# Report

## Alpha Coal Mine Project Air Quality Assessment - Model Refinements

21 MAY 2012

Prepared for

Hancock Coal Pty Ltd

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# Table of Contents

Table of Contents



## Tables

## Table of Contents



## Figures

## Table of Contents



## Appendices

# Abbreviations

| Abbreviation | Description |
|---|---|
| ACIRP | Australian Coal Industry Research Program |
| AED | Advanced Environmental Dynamics |
| AHD | Australian Height Datum |
| BFS | Bank Feasibility Study |
| CHPP | Coal Handling and Processing Plant |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| EETM | Emissions Estimation Technique Manual |
| EIS | Environmental Impact Statement |
| EM Plan | Environmental Management Plan |
| EPP | Environmental Protection Policy |
| FEL | Front End Loader |
| FMZ | Fume Management Zone |
| HCPL | Hancock Coal Pty Ltd |
| IPCC | In-Pit Crushing and Conveying |
| MLA | Mining License Application |
| NPI | National Pollutant Inventory |
| PM | Particulate Matter |
| ROM | Run of Mine |
| SEIS | Supplementary Environmental Impact Statement |
| US EPA | United States Environmental Protection Agency |
| VKT | Vehicle Kilometres Travelled |

# 1 Introduction

## 1.1 Scope

Hancock Coal Pty Ltd (HCPL) is proposing to develop the Alpha Coal Project (the Project), a 30 million tonnes per annum (Mtpa) product open-cut thermal coal mine to target the seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The Project will be supported by the development of a standard gauge, single track, non-electrified, 495 kilometre (km) long railway line for the purposes of transporting processed coal from the Alpha coal mine to the Port of Abbot Point. An Environmental Impact Statement (EIS) was prepared to assess the environmental impacts of the Project (November 2010), and in response to submissions received and changes to the Project Description, a Supplementary EIS (SEIS) report was also prepared (September 2011).

As part of HCPL's ongoing development of their technical assessments, the mine air quality assessment provided as part of the SEIS has now been updated. This update is known as the 'Refined Model' hereafter. This has included external peer review of all emissions sources, modelling methodology and new information that has become available since the SEIS was completed. This independent, technical review has been undertaken by Dr. Darlene Heuff of Advanced Environmental Dynamics (AED) in an independent technical review role. A summary of the modelling review by AED is provided in Appendix A. The URS response to this review is provided in Appendix B. Appendix C is a summary of the Refined Model Addendum report review and a statement as to the scope of the external peer review by AED.

This report is intended to provide the following information:

- A summary description of the evolution of the predictive modelling assessment since the EIS, including key changes made to the methodology and the model results.
- A summary of the key changes made to the modelling assessment and how these interact with operational procedures at the mine;
- Detailed technical description and justification for the changes made to the assessment.
- A description of the key issues raised by statutory consultees: Department of Employment, Economic Development and Innovation (DEEDI), Department of Environment and Resource Management (DERM) and Queensland Health; and
- The provision of clarifications and supplementary information requested by the statutory consultees.

The technical elements of the report have been used to inform the development of a detailed Environmental Management Plan (EM Plan) including air quality monitoring and mitigation measures.

# 2 Summary of Air Emissions Modelling at Alpha Coal Mine

## 2.1 Introduction

URS has conducted air quality assessments of the impacts of dust emissions from Alpha Coal Project (the Project) on behalf of Hancock Prospecting Pty Ltd (HCPL). In each assessment, a site-specific emissions inventory was developed for 30 years of the life of the Project. The emissions and impacts of dust from mine-related activities including total suspended particulates (TSP), particulate matter less than 10 microns (µm) in diameter ($PM_{10}$), particulate matter less than 2.5 µm in diameter ($PM_{2.5}$) and dust deposition, were considered. Ground-level concentrations of TSP, $PM_{10}$, $PM_{2.5}$ and dust deposition were predicted using the CALPUFF atmospheric dispersion model at ten sensitive receptor locations including the proposed on-site Accommodation Village.

In Queensland, air quality is managed under the Environment Protection Act 1994 (the Act), the Environmental Protection Regulation 2008[1] (the Regulation) and the Environmental Protection (Air) Policy 2008[2] (EPP (Air)) which came into effect on January 1, 2009. The Act provides for long-term protection for the environment in Queensland in a manner that is consistent with the principles of ecologically sustainable development. The primary purpose of the EPP (Air) is to achieve the objectives of the Act in relation to Queensland's air environment.

## 2.2 Summary of Dispersion Modelling Studies

All atmospheric dispersion modelling studies described in this report have been undertaken using the same broad inventory development and modelling techniques. These methods include the use of Australian National Pollutant Inventory (NPI) and United States Environmental Protection Agency (US EPA) AP-42 emission factors to develop emissions inventory, and the use of the TAPM (meteorology) and CAPLUFF (pollutant dispersion) models. More detail about these models can be found in the EIS and SEIS technical report assessments[3,4]. There follows a summary of the evolution of each modelling study and the reasons behind the model changes.

### 2.2.1 Environmental Impact Statement (EIS) – September 2010

The EIS was completed in September 2010 and reported in ground level predictions of particulate matter fractions $PM_{10}$ and $PM_{2.5}$ in excess of the EPP (Air) standards for the 24-hour averaging period. These exceedences were predicted at sensitive receptors to the north, east and south of the site. The frequency of exceedences was predicted to range between 5 and 30% of all days in the year throughout the life of the mine with receptors to the south and north worst affected.

### 2.2.2 Supplementary EIS (SEIS) – March 2011

Updates to the project description were applied to the EIS emissions inventory and a new inventory was developed for the SEIS. The changes to the project description with the potential to impact upon dust generation were as follows:

- Introduction of In-Pit Crushing and Conveying (IPCC) resulting in the reduction in wheel generated dust from unpaved roads;

[1] Queensland Government, *Environmental Protection Regulation* 2008, Office of the Queensland Parliamentary Counsel
[2] Queensland Government, *Environmental Protection (Air) Policy* 2008, Office of the Queensland Parliamentary Counsel
[3] Hancock Prospecting Pty Ltd (2010). Air Quality Assessment. Alpha Coal Project Mine. 18 September 2010.
[4] Hancock Prospecting Pty Ltd (2011). Alpha Coal Project Mine Project Air Quality Assessment-Supplementary Report. 30 March 2011.

## 2 Summary of Air Emissions Modelling at Alpha Coal Mine

- Mine layout changes due to updates to geological model and modification to mining methods resulting in a reduction in dust from draglines, excavators and shovels;
- An increase in the proposed use of land bridges included in the mine layout resulting in a reduction in wheel generated dust from unpaved roads and dust from dragline rehandle;
- The introduction of two new pits in addition to the four modelled in the EIS; and
- The relocation of the Accommodation Village;

In addition to changes to the layout and emissions inventory, observed meteorological data from Emerald Bureau of Meteorology station was incorporated into the TAPM meteorological model and the size of the meteorological grid was increased to enable prediction of dispersion plumes over a larger area.

Incorporation of these changes into the emissions inventory and dispersion modelling reduced the overall dust generation from the mine in the new SEIS inventory. However, these savings were off-set by the discovery of an underestimation of wind speed dependent emission sources in the EIS model.

In the SEIS model, predictions of ground level $PM_{10}$ and $PM_{2.5}$ were in excess of the EPP (Air) standards for the 24-hour averaging period. As in the EIS, these exceedences were predicted at sensitive receptors to the north, east and south of the site. The frequency of exceedences was predicted to range between 5 and 40% of all days in the year throughout the life of the mine with receptors to the south and north still worst affected.

### 2.2.3 SEIS Refined Model – November 2011

The frequency and magnitude of the exceedences predicted in the SEIS led to a comprehensive review of the SEIS modelling and a new ‘refined’ and more realistic inventory and dispersion model was developed as a result. The basis for the refinements made to the SEIS model is described in detail in Section 4 and is summarised as follows:

- The availability of new data sources since completion of the SEIS;
- The application of new mitigation; and
- Adjustments to the SEIS inventory.

The incorporation of these new data sources, mitigation controls and adjustments to the inventory into the Refined Model assessment highlighted the inherent conservatism in the results reported in the EIS and SEIS.

It should also be noted that the Accommodation Village was removed as a sensitive receptor in the Refined Model assessment as human exposure at this location will be regulated under Coal Mining Health and Safety Act 1999. Furthermore, two new sensitive receptors were added to the assessment. The Spring Creek and Glenn Innes Homesteads were introduced after they were understood to be habited on an infrequent basis. The Spring Creek Homestead receptor is located at 429264 (m) east and 7414981 (m) north. However, predictions made at the nearest model grid point were used to represent exposure at this location because it was not included as a specific location in the EIS, SEIS or Refined Model. The grid point chosen is located at 429750 (m) east and 7415250 (m) north which is approximately 550 m closer to the mine than the Spring Creek Homestead. Similarly, the Glenn Innes Homestead receptor is located at 441844 (m) east and 7408274 (m) north and is represented by the grid point 441750 (m) east and 7408250 (m) north which is some 97 m away. This represents a conservative approach as model predictions are likely to be higher at locations nearer to the mine.

The results of the Refined Model are presented in Section 3.

## 2.3 SEIS Model Refinements Summary

### 2.3.1 Availability of New Moisture Content Data

For the development of the SEIS Refined Model, additional data relating to the moisture content of overburden and coal became available. A conceptual model of moisture content was, therefore, developed,

#### *2.3.1.1 Moisture Content Conceptual Models*

The moisture content variability of both the overburden (material on top of the product coal seams) and the product coal material has an impact on the potential dust emissions released from mining activities. Relatively lower moisture content increases the potential for material to be disaggregated in to finer particles, once disturbed through activities such as stockpiling via dragline handling and transfer to trucks. Consequently, finer particles have the potential to be transported by wind further from the source before deposition occurs, thus increasing the likelihood of impacting sensitive receptors external to the site. Relatively higher moisture content will lower the potential for finer particles to be released to the atmosphere as material remains better aggregated. Any release of particulates to the atmosphere would be more likely to deposit within a shorter distance from the emissions source, given the particulate would have a relatively higher mass, thereby reducing the potential impact to far field sensitive receptors.

##### *Overburden Moisture Content*

Overburden and product moisture content were evaluated and, where necessary, refined within the SEIS addendum assessment. The refinements were made based on the release of the Bank Feasibility Study (BFS) Design Criteria Coal Handling and Preparation Plant (CHPP) 'BFS Criteria Report' (Hancock Coal, 2010).

The overburden material consists of two layers, being weathered material on top of sandstone bedrock. Borehole data obtained from the site were used to develop a conceptual model for estimating the overburden moisture content. The moisture content of each overburden layer was determined through the analysis of the BFS data. The BFS moisture content data were found to be consistent with the moisture content data obtained from the borehole samples. Details on how the overburden moisture conceptual model was refined are provided in Section 4.1.1 and Section 4.4.2.

##### *Product Moisture Content*

Previous revisions of the EIS assumed a highly conservative air dried basis for moisture content. However, the moisture content data provided by the BFS document reports that Alpha coal has a relatively high level of both air dry and total product moisture. The tests undertaken on seam section coal samples were in accordance with industry best practice codes and ensured consistency throughout all coal testing procedures. The results of these tests were considered to provide more realistic product moisture contents, given that they represented 'as received' figures from the coal samples. Input of this data in to the refined dust emission inventory had the effect of reducing the overall dust generation total attributed to mining activities, and thus lower peak and average particulate matter concentrations at sensitive receptors. Further details on the derivation of product moisture contents and their application within the Refined Model are provided in Section 4.1.1 and Section 4.4.3.

The technical detail behind the revised moisture conceptual model in the SEIS assessment is shown in Section 4.1.

### 2.3.2 Adoption of New Dust Mitigation Methods

#### *2.3.2.1 Revision of Emissions Factors*

For Front End Loading (FEL) of trucks, under the National Pollutant Inventory (NPI) no effective mitigation is listed and so a control factor cannot be applied on this basis. However, the default NPI emission factor makes no allowance for moisture content and is based on research studies in the Hunter Valley, where the moisture content of overburden is significantly lower than found in this study. The NPI Emissions Estimation Technique Manual (EETM) for Mining notes at section 1.1.1 that a moisture content of 1% would be plausible for the Hunter Valley. The US EPA AP42 (Section 13.2.4-3)5 emission factor equation for FEL of Trucks suggests that increasing moisture content by a factor of two results in a reduction in $PM_{10}$ emissions of more than 60%. Although the calculated AP42 emission factor is considered in the NPI Manual to be unrealistically low for Australian (Hunter Valley) conditions, it is reasonable to assume that the very high moisture content of overburden at the Alpha Coal Mine would significantly reduce particulate emissions from this source. This principle has also been applied to the mitigation of emissions from truck dumping of overburden.

