

4 Hydrogeological Setting and Data

4.11 Transient Calibration Data

4.11.1 Introduction

This section describes groundwater level and pumping data available for transient calibration of the groundwater assessment model. Available data consists of:

- Groundwater level monitoring data; and
- Data from the operation of the Alpha Test Pit (ATP), which includes groundwater level data and pumping data.

These data are described in more detail below.

4.11.2 Groundwater Level Monitoring Data

Groundwater monitoring bore data is available from site from December 2009 to current. During this time there have been two significant wet season rainfall periods (2009/2010 and 2010/2011 wet seasons). In spite of this, groundwater levels have remained relatively stable over the period of monitoring (Figures 4-15 to 4-22). This is interpreted to indicate the following:

- The intervals where the majority of monitoring is undertaken (C-D and D-E sandstone) do not respond to rainfall recharge in the short to medium term. This indicates that the intake areas for these units are located some distance from the site; and
- Direct rainfall recharge could occur in the upper unconfined Quaternary and Tertiary sediments. However, drilling and shallow standpipe bores (Figure 4-27 and **Appendix A**) are often dry indicating limited perched water within these units.

The lack of response to rainfall events means that there is no local data available for calibration of rainfall. However, the data does serve to indicate areas where rainfall recharge does not directly apply, and does suggest that water removed from the model will not be readily replaced by rainfall recharge.

4.11.3 Data from Operation of the Alpha Test Pit

The Alpha Test Pit was developed between November 2010 and July 2011 to enable a bulk sample of coal (150,000 ROM (Run of Mine) tonnes to be extracted for product testing. The ATP was excavated to a depth of 66 m below natural surface, and required advance depressurisation to allow mining to proceed safely to depth (i.e. for prevention of floor heave and to maintain geotechnical stability of the pit walls).

Monitoring of daily pumping volumes from 12 pit perimeter bores (from commencement of pumping on 21 April 2011 to cessation of pumping on 20 July 2011), and 6-hourly groundwater level monitoring of bores adjacent to the pit, provided a data set that was used for calibration of the groundwater assessment telescoped model (Section 8).

A summary report has been prepared (JBT Consulting, 2011g) and is included in **Appendix C**.

The transient data, groundwater levels and groundwater extraction, was used to calibrate a telescoped model in order to obtain site specific storativity and permeability data for use in the predictive modelling (Section 10).

Description of Mining

5.1 Alpha Coal Project

The pit shell for mining at Alpha and Kevin's Corner is shown on Figure 5-1. The Alpha mining schedule is shown on Figure 5-2.

