

The underground mine plans considered the risk of water ingress from Bowmans Creek. Two alternative mine plans were considered. The first option limited the western extent of development to avoid subsidence impacts on Bowmans Creek. This option sterilized almost 40% of the available coal resources and had a significant affect on the amortisation of fixed assets.

The selected option provides adequate surface area for the diversion of Bowmans Creek outside of the limits of subsidence. Longwall panels 5 and 6 were shortened from the original mine plan to allow for meanders in the northern section of the diversion. The option is much closer in design to a natural creek system.

The length of the longwall panels at the southern end have been shortened to avoid any potential impact on the Hunter River alluvium. Studies which are discussed in **Section 3**, identified the boundary of the Hunter River alluvium, and therefore determined the length of the longwall panels. Likewise, the eastern limit of the longwall panels have been restricted to avoid any potential impact on Glennies Creek and its associated alluvium.

Most importantly, the mine plan has been developed to incorporate concerns raised by the community with emphasis on maintaining the amenity of Camberwell village. The initial works for the Ashton Coal Project is the erection of environmental bunds. The open cut mine then operates behind these bunds and progressively works to the north and west away from the village.

The mine plan proposed is considered to provide the greatest overall advantage in terms of:

- Minimal impact upon the residents of Camberwell;
- Safety;
- Coal recovery;
- Environmental protection; and
- Economic benefit.

7.3 Coal Transport

Coal from the open cut mine will be delivered to the ROM stockpile area within Arties Pit by truck as the depth and layout of the Barrett Pit is not conductive to conveyor transportation.

Coal from the underground mine will be delivered directly to the ROM stockpile area by an overhead conveyor gantry system. The ROM stockpiles are located on the floor of the Arties Pit and are therefore below surface level.

The transport of coal from the ROM stockpile area to the CPP and thence to the product coal stockpile area and the train loading bin will utilise conveyors. Consideration was given to truck transport for parts of this operation, however neither alternative proved to be economically or environmentally feasible.

During the construction phase of the CHPP, ROM coal could be transported to Macquarie Generation. This will be transported on trucks via an internal haul roads, to Macquarie Generation's overland conveyor belt system. With this option available to the project, it was not considered feasible to transport coal via the New England Highway.

Following this initial period, saleable coal will be produced for the export and domestic markets and will be transported via rail to the Port of Newcastle or Macquarie Generations rail loading facility near Ravensworth. Road transport of coal to the Port of Newcastle was not considered due to the long-standing arrangements of the coal industry to use rail in preference to road to transport coal to market or export facilities.

7.4 Mine Design and Infrastructure

The mine design for the open cut provides for an initial box cut immediately east of the Camberwell anticline, with the mine then progressing in a westerly direction across the anticline. At the start of year 4, the mine pivots with a second box cut in the south west corner, then progressing north to leave the final void in the north west corner of the pit. This option maximises the amount of overburden

which can be dumped within the mine void, and results in a final void which is in close proximity to the CPP. An alternative design for a continuous east to west development was considered, but was discounted due to a significantly larger requirement for the external disposal of overburden. This also impacted on the visual amenity of the project and left a larger void along the western boundary of the pit.

The design for the underground mine was limited by the physical constraints described previously, as well as a desire to align the longwall panels within 30 degrees of the direction of the principal horizontal stress and the need to avoid having longwall panels parallel with the joint orientation. The selected design achieved these goals and optimised the direction of the gate roads. Alternative designs for the orientation of the gate roads and longwall panels were discounted due to reduced resource recovery.

The mine surface infrastructure has been concentrated in the north western corner of the tenement and on the east side of Bowmans Creek. This option minimises the sterilization of recoverable coal and avoids the need to transport all ROM coal across the creek, thereby obviating the potential for inadvertent spillage of coal into the waterway. The selected location also ensures that the permanent operational structures are outside the zone of subsidence and as far as practicable away from the village of Camberwell. This reduces the noise and night lighting impact on immediate neighbours. It also minimises the distance that product coal needs to be transported prior to loading into rail wagons. Three other alternative sites were given consideration, but none offered the overall combination of advantages provided by the selected site.