The emissions inventory has been reduced for all activities beyond the CHPP as the material will be in the form of a ‘slurry’ with a moisture content in excess of the 15.7% threshold for dust generation described in the Hancock Prospecting Pty Ltd ‘Dustiness Moisture Relationship Report’ (ACIRL, 2010). These mitigation controls are summarised in Table 2-3.

#### *2.3.2.2 Dragline Drop Heights*

A dragline is used to remove and transfer overburden material to facilitate the mining process and negates the need for using trucks to transport material over disaggregated surfaces. Dust is released throughout the dragline process as the material is disturbed through the transfer of material from origin to stockpile. The height from which the material is dropped has a direct influence on the generated dust emissions. A higher drop height would result in the release of relatively higher volumes of dust, given the larger distance it would travel before reaching the ground. As a consequence, the generated dust would have the potential to travel further distances from the source. The SEIS assesses the dust generation from the release of material from the dragline, in accordance with the HCPL proposed operational dragline procedures. The revised drop height is now 6 m, reduced from 15 m in the submitted SEIS. This results in a lower predicted particulate matter generation from dragline activities, and contributes to a lower overall dust generation total from mining.

Details on the assessment of dust emissions relating to the dragline drop height are provided in Section 4.2.2 and Section 4.4.1.

The new dust mitigation methods adopted in the SEIS model are shown in Section 4.2.

[5] http://www.epa.gov/ttnchie1/ap42/

### 2.3.3 Adjustments to SEIS Model

#### *2.3.3.1 Reduction in Overburden Haulage*

A review of the emissions inventory identified an over-estimation of overburden haulage emissions. In the Refined Model, these emissions have been reduced by making the following amendments to the inventory:

- Reducing the overburden material transported by haul road as a result of the introduction of In-Pit Crushing and Conveying (IPCC); and
- Reducing the overburden material transported by haul road to account for the overburden material removed by dragline. This was double counted in the SEIS inventory.
- The total trucked overburden waste in the SEIS was therefore significantly reduced in the Refined Model inventory. In years 10-30 this reduction is by approximately 50% in comparison to the SEIS inventory.

#### *2.3.3.2 Tailings Dams*

The entire surface area of the tailings dams was represented as a source of dust emission in the SEIS. Through the analysis of aerial photography for similar tailings dams for coal mine projects of a similar scale, it was determined that the majority of the tailings area will be moist and therefore not a source of dust emissions. Therefore, the tailings dam surface area was reduced to 10% of its size in the SEIS.

The adjustments made to the SEIS model are described in detail in Section 4.3.

## 2.4 Key Issues Raised by Statutory Consultees

### 2.4.1 Peak or ‘worst case’ Emissions

In 1998, NEPC made the Ambient Air Quality National Environment Protection Measure (AAQ NEPM) that set national ambient air quality standards to apply in all States and Territories and over land controlled by the Commonwealth. These standards cover six pollutants – particles ($PM_{10}$), ozone, sulphur dioxide, nitrogen dioxide, carbon monoxide and lead. The NEPM provides a nationally consistent framework for the monitoring and reporting of these six pollutants. This was the first time that national air quality standards had been set in Australia. In Queensland, the AAQ NEPM has been adopted and are implemented through the Environment Protection Policy (Air) (EPP (Air).

In this study, the 5th highest predicted $PM_{10}$ concentrations averaged over 24-hours have been compared to the EPP (Air) objective. In the AAQ NEPM, the ‘allowable number of exceedences, specified in the NEPM at 5 per year for $PM_{10}$, was set to account for natural events such as bushfires and dust storms as well as the impact of prescribed burning for fire management purposes.’ Therefore, the concentrations reported in the Addendum report do not reflect the maximum possible predicted concentration which is not a requirement of the EPP (Air). However, in Section 3.3, a description of the maximum predicted concentrations is provided at each sensitive receptor at the request of Queensland Health. If the maximum concentration had been reported, exceedences at receptor 4 in year 5 and receptor 1 in year 30 would have been predicted, which were not in reporting the 5$^{th}$ highest value. However, as the maximum was not significantly higher than the 5$^{th}$ highest reported value, which were already close to the EPP (Air) objective, reporting the maximum would not change the mitigation actions proposed in the EM Plan.

### 2.4.2 Non-particulate Emissions from Mines

Although combustion pollutants $NO_x$, CO and $SO_2$ from blasting for open cut mining may only contribute a only a small proportion of total emissions, the rapid release and high concentration that may be associated with such activities could pose a health risk should the resulting plume not dissipate sufficiently before reaching human. Therefore, at the request of Queensland Health, emissions from blasting have been assessed. The assessment scope covers those emissions which can be expected under 'normal' blast conditions where the explosive fuel is completely combusted and 'upset blasting conditions' which have the potential to produce clouds of visible noxious gas outside the standard blasting exclusion zone ('fume events'). These have the potential to impact upon human health during short periods of exposure if populations are exposed.

It was determined that under normal blasting conditions, all pollutants are predicted to be under the EPP (Air) objectives at all human receptor locations including Kia-Ora Homestead. Under abnormal blasting conditions, fume events occur when a non-ideal explosive reaction generates a cloud of pollution which moves outside the standard blast exclusion zone. This cloud consists of $NO_2$, nitric oxide (NO), and CO which are harmful to human health. The standard blast exclusion zone is designed to provide protection from projections and blast overpressure. It is difficult to quantitatively assess emissions during fume events due to the uncertainty in emissions factors which are described in Section 3.6. Therefore, the assessment of emissions during fume events has been undertaken qualitatively with a focus on the length of the potential downwind exclusion distance and the best practice management approaches recommended in the Department of Employment, Economic Development and Innovation (DEEDI) guidance note QGN 20 v3[6]. HCPL will operate a Fume Management Zone (FMZ) around the pits where emissions from blasting will be carefully managed in compliance with the best practice recommendations in guidance note QGN 20 v3. This will include preventative, management and incidence reporting measures.

The technical assessment of blasting emissions is provided in Section 3.6.

### 2.4.3 Cumulative Impacts

It is possible that there will be development of other mines within the Galilee Basin area such as Waratah Coal Mine and Kevin's Corner Coal Mine. Therefore, a quantitative assessment of cumulative impacts would be required in order to accurately estimate the likely cumulative effects impact on the future air quality environment.

Such an assessment has not been undertaken for the Alpha Coal Mine Project for a number of reasons. The timeline for the development of the Kevin's Corner and Waratah mines was unclear although they are likely to commence later than the Alpha Coal Mine. Cumulative impacts are only expected to be important during the open cut phases of the Waratah and Kevin's Corner mine project developments. It was unclear at the time of the SEIS when these open cut phases would occur so a quantitative cumulative impact assessment taking into consideration peak emissions from cumulative open cut activities was not possible. However, a qualitative assessment has been carried out.

[6] DEEDI (2011). Queensland Guidance Note QGN 20 v3 Management of oxides in nitrogen in open cut blasting

# 2 Summary of Air Emissions Modelling at Alpha Coal Mine

Plans for the development of the Waratah and Kevin's Corner Coal mines indicate a dominant component of underground mining with a relatively small proportion of high dust generating open cut mining. The EIS for the Kevin's Corner and Waratah coal mines have shown that emissions generation is likely to be significantly lower than Alpha which means that Alpha will be the dominant contributor to the cumulative impact. Such is the distance of the Kevin's Corner and Waratah coal mines from each other it is unlikely that the cumulative impact from all three mines will differ from the cumulative impacts of Alpha plus Waratah or Alpha plus Kevin's Corner.

The sensitive receptors at which the highest concentrations are predicted (8 Kia-Ora Homestead, 9 Monklands Homestead and 14 Glenn Innes Homestead) are located to the south of the Alpha coal mine. Therefore, the impact on peak concentrations at these receptors from dust generated during northerly wind events will be impacted cumulatively by the Alpha and Kevin's Corner coal mines only. Similarly, during southerly wind events, these receptors will be impacted by emissions from the theWaratah coal mine only (if these receptors are still present as they are located in the Waratah mining footprint). Therefore, all three coal mines cannot contribute to the peak concentration at these receptors at the same time. However, all three mines could contribute to the number of exceedence days during the year when winds are from the north (Kevin's Corner plus Alpha) or south (Waratah plus Alpha). Therefore, a cumulative impact assessment should be undertaken when full development plans for Kevin's Corner and Waratah are available. A cumulative impact assessment of emissions from Alpha and Kevin's Corner was undertaken in the Kevin's Corner EIS which will subsequently be updated in the Kevin's Corner SEIS. This will include the contribution from the Alpha SEIS Refined Model and the updated Kevin's Corner SEIS model. All three mines will adopt similar methodologies to manage impacts at sensitive receptors and the Alpha emissions will be managed in accordance with industry best practice.

The Galilee Basin is characterised by a low population density as a result of the low yield nature of its pastoral and grazing land. Therefore, cumulative impacts of air pollution would impact on a small population if the basin. It is therefore considered that the Galilee Basin is a suitable location for a several mining projects to co-exist.

### 2.4.4 Sensitivity Analyses

Comments received in relation to the submitted SEIS, from DERM and an independent peer review (see Section 4.4), both recommended that worst case conditions for the handling of material via dragline, and for overburden and product moisture be considered with respect to emissions of particulate matter. As such, two scenarios were compared which assessed total $PM_{10}$ generation in years 5 and 30 of mining activities. The first scenario considered the modelled conditions relating to dragline height and moisture content, as presented in the SEIS, with the second considering worst case conditions for the respective elements. A review of both scenarios determined that the Refined Model scenario is considered to be a representative assessment of $PM_{10}$ generation from mining activities. However, the use of worst case assumptions within the second scenario is not considered to significantly alter the assessment findings.

Full details of the sensitivity analyses are provided in Section 4.4.

## 2.5 Key Issues Raised by Non-Statutory Consultees

### 2.5.1 Carbon Emissions from Land Clearance

The SEIS did not include a calculation of the release to atmosphere of stored carbon from land to be cleared for mining. HCPL did not include this in the total carbon inventory for the Project because it was not a requirement in the Terms of Reference (ToR) for the EIS, issued by the Department of Infrastructure and Planning (June 2009). However, to supplement the studies undertaken in which HCPL met the ToR, this calculation has been made and added to the total $CO_2$ emissions inventory.

Carbon emissions due to land clearing were calculated using the Department of Climate Change (DCC) FullCAM Modelling tool. FullCAM is a fully integrated carbon accounting model for estimating and predicting all biomass, litter and soil carbon pools in forest and agricultural systems. FullCAM is the model used to construct Australia's national greenhouse gas emissions account for the land use sector. It was developed under the National Carbon Accounting System (NCAS) at the Australian Greenhouse Office (AGO) to integrate data on land cover change, land use and management, climate, plant productivity, and soil carbon over time — to provide a dynamic account of the changing stock of carbon in Australia's land systems since 1970. Users of the model are able to determine project-based results on a similar basis to Australia's official recording of greenhouse gas emission trends for land use and land use change. The model incorporates a suite of verifiable component models, adapted for use at a fine spatial scale and temporary resolution for the Australian continent.

The model was used to produce an estimate of carbon emissions from land clearing at the initial phase of the project, which were subsequently averaged across the 30-year life of mine. The model output presented results that predict the total carbon content accumulated over a 100 year lifecycle of vegetation within the project area. This was then used as the total amount of carbon released to the atmosphere due to land clearing. The estimated annual averaged carbon output from land clearing was compared against Australian and Queensland project GHG emissions.

When viewed in both an Australian and Queensland context, the land clearing emissions from the Project represent relatively small contributions to the State and national inventory. Annual averaged land clearance emissions represent less than 0.1% of the national 2009 annual greenhouse gas inventory, and represent less than 0.2% of the Queensland inventory.

Full details of this calculation are provided in Section 4.6.

## 2.6 Operational Procedures and the EM Plan

Predicted pollutant concentrations plus estimates of background concentrations, are used to assess whether the EPP (Air) objectives are likely to be exceeded. It is the responsibility of HCPL to take all reasonably practicable actions to ensure that the EPP (Air) guidelines are met at sensitive receptor locations. The magnitude of these impacts determines the dust control or 'mitigation' actions required. These actions are implemented through the Environmental Management Plan (EM Plan) which HCPL is obliged to develop and submit to DERM for approval prior to receiving consent to commence mining operations. The EM Plan includes commitments to undertake actions to mitigate dust impacts which are set as conditions of project consent. The EM Plan is supplemented by a series of internal, non-statutory operational procedures which HCPL will follow to meet the commitments made in the EM Plan. Such operational procedures will be followed where practicable and have been developed in consideration of best practice for the coal mining industry.

# 2 Summary of Air Emissions Modelling at Alpha Coal Mine

The Project will be subject to Environmental Authority conditions imposed by DERM as the administering authority under the Environmental Protection Act 1994. These conditions are actions which HCPL must take to be able to operate the Project. These conditions are legally binding commitments which will be negotiated and accepted by HCPL prior to commencement of the Project.