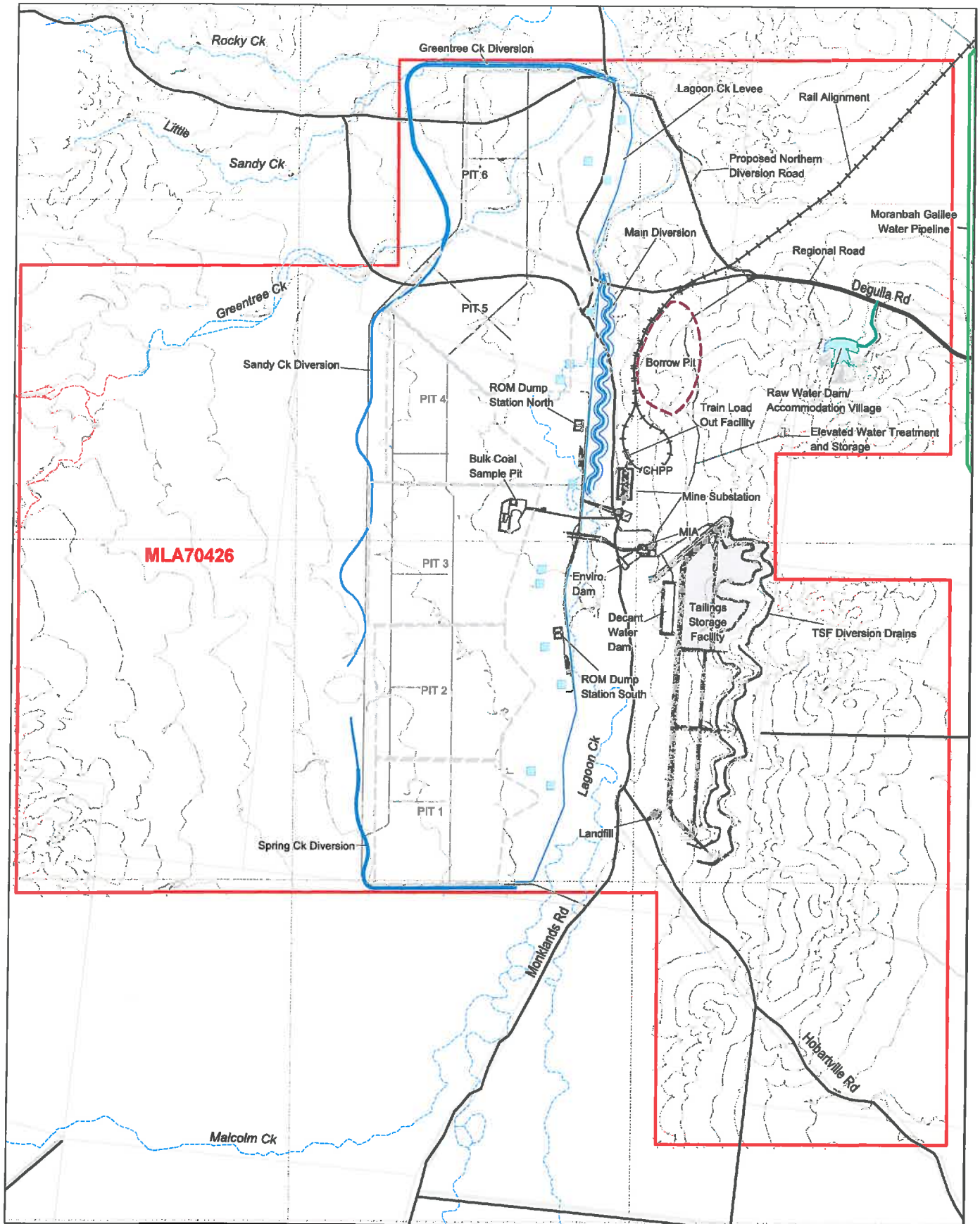
Mining is set to commence in 2013 and ramp up after the first year to a total production of 30 Mtpa of product coal. The operation has a nominal life of 30 years, but it is anticipated that reserves could extend the mine life beyond the 30-year period. At this stage all modelling assessments have been undertaken on the assumption of a 30-year mine life (end of mining in 2043).

During the first few years of the operation coal will be taken from a number of discrete box-cuts extending along the strike length of the operation. By year 5 the mine will be open along the full strike length of approximately 24 km, with mining extending in a westerly direction. Internal dumping behind operations will mean that the open pit floor at any time will have a width in the order of 100 m.

5.2 Kevin's Corner Coal Project

The Kevin's Corner mining schedule is shown on Figure 5-3. Mining is set to commence in late 2014 from two open-cut operations, with underground operations to commence the following year. Production will ramp up after the first year to a total production of 30 Mtpa of product coal. The operation has a nominal life of 30 years, but it is anticipated that reserves will push the mine life beyond the 30-year period. At this stage all assessments have been undertaken (for the purpose of modelling) on the assumption of a 29-year mine life (2014 to 2043, Figure 5-3).

In the first few years of the operation coal will be taken from box-cuts in the east of the project area. The smaller north pit (Figure 5-3) will be mined out after several years, but the larger southern pit will continue operation until 2042. Mining underground will be undertaken through three separate underground mines (northern, central, and southern).



- Diversion
- Contour (10m interval)
- Water Pipeline
- Mining Lease Application (MLA70426) Boundary
- Water Dam
- Borrow Pit
- Pit Outline

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS Volume 2, Appendix B

0 2 4Km
Scale 1:150,000 (A4)
Datum: GDA84, MGA Zone55



HANCOCK PROSPECTING PTY LTD
Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE) PROJECT LAYOUT

Job Number 4262 6680
Revision C
Date 09-03-2011

Figure: 2-4

File No: 42626680-g-1001.wor

Copyright: This document is and shall remain the property of Hancock Prospecting Pty Ltd. The document may only be used for the purposes for which it was produced. Unauthorised use of this document in any way is prohibited.
Bing Maps © 2009 Microsoft Corporation and its data suppliers, ESRI/ArcGIS Online 2011, © Microsoft Australia Pty Ltd and PSHA Australia Ltd, © Commonwealth of Australia (Geoscience Australia) 2006, © The State of Queensland (Department of Environment & Resource Management) 2010, © The State of Queensland (Department of Mines and Energy) 2010.
This map is based on or contains data provided by GHD and URS 2011, which makes no representation or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages or other costs (including indirect or consequential damage) which are or may be incurred by any party as a result of data set being inaccurate, incomplete or unsuitable in any way for any reason.