7.5 Reject Disposal Methods

The ROM coal produced from both the open cut and underground mines contains varying amounts of stone and ash that needs to be removed prior to sale into the export market. This removal occurs in the CPP and results in two products of little or no economic value; namely coarse reject and tailings.

The coarse reject is planned for disposal in defined areas of the eastern emplacement area, during initial open cut operation. Once the final void is established, the coarse rejects will be used to fill available space. Coarse rejects will also be used for the construction of tailings pond walls to act as a filter medium to enhance the recovery of process water from the tailings for use in the CPP. Alternatives considered were disposal of coarse rejects into the goaf of the underground mine and disposal into the voids of other mine sites. The former option was negated by timing and safety issues, whilst the latter option has significant disadvantages in terms of the cost of haulage to other sites and the potential legal liabilities for the remediation of previously disturbed sites.

The tailings disposal regime involves two initial settling ponds in advance of the Barrett Pitt. These will then be replaced by transition ponds, developed on the overburden emplacement area at the south end of the Barrett Pit. At the completion of open cut, mining tailings will be placed into the final void.

Once again, consideration was given to pumping tailings into the goaf area of the underground mine, but this disposal method would create a large pool of water underground which could create a safety risk when the next lower coal seam is extracted.

Consideration was also given to co-disposal into the overburden emplacement area however, this option was negated by cost and desire to keep the tailings in a concentrated area.

7.6 Coal Preparation

A number of options for the washing of Ashton coal were considered. These included trucking or conveying ROM coal to neighbouring mine facilities where additional CPP capacity had been identified. The investigation concluded that the risks associated with the continued availability of this capacity, the environmental impacts of the preferred transport method and the associated costs of upgrade meant these options were not economically viable.

7.7 Consequences of Not Proceeding

The "Do Nothing" alternative involves not proceeding with the Ashton Coal Project. Should the project not go ahead, there will be a loss of potential employment which would have a negative social and economic impact in the locality and region through loss of income and financial flow-ons as addressed in **Sections 5.10** and **5.11**.

The 2000 Coal Industry Profile reported that between 1997 and 2000 the number of people employed by mines in the Hunter Coalfields dropped from 6,358 to 4,770. This represents a decrease in employment of 25% from 1997. The Ashton Coal Project proposes to employ approximately 200 personnel during the construction phase and approximately 140 personnel during the operational phase. It is proposed that the mine and the CHPP will operate for an estimated 20 years.

The Ashton Coal Project will not only provide direct employment for local workers but will also provide indirect and induced employment in the surrounding district. Such employment opportunities would occur in the mine servicing industry, retail trade and employment related to the provisions of services (e.g. government, health care, childcare, community and recreational services). Given the existing employment situation in the upper hunter valley, the potential to create further employment is an important issue.

Ashton proposes to expend an estimated $11.2Mpa in wages during the operation of the underground and open cut mines. In addition construction wages are likely to be in the order of $18M for the period. An income multiplier of 1.66 has been used in assessing the income impacts. Using the multiplier the extended mine can be expected to generate addition flow-on income of $7.4Mpa during open cut and underground operations. This means the Ashton Coal Project is likely to generate around $18.6M of income per annum during peak production.

It is expected that at least 50% of the Ashton workforce will live in or around Singleton LGA. It can be reasonably expected that 50% of wages and flow-on income will remain in this locality, representing an estimated $9.3M per year.
Based on a tax rate of 30% Commonwealth Government can expect to raise yearly revenue of $3.4M dollars as a result of income tax on wages of the direct employees. There is also expected to be significant royalties paid to NSW Government to assist in the operation of rail and port facilities.

It is expected that most of the coal mined at Ashton will be exported. It is projected that up to 50Mt of coal could be exported during the operation of Ashton. This will continue to assist with Australia's balance of payments and the reduction of the nation's trade deficit.