# 3 Results of the Refined Model

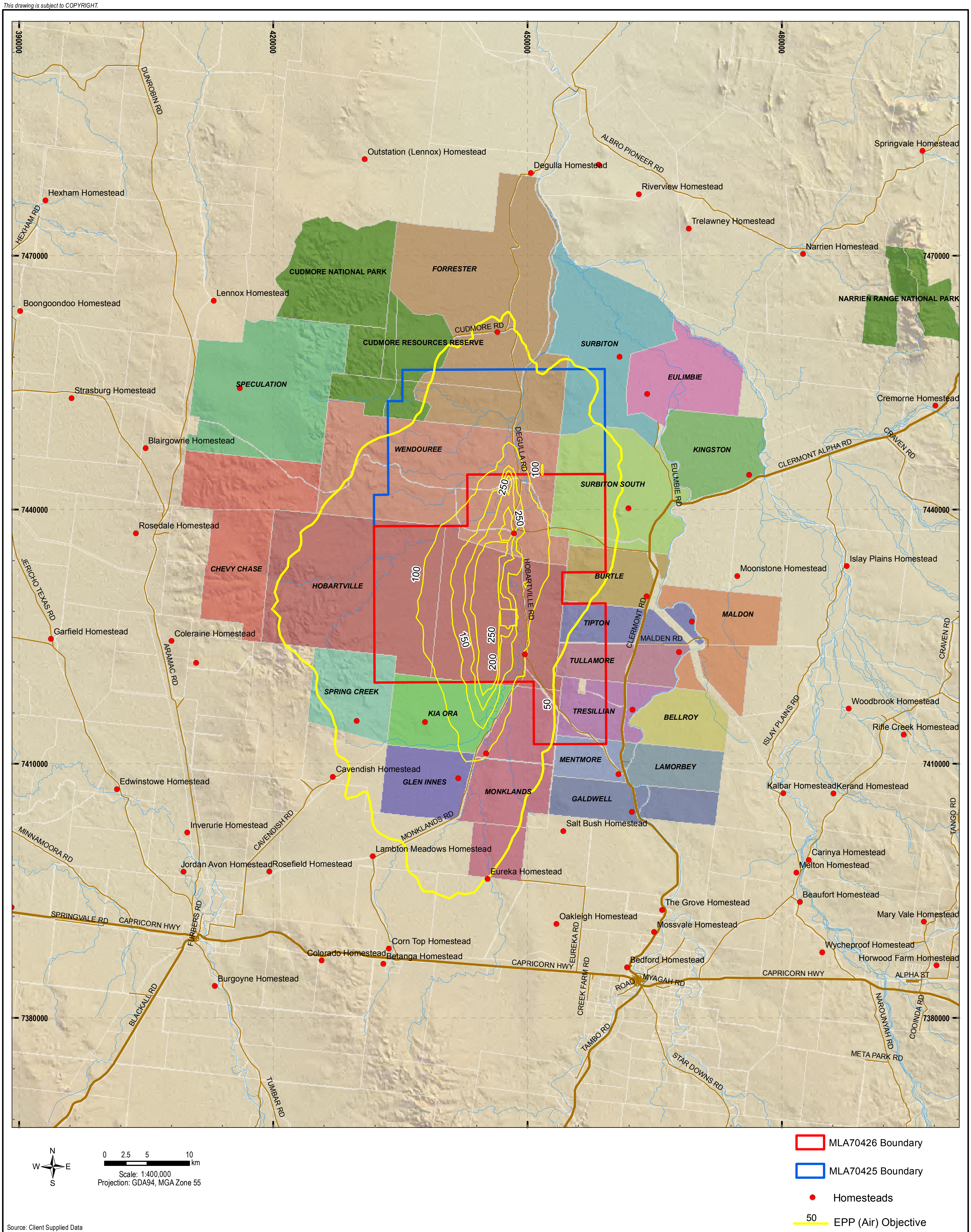
## 3.1 Introduction

This section shows the updated modelling results presented as contour plots for 24-hour average $PM_{10}$, 24-hour average $PM_{2.5}$ and annual average $PM_{2.5}$ and the number of exceedences predicted in the SEIS and Refined Model for 24-hour average $PM_{10}$. Also provide is a comparison of the changes to the predicted impacts from EIS to SEIS and the final Refined Model.

## 3.2 Refined Model Results

### 3.2.1 24-hour average $PM_{10}$

Figures 3-1 to 3-6 show the predicted contours for the model refinements for the 24-hour averaging period (5$^{th}$ highest) for $PM_{10}$. The EPP (Air) 50 µg.m$^{-3}$ contours for the model refinement assessments are highlighted to show the impact of the model refinements on the position of the EPP (Air) objective contour.




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ (µg/m³)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF 27µg/m³)

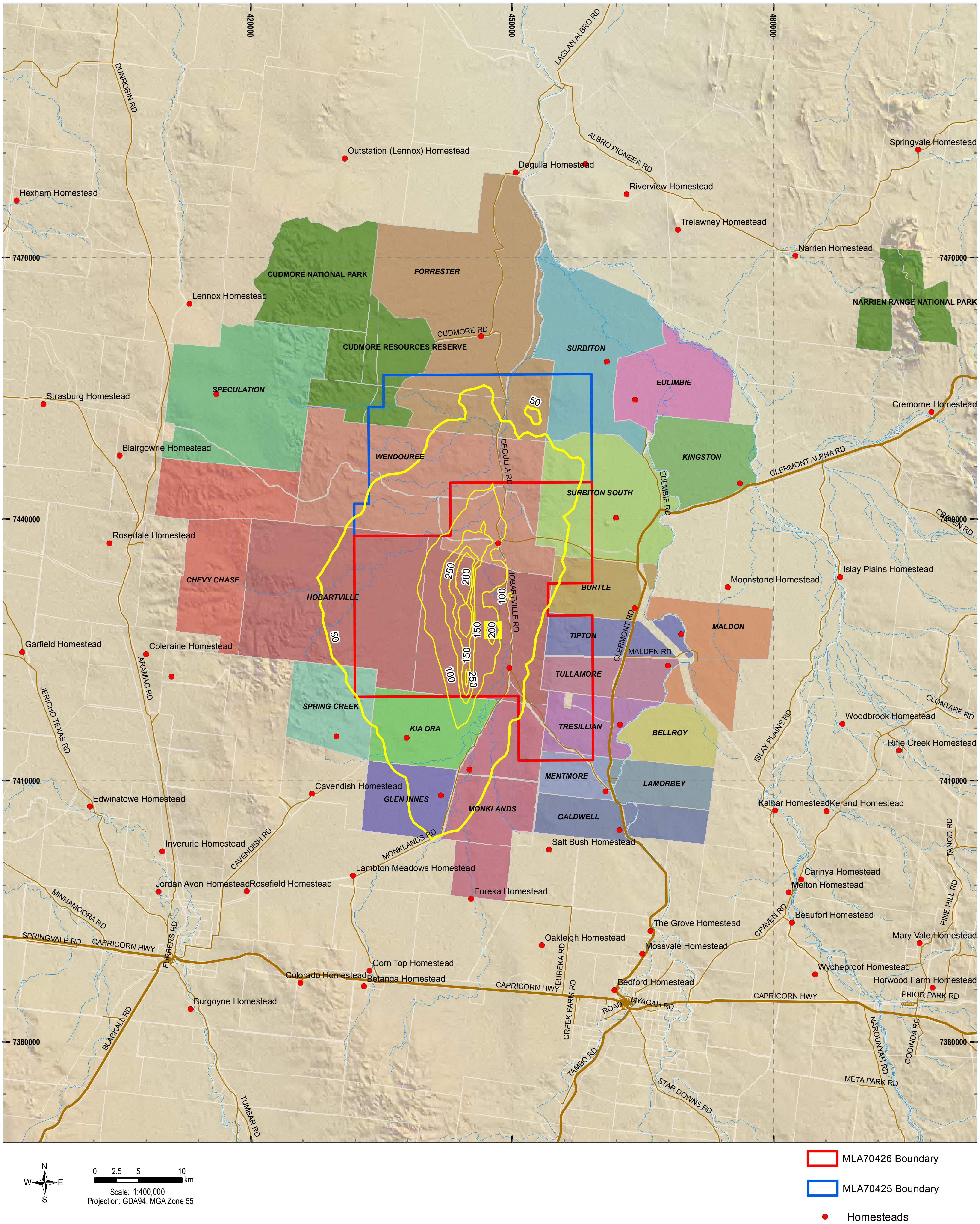
**MODEL REFINEMENTS YEAR 5**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-1**

File No: **42626680-g-595.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ ($\mu g/m^3$)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF $27 \mu g/m^3$)

**MODEL REFINEMENTS YEAR 10**

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ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS

Figure: 3-2

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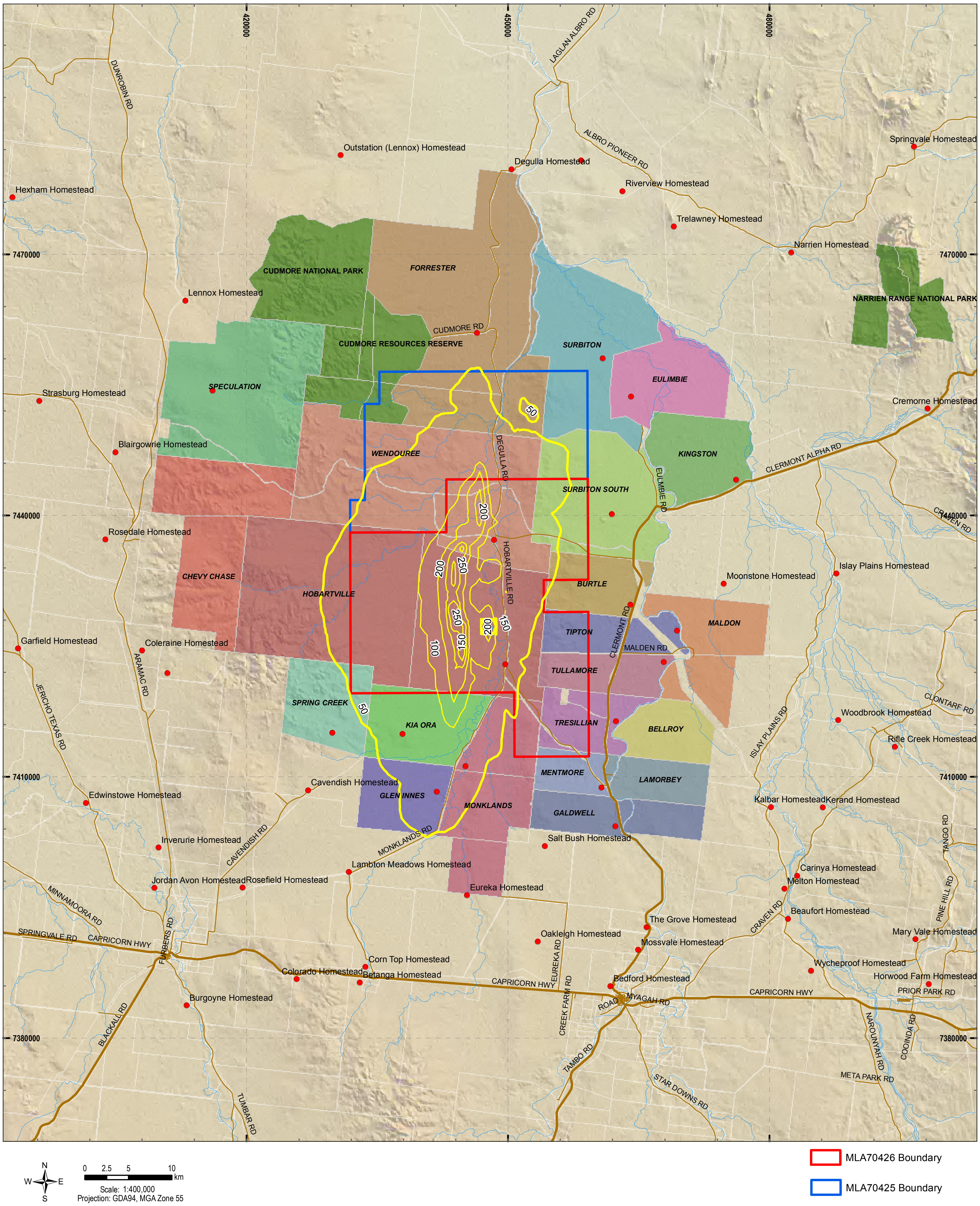


MLA70426 Boundary

MLA70425 Boundary

Homesteads

50 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ (µg/m³)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF 27µg/m³)