4 Hydrogeological Setting and Data

Figure 4-10 Cross-section through MLA70425 at 7454000N (Kevin's Corner)

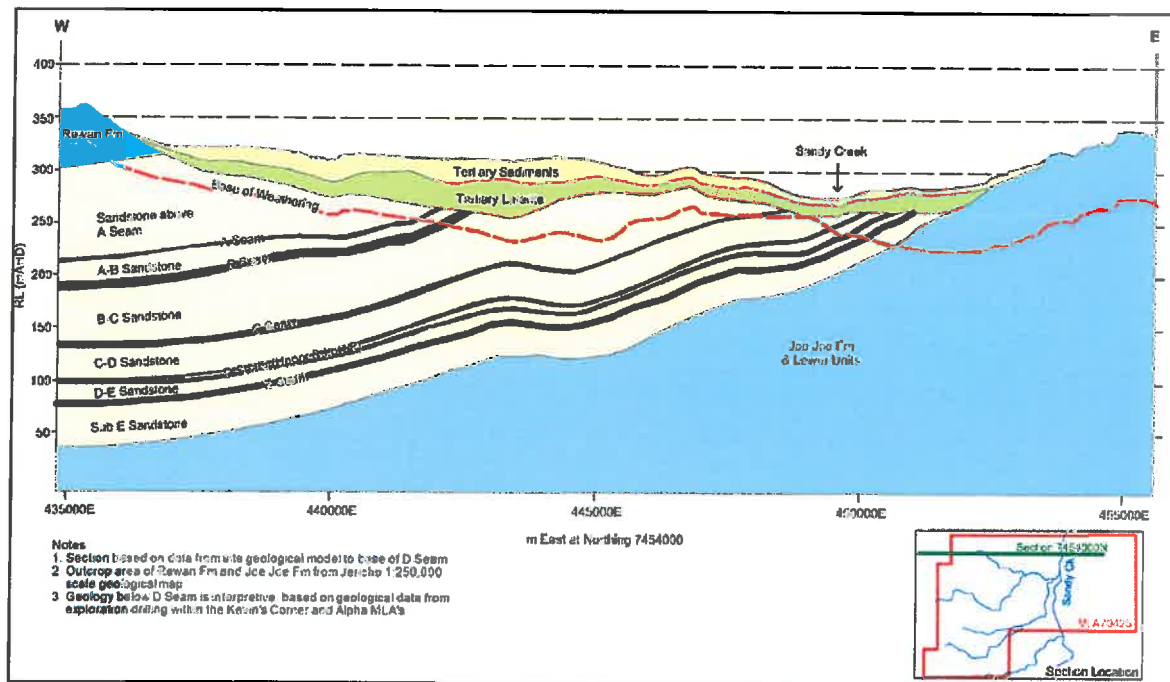
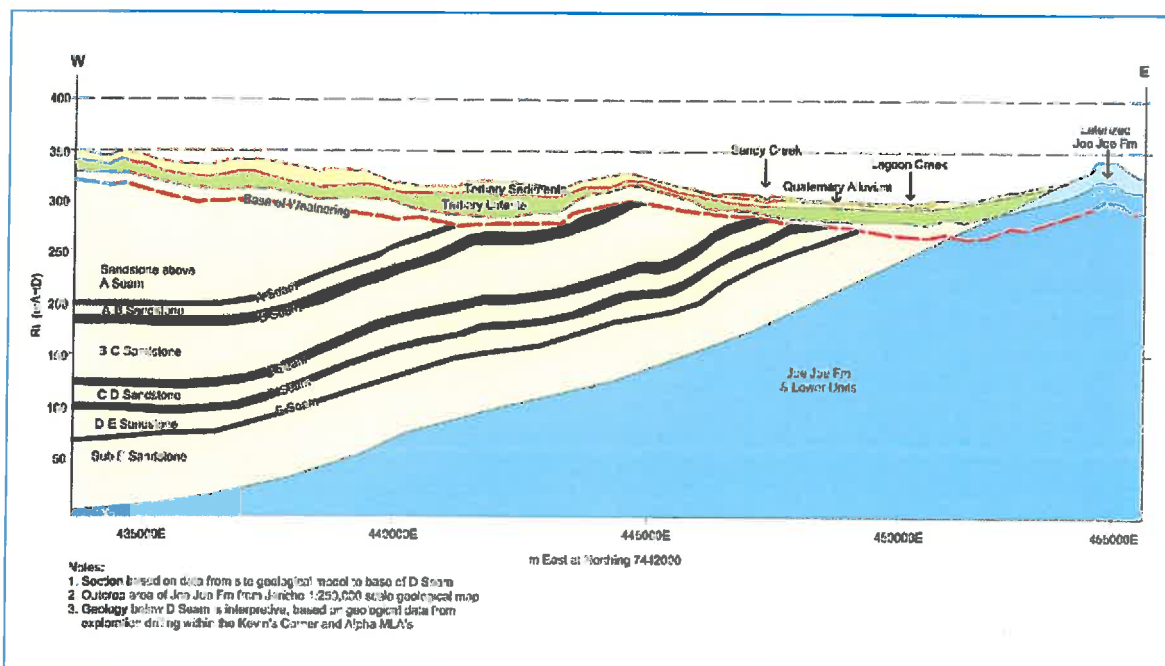


Figure 4-11 Cross-Section through MLA70426 at 7442000N (Alpha)

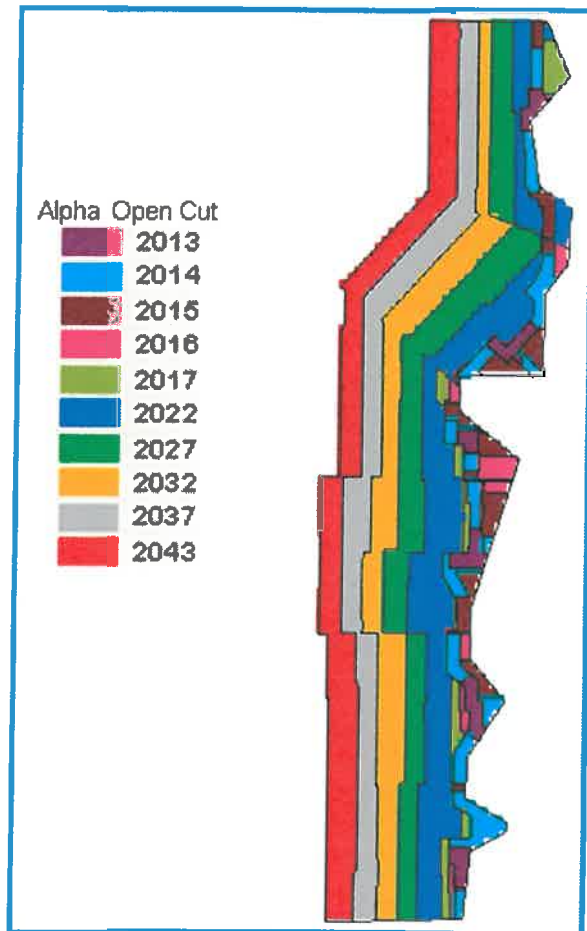


Tertiary intrusive and extrusive rocks (e.g. Tertiary basalts) have not been encountered on site.

In the Tertiary sediments above the base of weathering, water is encountered only sporadically, and as such is not regarded as comprising a significant groundwater resource. Quaternary alluvium associated with current surface water drainage systems may contain localised occurrences of