**MODEL REFINEMENTS YEAR 15**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: 3-3

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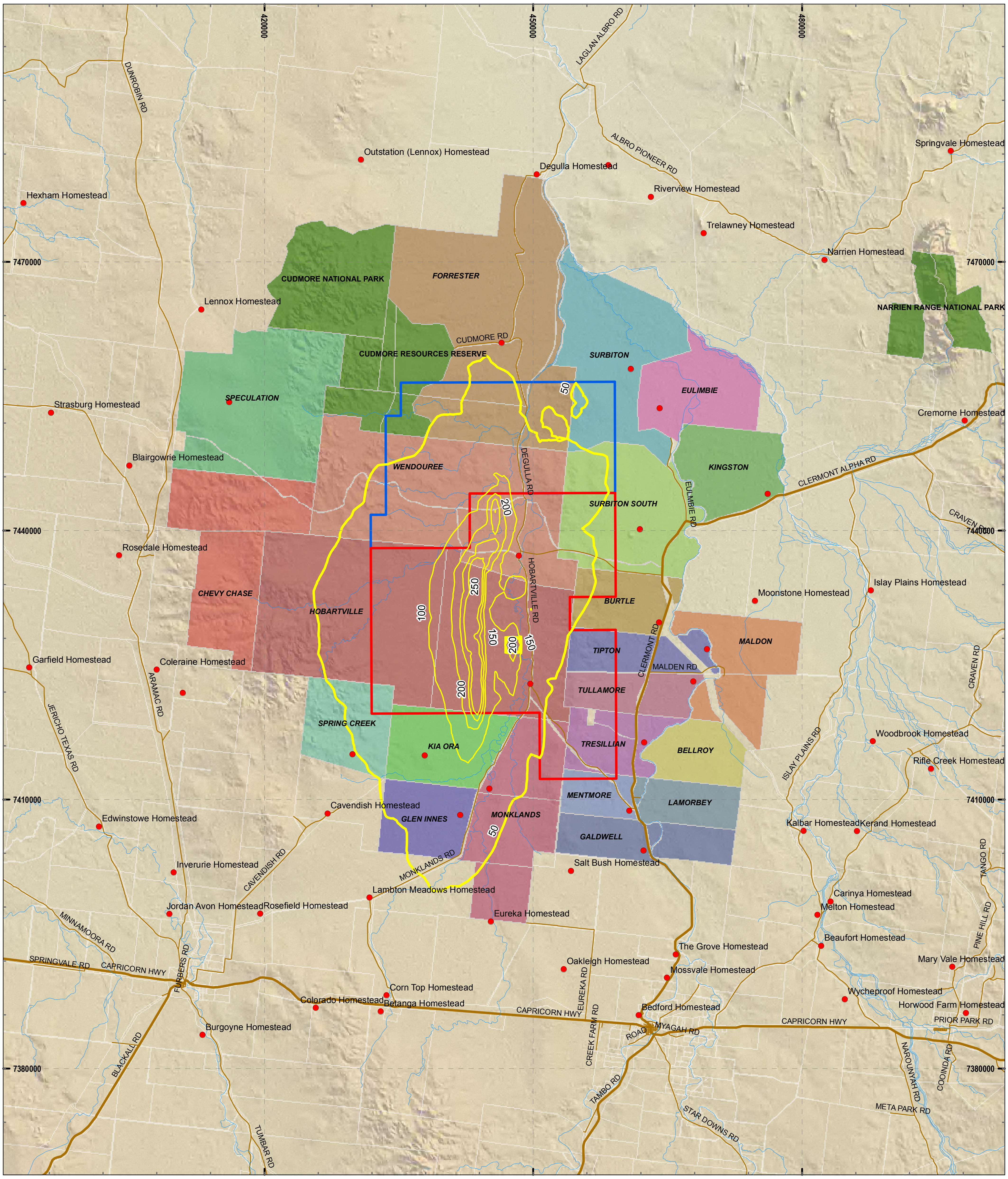



N
W E
S

0 2.5 5 10 km

Scale: 1:400,000

Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

50 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ ($\mu g/m^3$)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF 27$\mu g/m^3$)

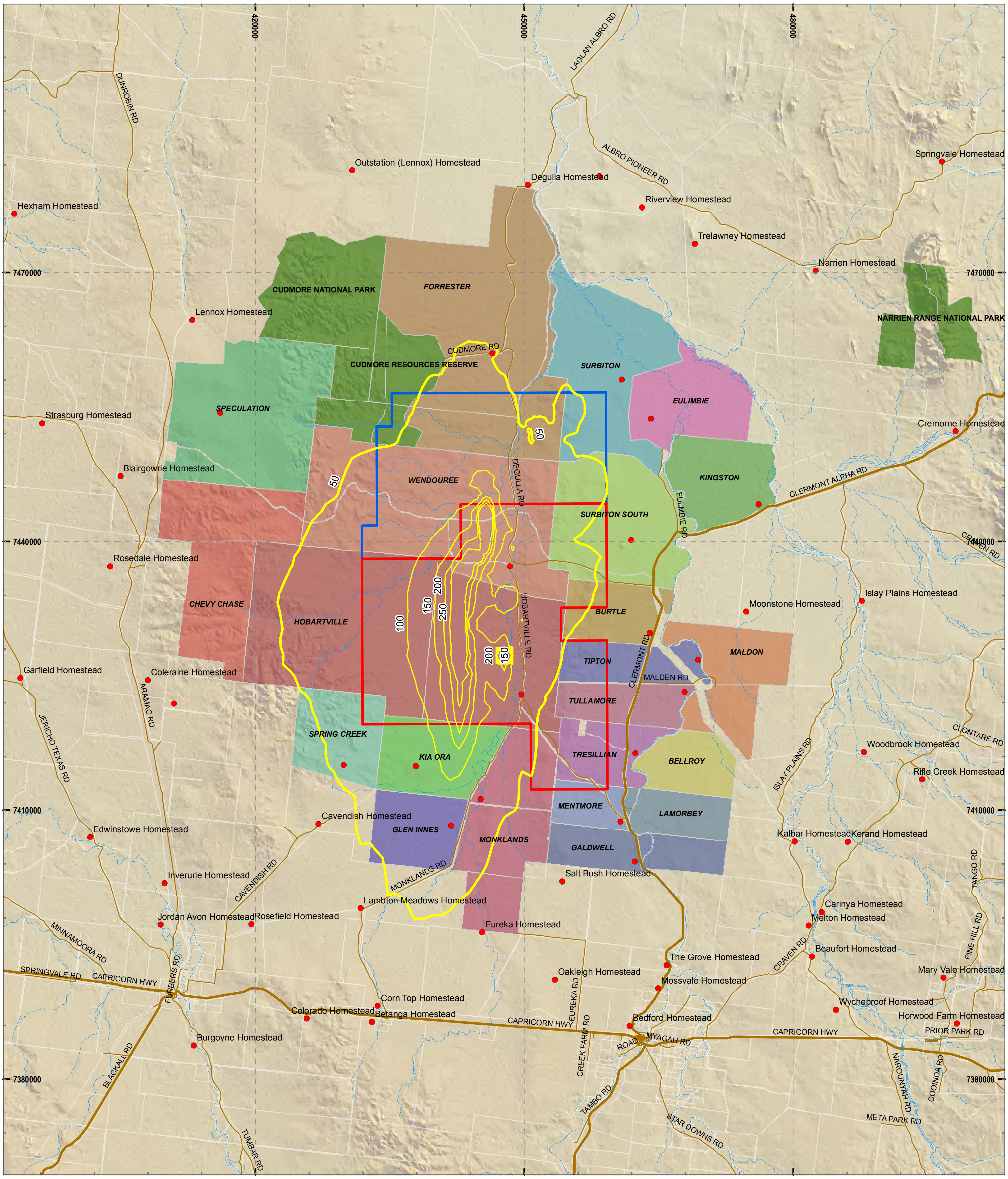
**MODEL REFINEMENTS YEAR 20**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-4**

File No: **42626680-g-598.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




N
W E
S

0 2.5 5 10 km

Scale: 1:400,000

Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

50 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ (µg/m³)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF 27µg/m³)

**MODEL REFINEMENTS YEAR 25**

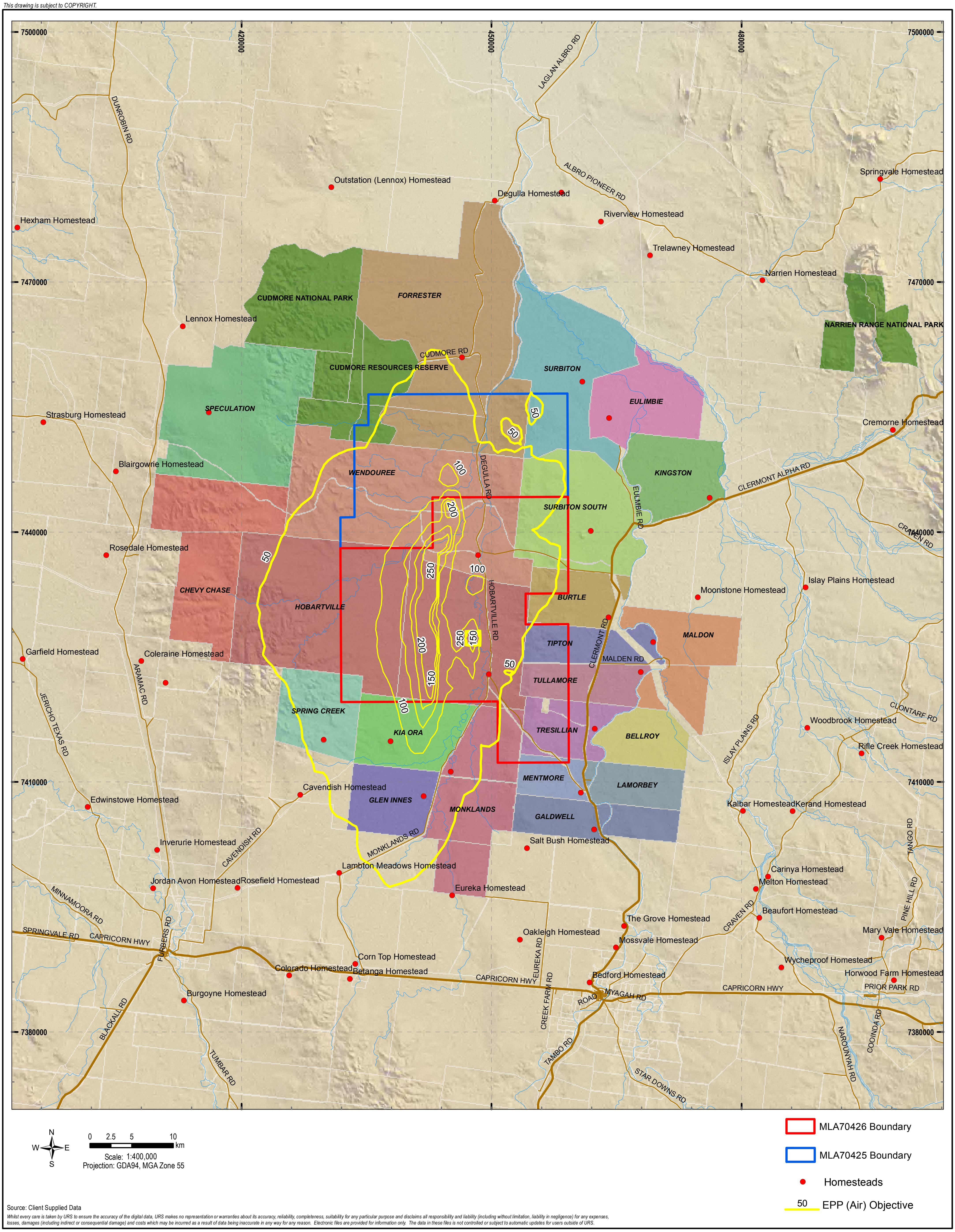
URS

ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS

Figure: 3-5

File No: 42626680-g-599.mxd Drawn: XL Approved: SB Date: 22-05-2012 Rev. E A4

This drawing is subject to COPYRIGHT.