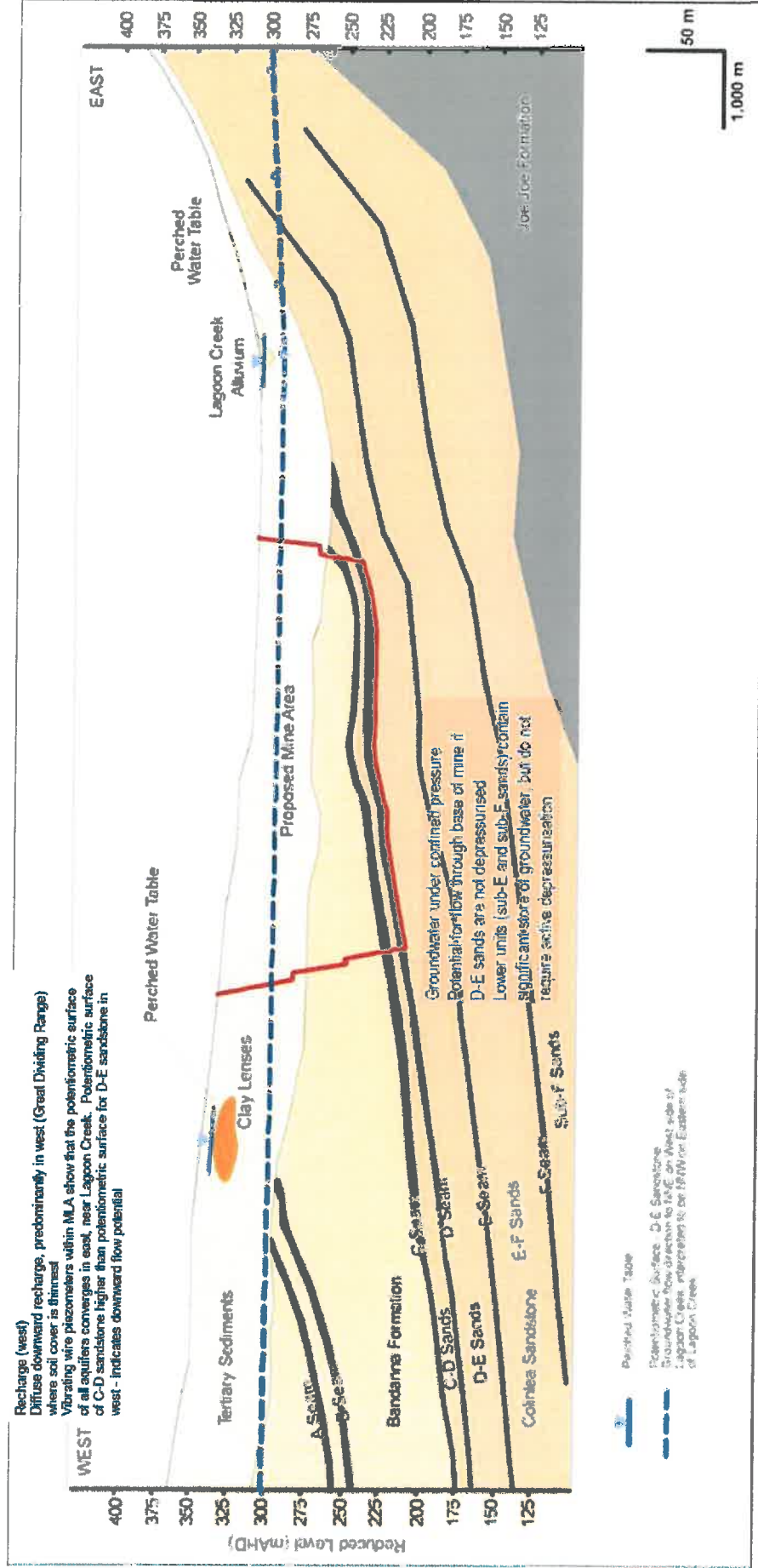
5 Description of Mining

Figure 5-2 Mining Sequence, MLA70425 Alpha



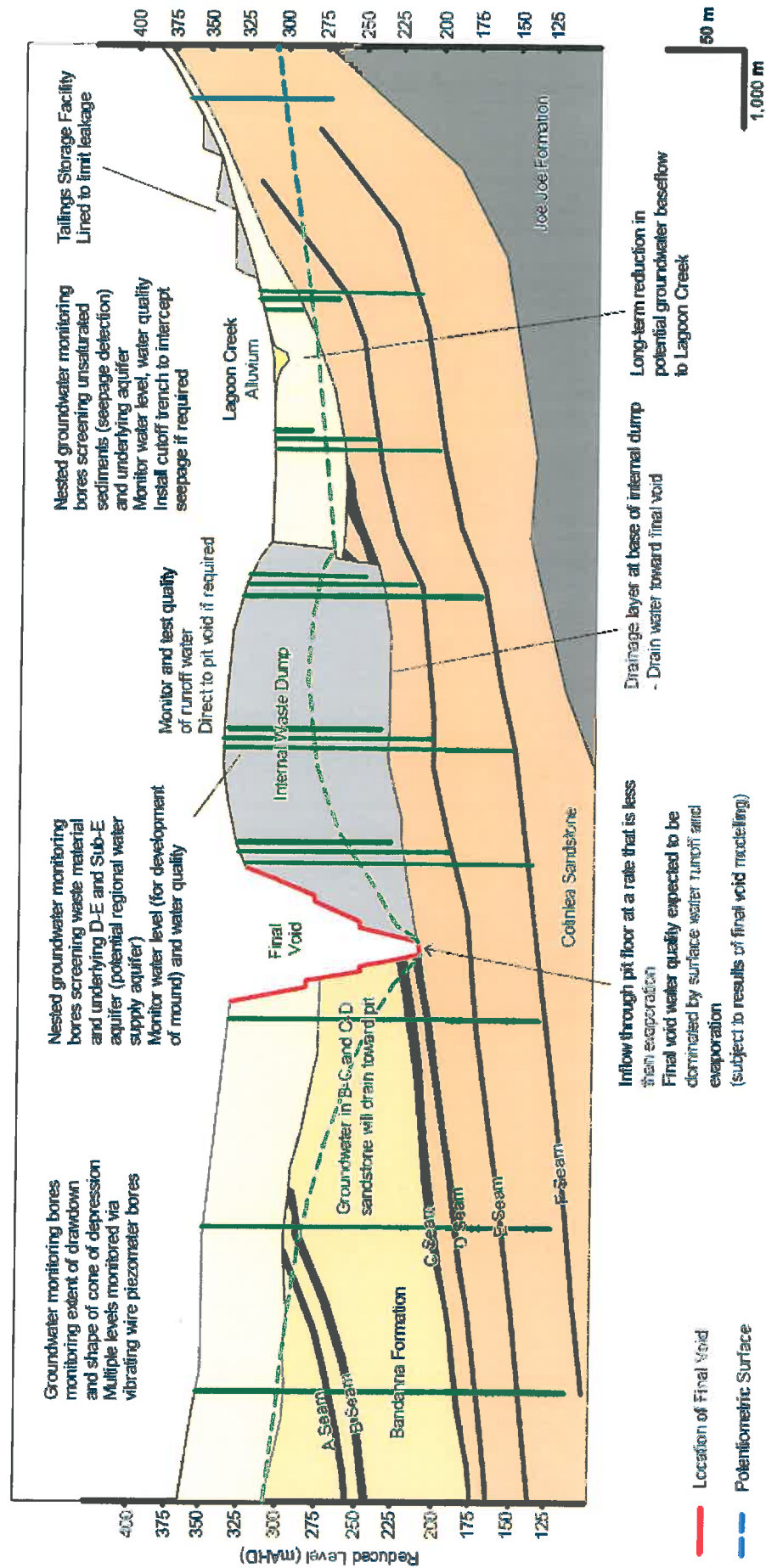
6 Conceptual Groundwater Model

Figure 6-1 Pre-Mining Conceptual Groundwater Model – Alpha



6 Conceptual Groundwater Model

Figure 6-2 Post Mining Conceptual Model – Alpha



Executive Summary

The predictive model was utilised to assess drawdown within the different aquifers and geological model layers, over time and spatially across the model domain. Projected groundwater levels below the Great Artesian Basin Rewan Formation and Clematis Sandstone do not indicate any drawdown effects as a result of mine dewatering over the life of mine (30 years). Thus no impacts of potential induced flow are considered.

The direct and indirect impacts of mine dewatering on the vegetation communities were evaluated based on the (largest) predicted drawdown associated with the D coal seam. There is limited potential for induced flow from the isolated (non-continuous) perched water down into the depressurised deeper aquifers. These perched water tables are regular recharged through rain and flood events and not reliant on upward groundwater movement. However, it is anticipated that there will be some direct impacts to the perched water table(s) due to direct drainage into the open mine voids. It has been predicted that there will be a 10 to 100 m zone of influence directly around the mine voids.

An assessment of neighbouring bores, which may be at risk from Alpha mine dewatering, was conducted. An assessment of bores within the projected 1 and 5 m drawdown contours for the target D seam, at the end of mining, was conducted. 18 neighbouring bores, recorded during the study, have been identified and will be field checked as part of the Proponent's make-good commitment.