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{10}$ (µg/m³)
(5th HIGHEST, INCLUDING BACKGROUND CONTRIBUTION OF 27µg/m³)

**MODEL REFINEMENTS YEAR 30**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: 3-6

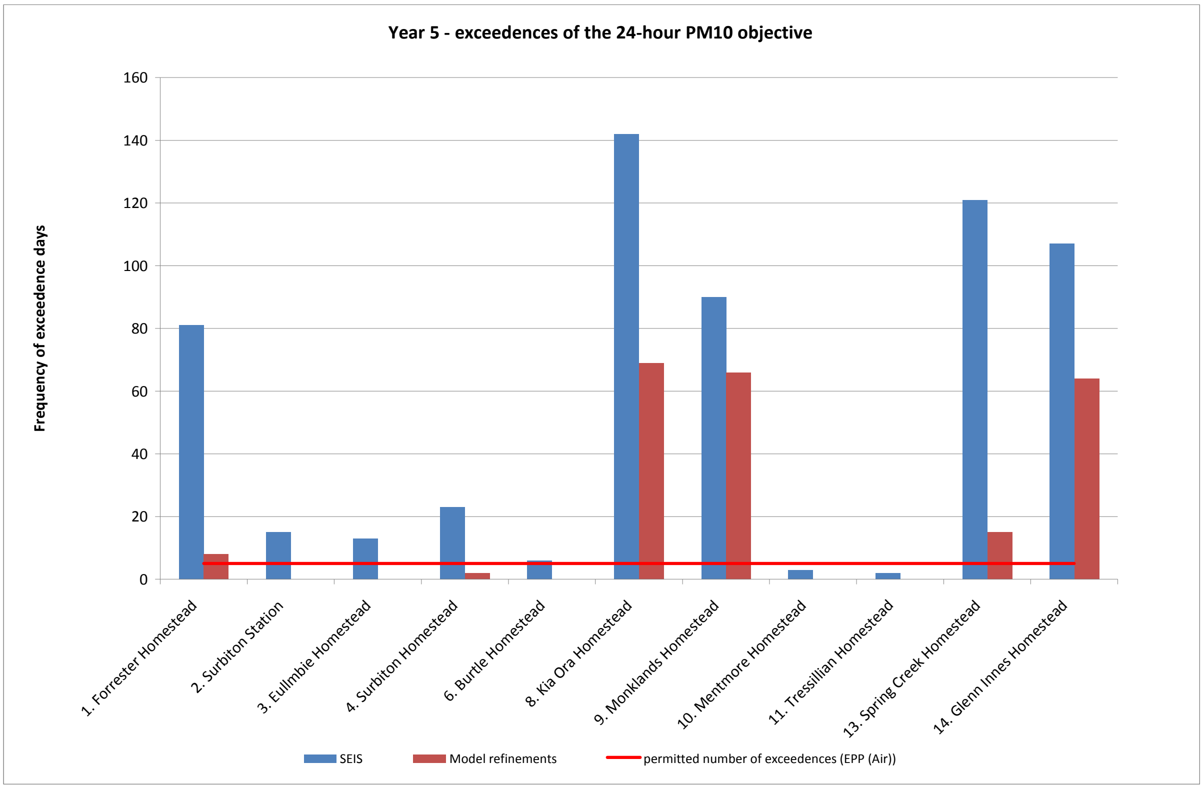
File No: 42626680-g-594.mxd | Drawn: XL | Approved: SB | Date: 22-05-2012 | Rev. E | A4

# 3 Results of the Refined Model

Figure 3-1 shows that in Year 5, the model refinement 50 µg.m$^{-3}$ contours extend outside Mining Lease Application (MLA) 70426. However, the model refinement 50 µg.m$^{-3}$ contour is significantly smaller than that presented in the SEIS. Figure 3-7 shows that in the SEIS, exceedences were predicted at all ten sensitive receptors in Year 5. The Refined Model shows that exceedence days are only predicted in the SEIS at the Forrester Homestead, Kia Ora Homestead, Monklands Homestead and Glenn Innes Homestead. Where excedeence days are predicted, they are almost entirely removed following model refinement at the Forrester Homestead and are reduced from 142 to 69 days at Kia Ora Homestead, from 90 to 66 days at the Monklands Homestead and from 107 to 64 at Glenn Innes. It should be noted that the Environmental Protection Policy (EPP) (Air) objective allows 5 days where exceedences are permitted to represent natural fluctuations in background concentration. Surbiton Homestead is predicted to experience less than 5 days exceeding the 50 µg.m$^{-3}$ threshold. Management and mitigation measures to minimise the number of exceedence days has been incorporated into the EM Plan.

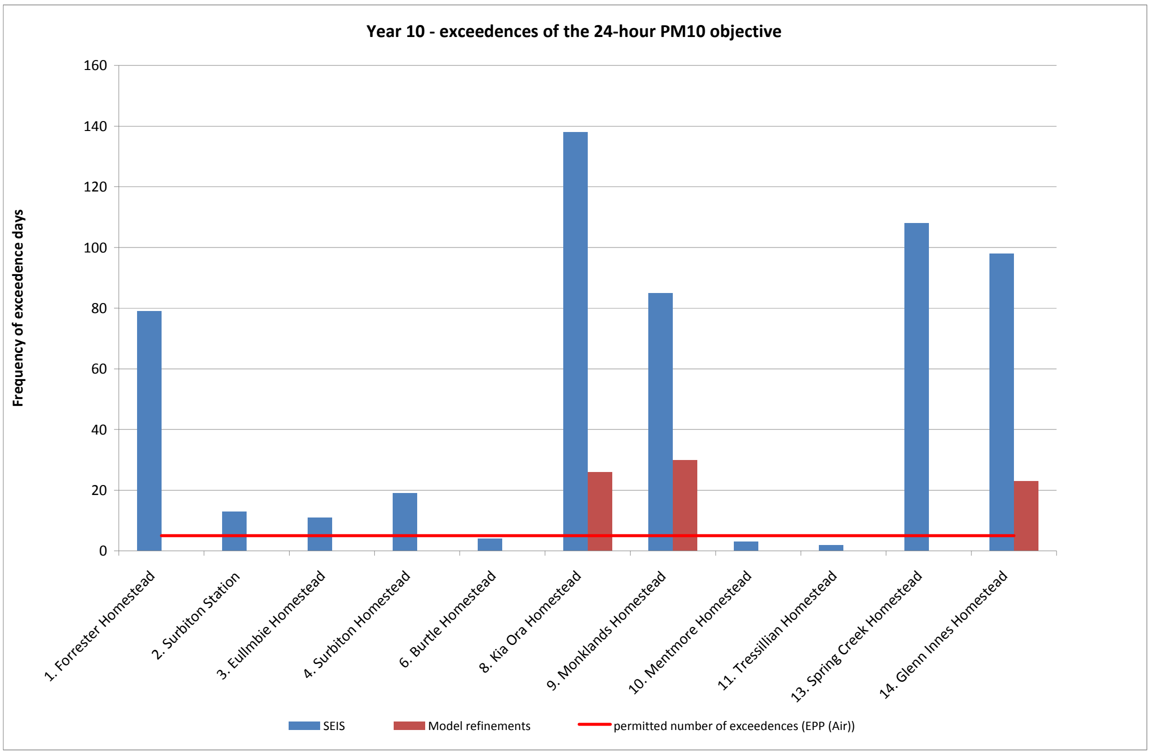
The trend for a reduction in the size of the 50 µg.m$^{-3}$ contour footprint and frequency of exceedence days is applicable to all modelled years as shown in Figures 3-1 to 3-6 and 3-7 to 3-12. Figure 3-2 shows that the contour footprint is significantly smaller in year 10 than in year 5. The number of days exceeding the 50 µg.m$^{-3}$ threshold is also lower at all sensitive receptors. This reduction corresponds to the introduction of IPCC which reduces the number of vehicle movements to the overburden dumps.

**Figure 3-7 Year 5 - exceedences of the 24-hour $PM_{10}$ objective**

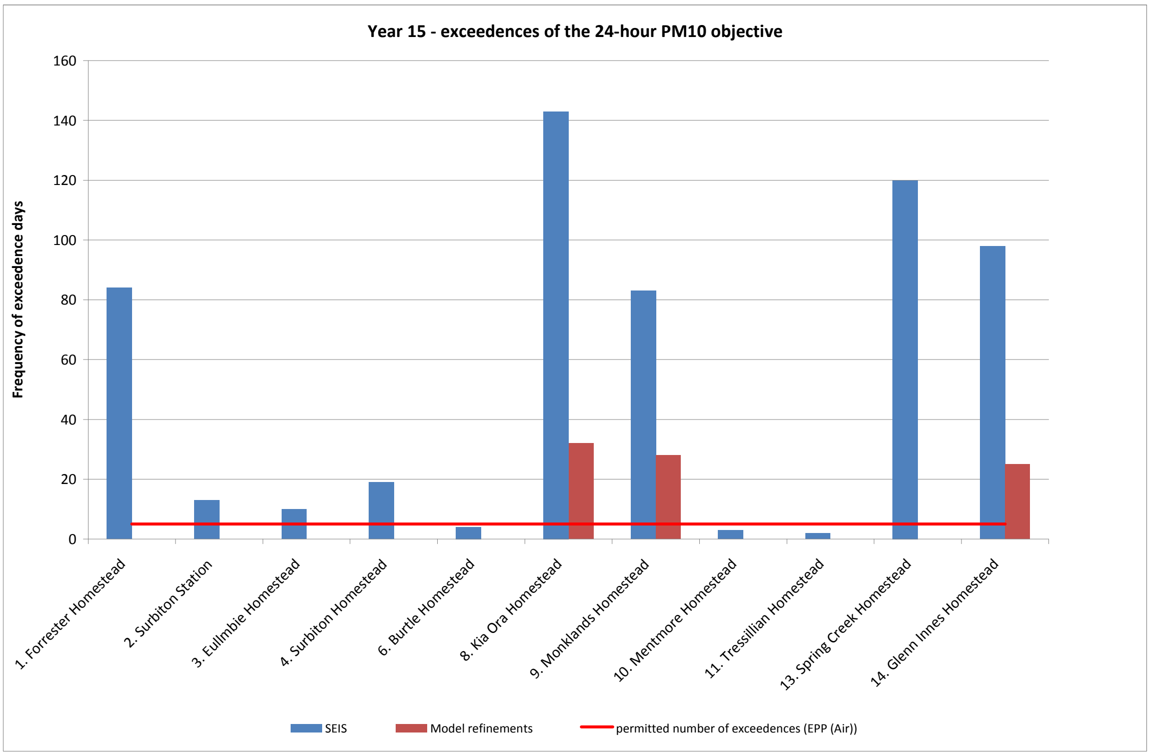


# 3 Results of the Refined Model

## Figure 3-8 Year 10 - exceedences of the 24-hour $PM_{10}$ objective




## Figure 3-9 Year 15 - exceedences of the 24-hour $PM_{10}$ objective



# 3 Results of the Refined Model

**Figure 3-10 Year 20 - exceedences of the 24-hour $PM_{10}$ objective**

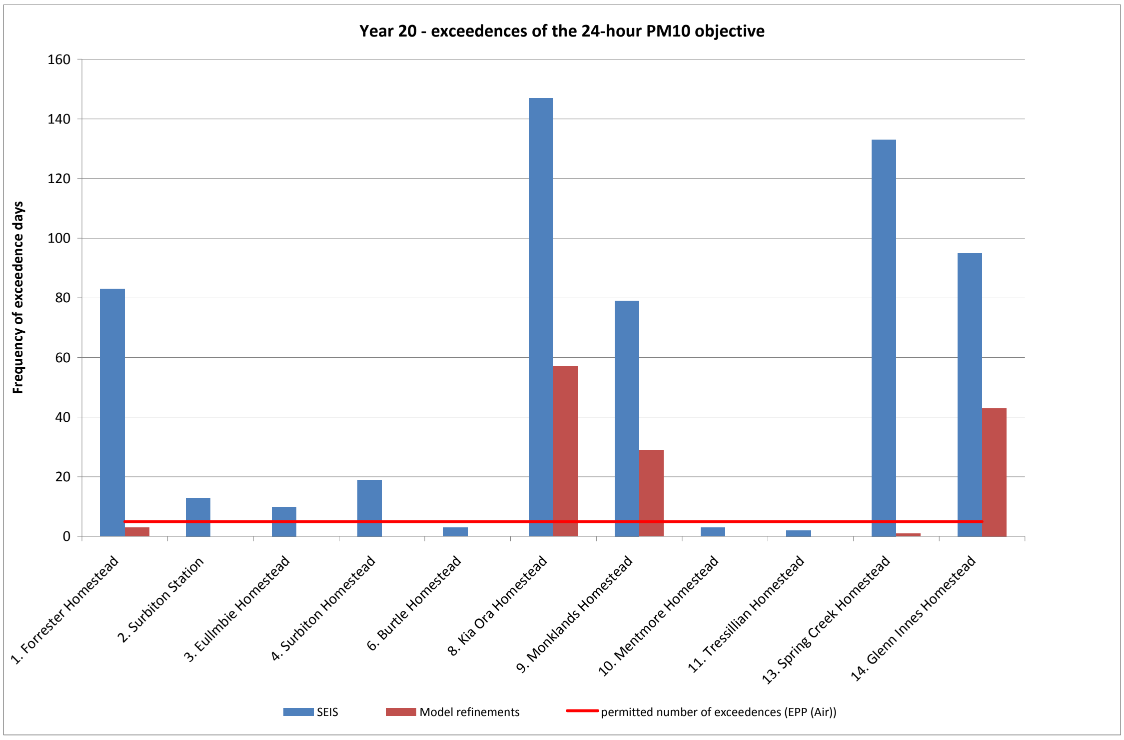
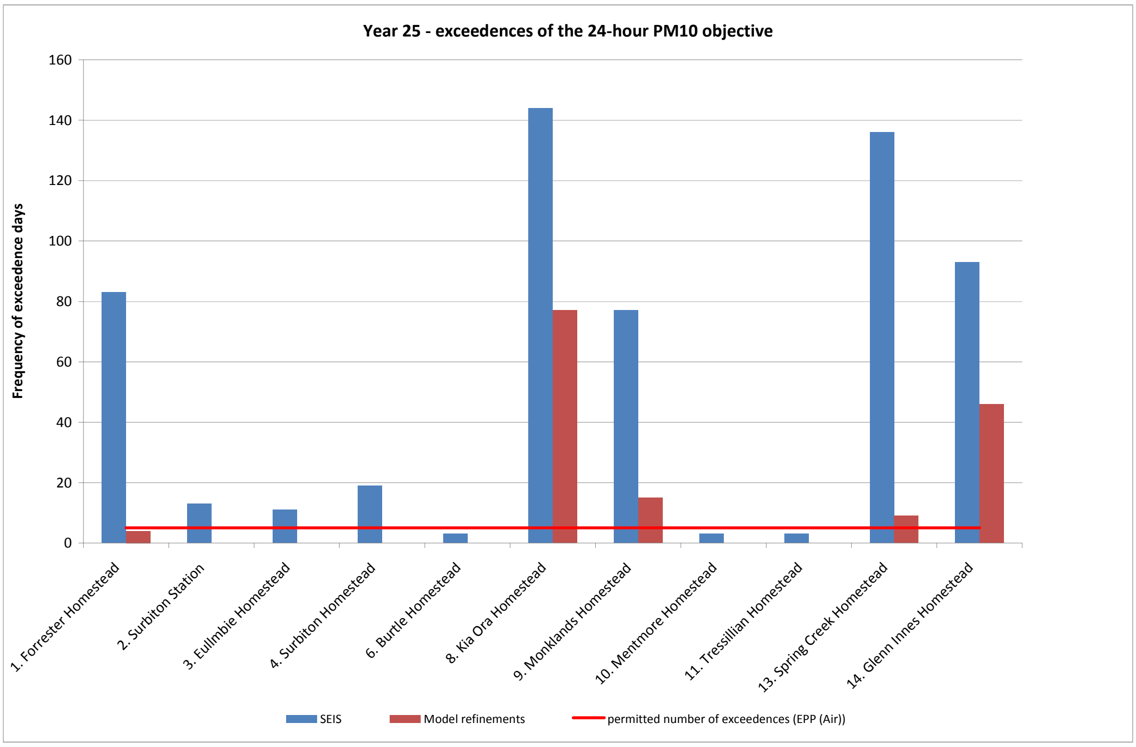



**Figure 3-11 Year 25 - exceedences of the 24-hour $PM_{10}$ objective**



## 3 Results of the Refined Model

**Figure 3-12 Year 30 - exceedences of the 24-hour $PM_{10}$ objective**

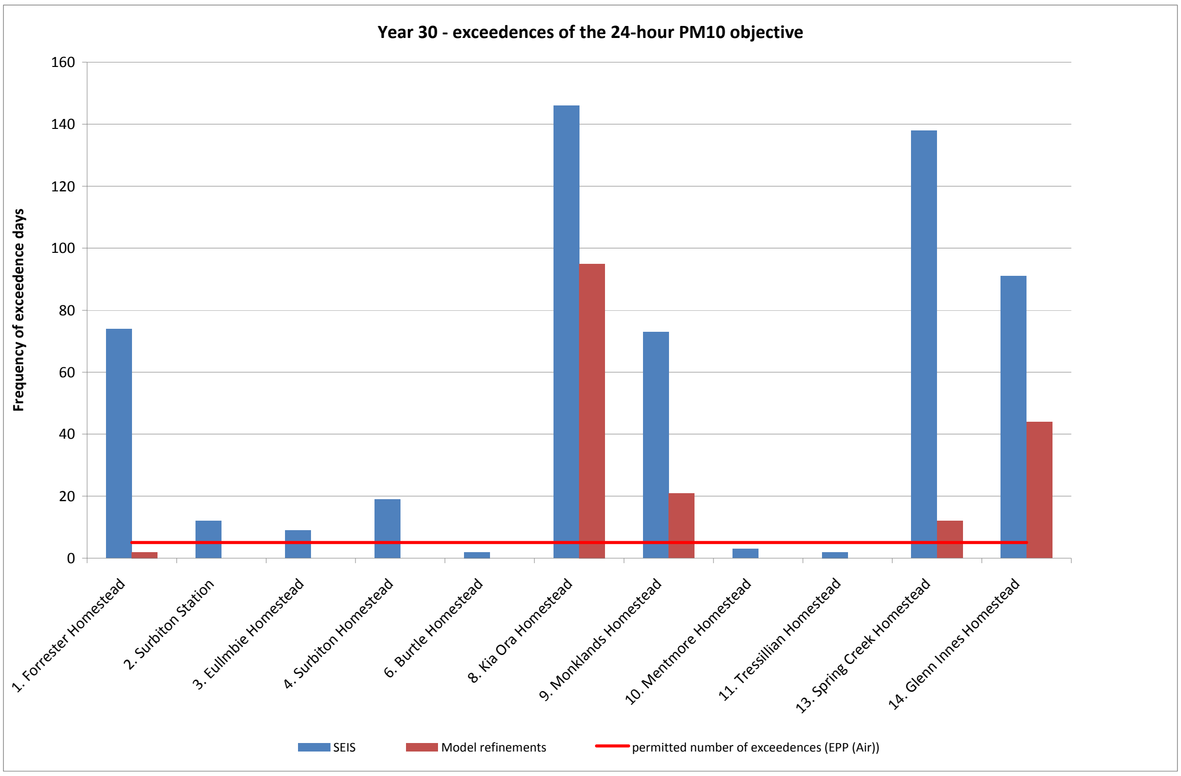



Table 3-1 shows the predicted 5th highest 24-hour average ground level concentration of $PM_{10}$ predicted at the sensitive receptors in the Refined Model.

**Table 3-1 Predicted 5th highest 24-hour average ground level concentration of $PM_{10}$**

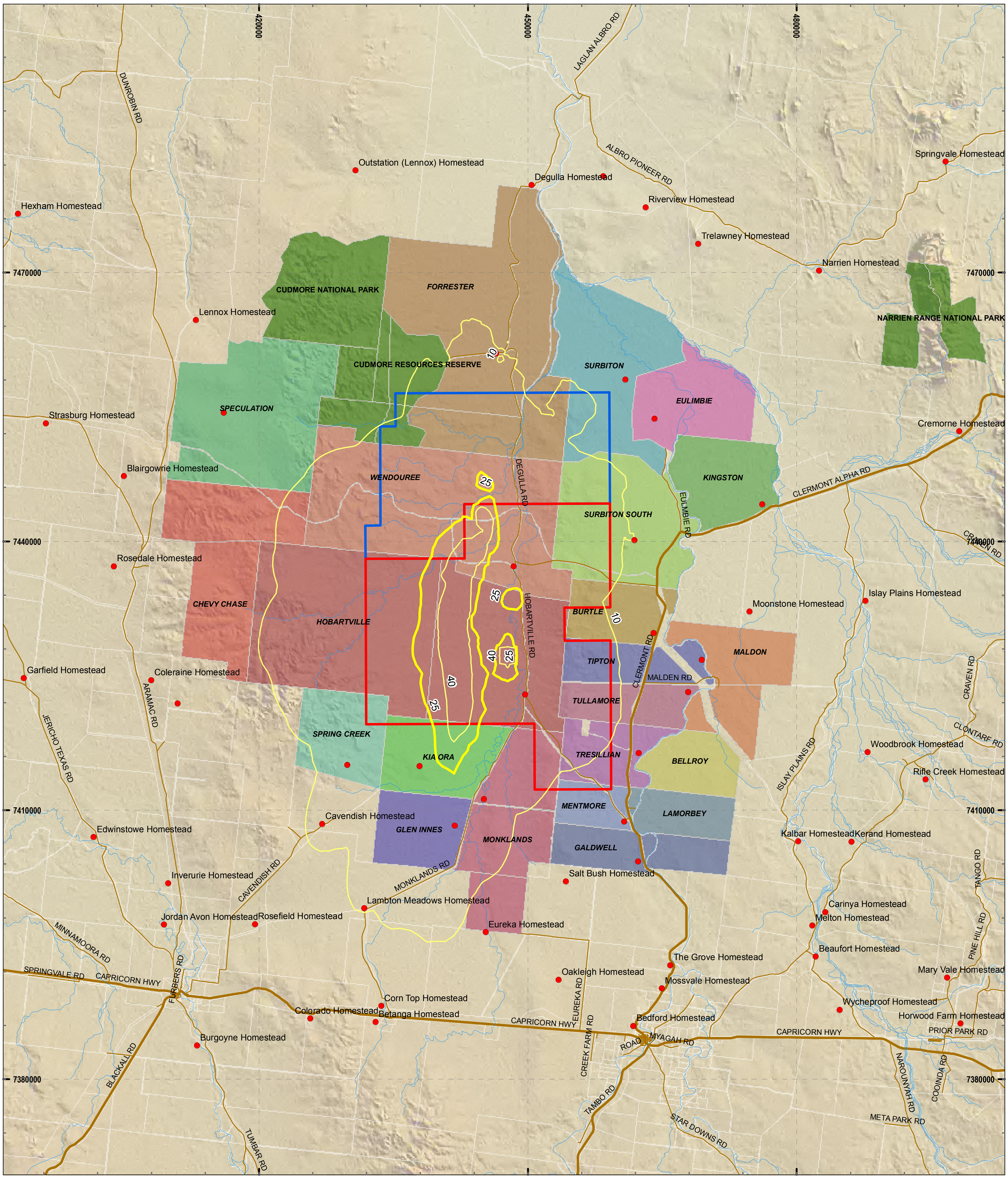
| Receptor | Y5 | | | Y30 | | |
|---|---|---|---|---|---|---|
| | Project ($\mu g.m^{-3}$) | Total[1] ($\mu g.m^{-3}$) | % of EPP (Air) | Project ($\mu g.m^{-3}$) | Total[2] ($\mu g.m^{-3}$) | % of EPP (Air) |
| 1 | 25 | 52 | 105 | 20 | 47 | 95 |
| 2 | 11 | 38 | 75 | 7 | 34 | 69 |
| 3 | 9 | 36 | 71 | 6 | 33 | 66 |
| 4 | 20 | 47 | 95 | 13 | 40 | 80 |
| 6 | 8 | 35 | 69 | 4 | 31 | 62 |
| 8 | 49 | 76 | 152 | 57 | 84 | 167 |
| 9 | 76 | 103 | 205 | 32 | 59 | 118 |
| 10 | 5 | 32 | 63 | 3 | 30 | 60 |
| 11 | 4 | 31 | 63 | 3 | 30 | 61 |
| 13 | 28 | 55 | 109 | 27 | 54 | 109 |
| 14 | 26 | 53 | 106 | 27 | 54 | 109 |
| EPP (Air) Objective | 50 | | 100 | 50 | | 100 |

Note (1): Background concentration estimated at 27 $\mu g.m^{-3}$.

Table 3-1 shows that exceedences are predicted for the 5th highest concentration at receptors 1, 8, 9 and 14. However, the only locations where the EPP (Air) objective will be exceeded by the contribution from the mine alone are receptor 9 in year 5 and receptor 8 in year 30. The process contribution at this receptor exceeds the objective by approximately 50% and the total concentration (including background) is double the standard. It should be noted however, that these predictions are made under the worst case meteorological conditions and HCPL will implement live meteorological monitoring technology to predict and mitigate such exceedences before they occur. These techniques are described in detail in the EM Plan.

### 3.2.2 24-hour average $PM_{2.5}$

Figures 3-13 to 3-18 show the predicted contours for the model refinements for the 24-hour averaging period for $PM_{2.5}$. The 25 $\mu g.m^{-3}$ contour is highlighted on each plot for the model refinements.