Drawdown cones in the D coal seam were contoured, up to 0.5 m, to assess groundwater level change during mining for Alpha alone and also for (cumulative contours) Alpha and Kevin's Corner. The projected contours indicate that there will be minimal drawdown to the east of the mine footprint because of the aquitard nature of the Joe Joe Formation metasediments. This low permeability unit restricts groundwater drawdown, resulting from mining, to the east. Drawdown cones elongate north and south, within the more permeable Colinlea Sandstone. The cumulative impact of adding the Kevin's Corner dewatering results is deeper drawdown where drawdown cones overlap and further elongation along strike. The low permeable Bandana Formation and Rewan Formations constrain drawdown to the west. These constraints apply across the entire portion of the Galilee Basin containing Alpha. This means that the potential for induced flow from the GAB or drawdown in the older units to the east of the Joe Joe Formation does not increase based on additional mining.

An integrated model was constructed to allow for an assessment of potential long term impacts based on predicted final void water levels and long term groundwater levels. The final void modelling predicts that the final void water level reaches a pseudo steady-state after ~ 50 years, at around 37 m above pit floor (around 250 m AHD depending on location within the final void). An uncertainty assessment, allowing for varying climate conditions (long term climate change) indicates that the variation in in / out flux components in the integrated model do not markedly alter predictions, ~ 1 m. The lowest elevation point where decant could potentially occur is along the northern most portion of the final void, at an elevation of 305 m AHD. The projected final void water level in the northern portion of the final void is 249 m AHD, some 56 m below the lowest pit surface elevation. The risk of decant is, therefore, considered negligible.

Final void quality is recognised to deteriorate over time due to the concentration of salts as a result of evaporation. The final void water could be utilised for ~ 150 years before the salinity reached 5,000 mg/L TDS, the ANZECC 2000 guidelines for cattle livestock drinking water.

Based on requests for data compiled post EIS submission, additional predictive groundwater

Executive Summary

modelling was undertaken to allow for an assessment of possible risks with regards to:

- The closest Great Artesian Basin (GAB) major aquifer, the Clematis Sandstone;
- The basal unit of the GAB, the Rewan Formation, which overlies the target Permian sediments;
- Registered springs to the north of Alpha and Kevin's Corner coal projects;
- Sub-E coal seam sandstone, which has been identified as a source of make-good water; and
- Cumulative impacts through assessing the model predictions for Alpha alone and then comparing the results of simulating Alpha and Kevin's Corner.

Observation points within the model allowed for the assessment of groundwater level changes in different model layers, over time (during mining and for 300 years post mining), within and adjacent to the Alpha Open Cut mine and final void. The predictions of the changes in groundwater resources as a result of mining and final void indicate a permanent alteration to groundwater flow patterns and levels around the final void.

The predicted changes in groundwater levels in the units below the Clematis Sandstone, after 300 years, are sufficiently small (within natural fluctuations) that the risk of induced flow from the Clematis Sandstone to the mine depressurised units is negligible. Larger drawdown is projected for the Bandana Formation below the Rewan Formation, which indicates limited potential (to the west of Alpha) to induce flow from this unit. The resultant change in groundwater levels would, however, not result in marked reductions in groundwater resources within this aquitard.

No projected impacts, in any of the model layers, below the northern registered springs have been predicted during or post mining.

The potentiometric pressure in the sub-E sandstone is predicted to decrease to ~ 275 m AHD adjacent to the final void, where the bottom of pit is ~ 220 m AHD. Thus the sub-E sandstone is still fully saturated (no dewatering) but has been depressurised (10 to 20 m depressurisation). It was, therefore, considered that the sub-E sandstone can be utilised, away from the immediate mining area, as a source of make-good water.

Cumulative impacts of multiple mines, along strike, within the Permian Galilee Basin units were considered. Based on the cumulative impact modelling of both Alpha and Kevin's Corner, the dewatering impacts (drawdown cones) are predicted to elongate north and south, within the more permeable sandstone units of the Colinlea Sandstone. The cumulative impact of adding the additional mine dewatering will result in deeper drawdown where drawdown cones overlap and further elongation along strike. Drawdown cones created for Alpha alone and for mining both Alpha and Kevin's Corner do not result in any additional or cumulative impact to the west. This indicates that the risk to the units to the west (i.e. the GAB units) is not increased by additional mine projects along strike of one another.

Limited risk of long term TSF impacts on Lagoon Creek were considered using concentration propagation simulations in the integrated model. Little or no risk to Lagoon Creek is predicted if the base of the TSF ensures vertical leakance of $1\text{E-}06$ (vertical permeability $\sim 1\text{E-}05$) or less.