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ (μg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 5.4μg/m³)

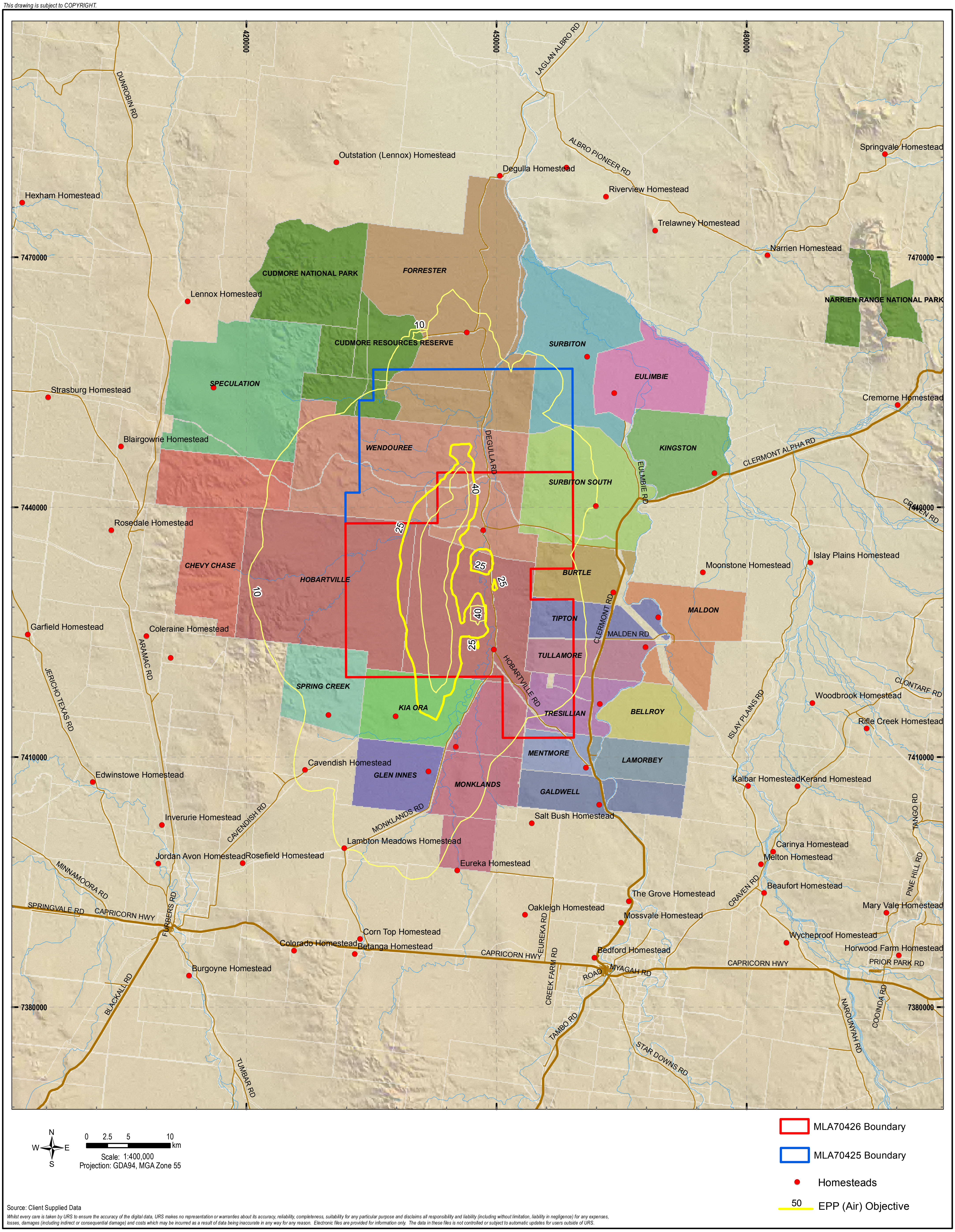
**MODEL REFINEMENTS YEAR 5**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-13**

File No: **42626680-g-600.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 5.4µg/m³)

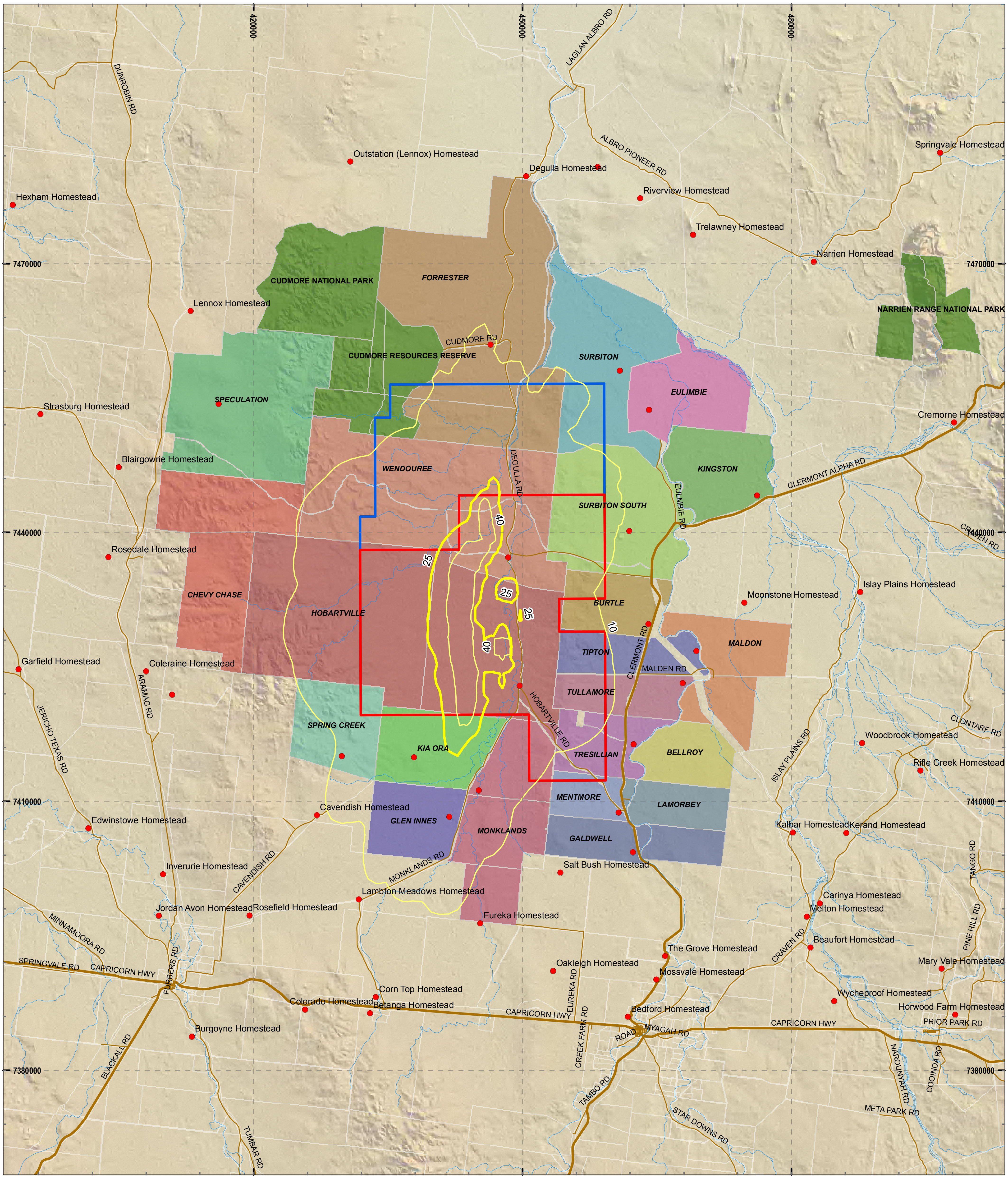
**MODEL REFINEMENTS YEAR 10**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-14**

File No: **42626680-g-601.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




N
W E
S

0 2.5 5 10 km

Scale: 1:400,000
Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

25 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 5.4µg/m³)

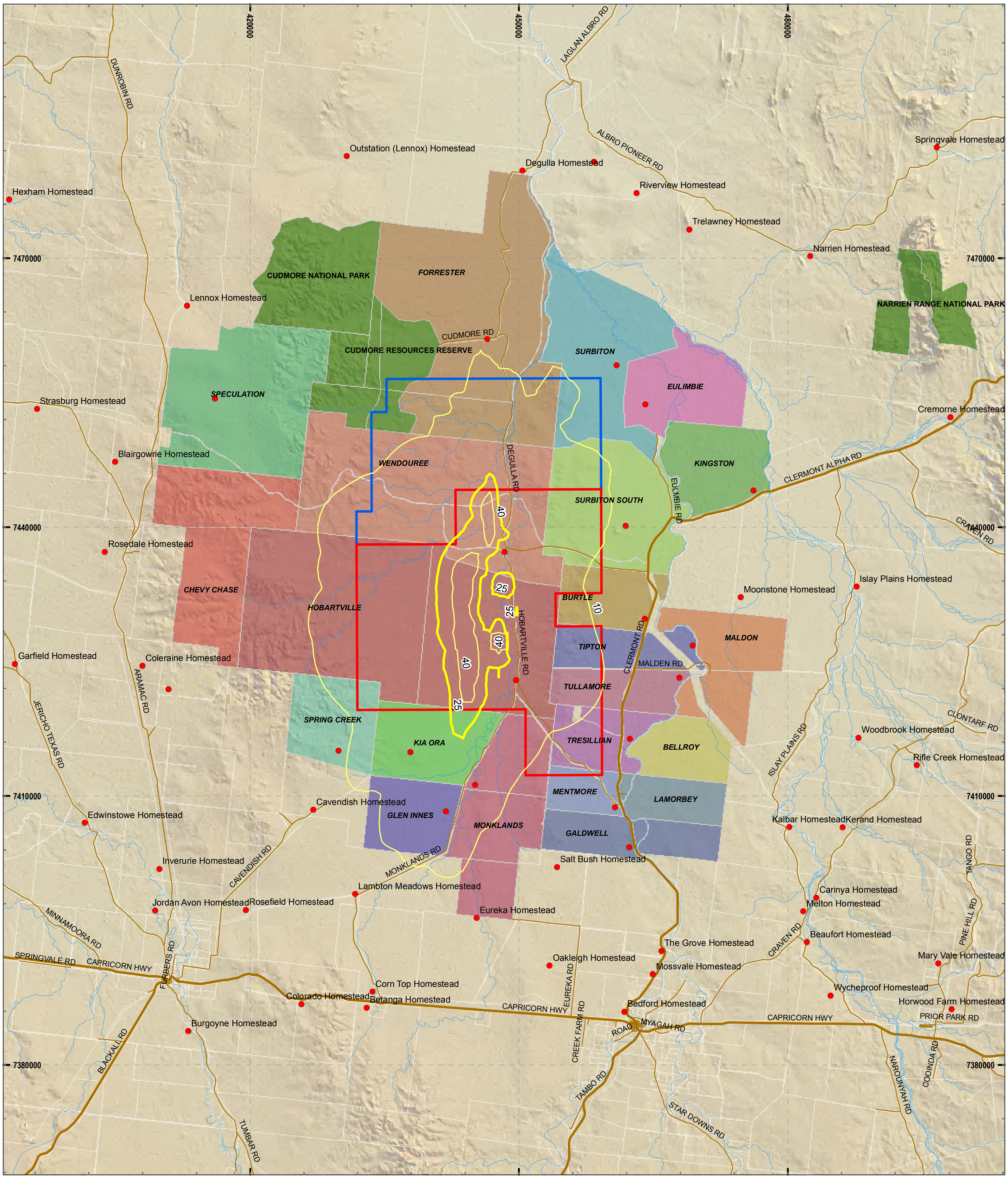
**MODEL REFINEMENTS YEAR 15**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-15**

File No: **42626680-g-602.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 5.4µg/m³)

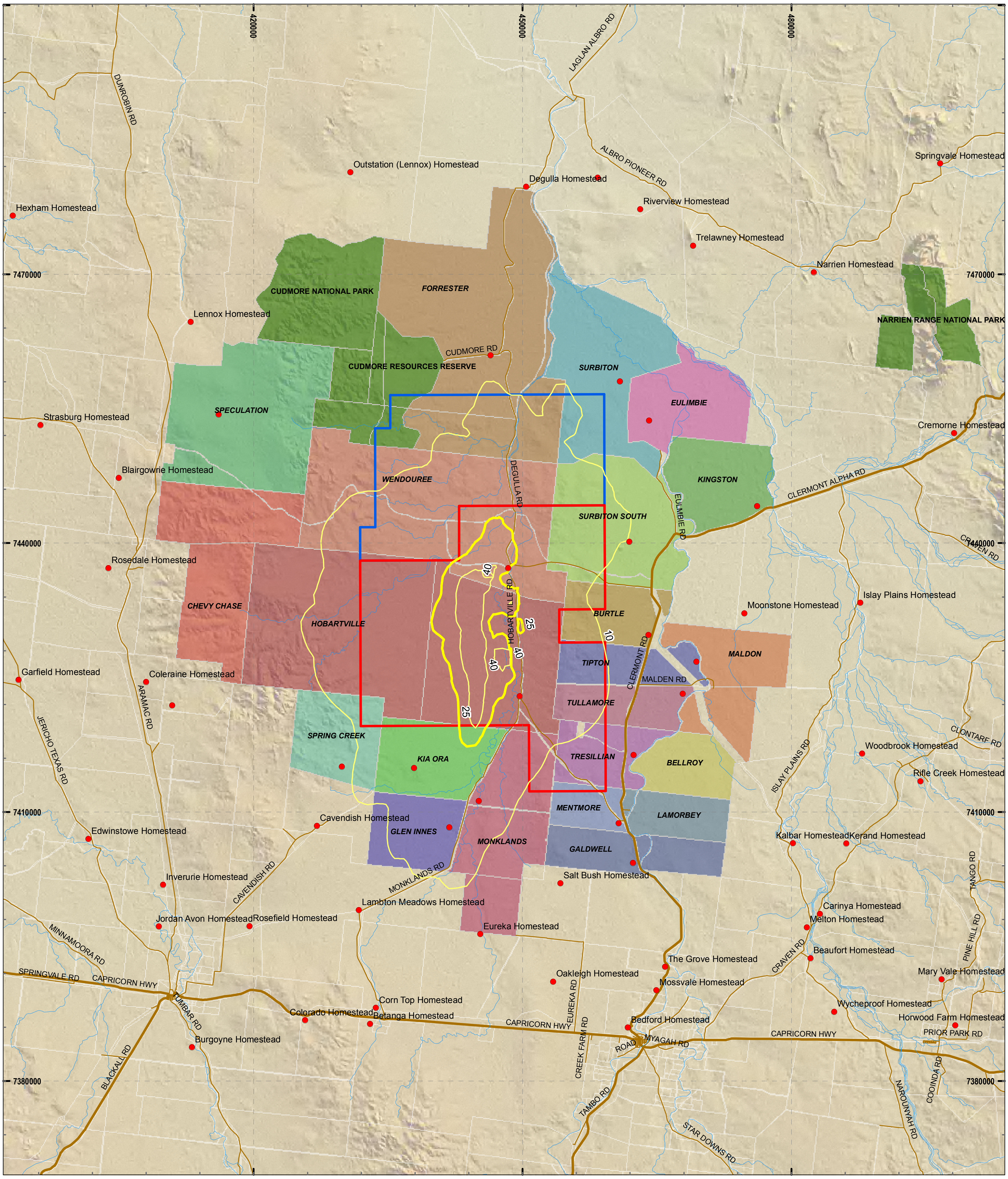
**MODEL REFINEMENTS YEAR 20**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-16**

File No: **42626680-g-603.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




N
W E
S

0 2.5 5 10 km

Scale: 1:400,000
Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

25 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 5.4µg/m³)

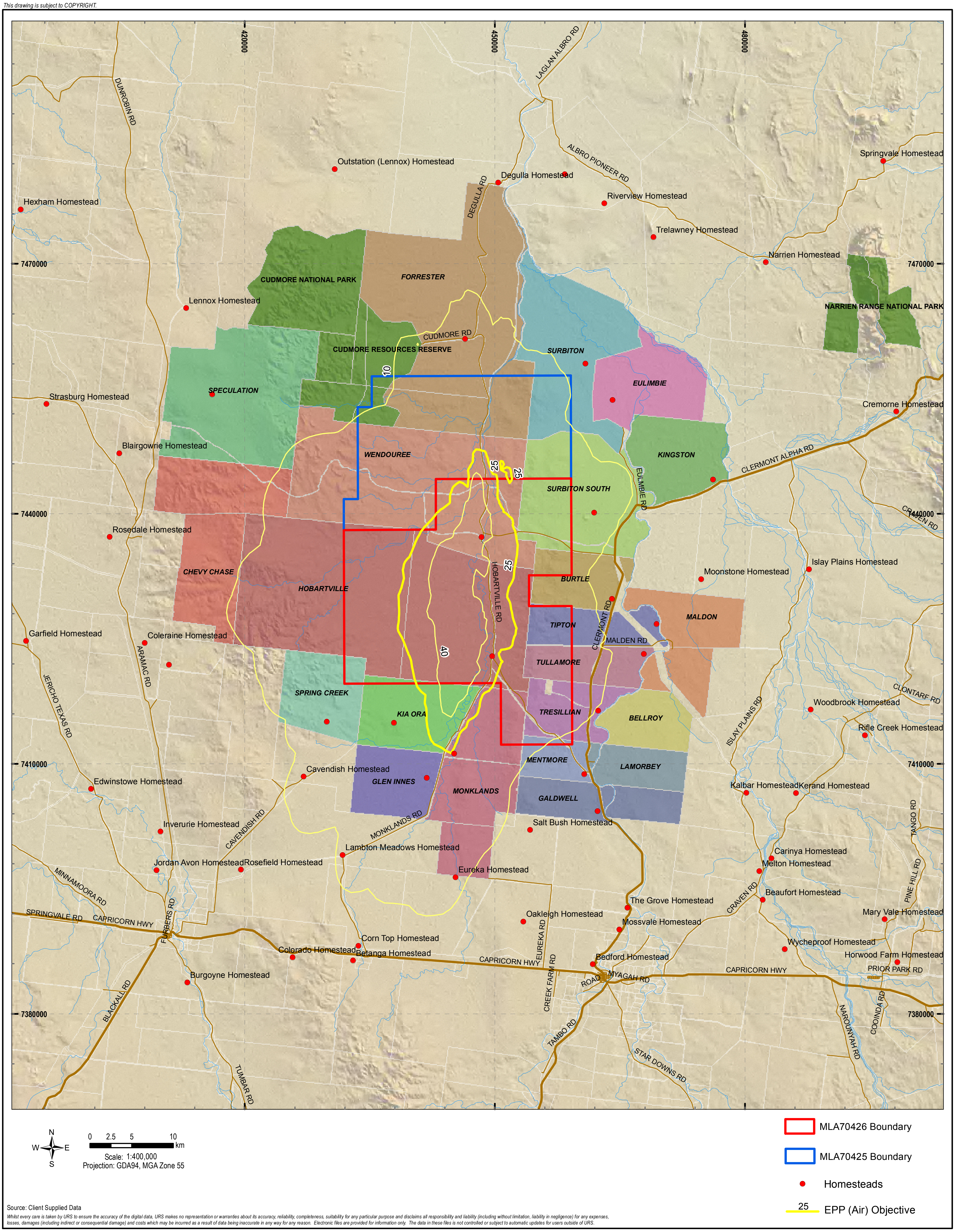
**MODEL REFINEMENTS YEAR 25**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-17**

File No: **42626680-g-604.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




HANCOCK COAL PTY LTD

24-HOUR AVERAGE $PM_{2.5}$ ($\mu g/m^3$)
(INCLUDING BACKGROUND CONTRIBUTION OF $5.4 \mu g/m^3$)

**MODEL REFINEMENTS YEAR 30**

**URS** | **ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-18**

File No: **42626680-g-605.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4

## 3 Results of the Refined Model

Figures 3-13 to 3-18 show that no 24-hour average $PM_{2.5}$ exceedences of the EPP (Air) objective are predicted and therefore no mitigation is required. However, actions to reduce $PM_{10}$ emissions are also expected to have a beneficial effect on concentrations of $PM_{2.5}$.

Table 3-2 shows the predicted maximum 24-hour average concentrations of $PM_{2.5}$ predicted at all receptors.

**Table 3-2 Predicted maximum 24-hour average ground level concentration of $PM_{2.5}$**

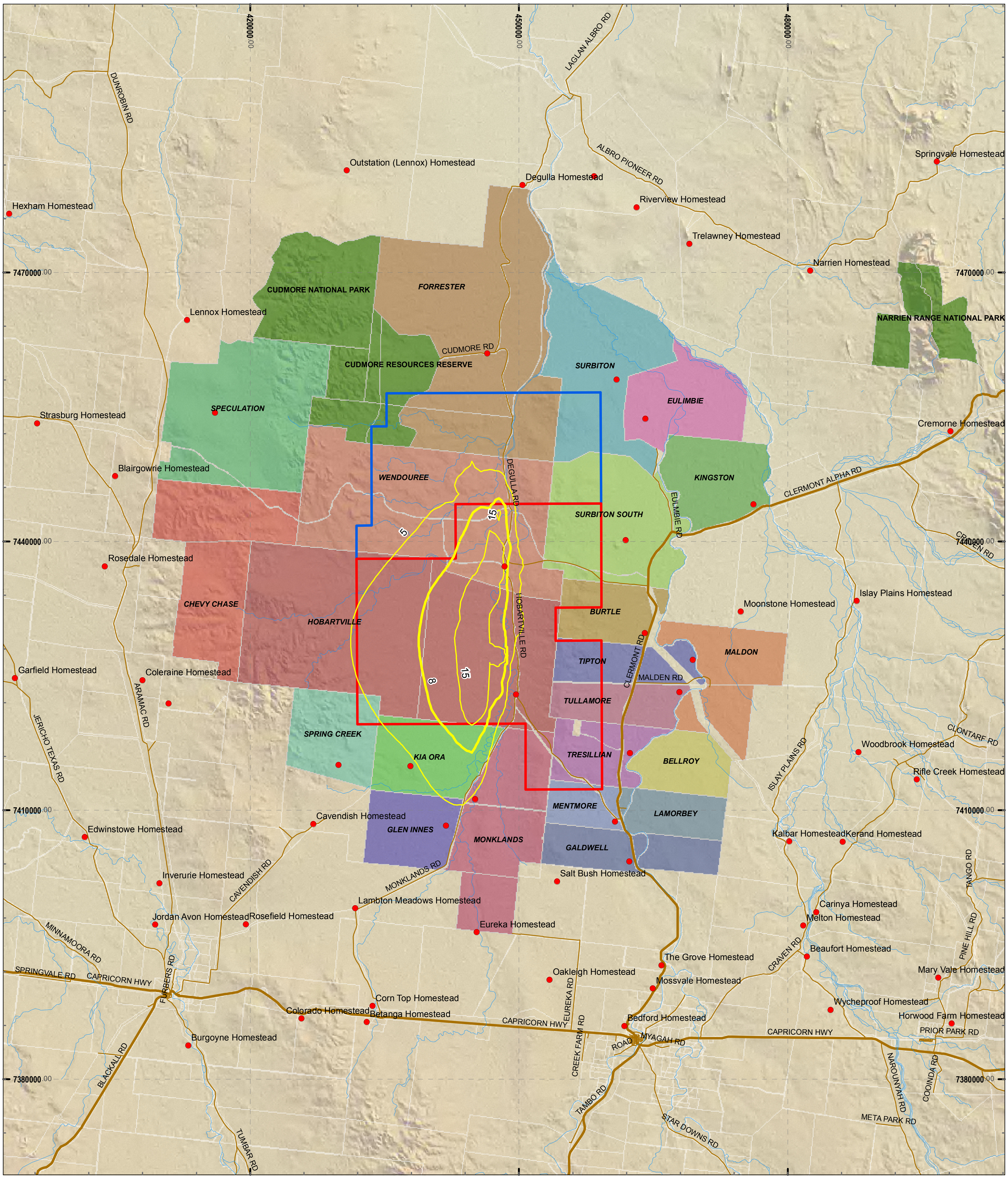
| Receptor | Y5 | | | Y30 | | |
|---|---|---|---|---|---|---|
| | Project ($\mu g.m^{-3}$) | Total[1] ($\mu g.m^{-3}$) | % of EPP (Air) | Project ($\mu g.m^{-3}$) | Total[1] ($\mu g.m^{-3}$) | % of EPP (Air) |
| 1 | 7 | 12 | 48 | 5 | 10 | 40 |
| 2 | 3 | 8 | 34 | 2 | 7 | 29 |
| 3 | 3 | 8 | 33 | 2 | 7 | 29 |
| 4 | 7 | 13 | 50 | 4 | 10 | 38 |
| 6 | 3 | 8 | 34 | 2 | 7 | 28 |
| 8 | 12 | 17 | 69 | 12 | 18 | 71 |
| 9 | 18 | 24 | 95 | 8 | 13 | 53 |
| 10 | 3 | 8 | 33 | 2 | 8 | 30 |
| 11 | 4 | 10 | 39 | 3 | 8 | 32 |
| 13 | 6 | 12 | 46 | 7 | 12 | 47 |
| 14 | 6 | 12 | 46 | 6 | 11 | 44 |
| EPP (Air) Objective | 25 | | 100 | 25 | | 100 |

Note (1): Background concentration estimated at 5.4 $\mu gm^{-3}$.

Table 3-2 shows that there are no predicted exceedences of the EPP (Air) objective for 24-hour $PM_{2.5}$ from the Project.

### 3.2.3 Annual average $PM_{2.5}$

Figures 3-19 to 3-24 show the predicted contours for the model refinements for the annual averaging period for $PM_{2.5}$. The 8 $\mu g.m^{-3}$ contour is highlighted on each plot for the model refinements.




N
W E
S

0 2.5 5 10 km

Scale: 1:400,000
Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

8 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

ANNUAL AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8µg/m³)

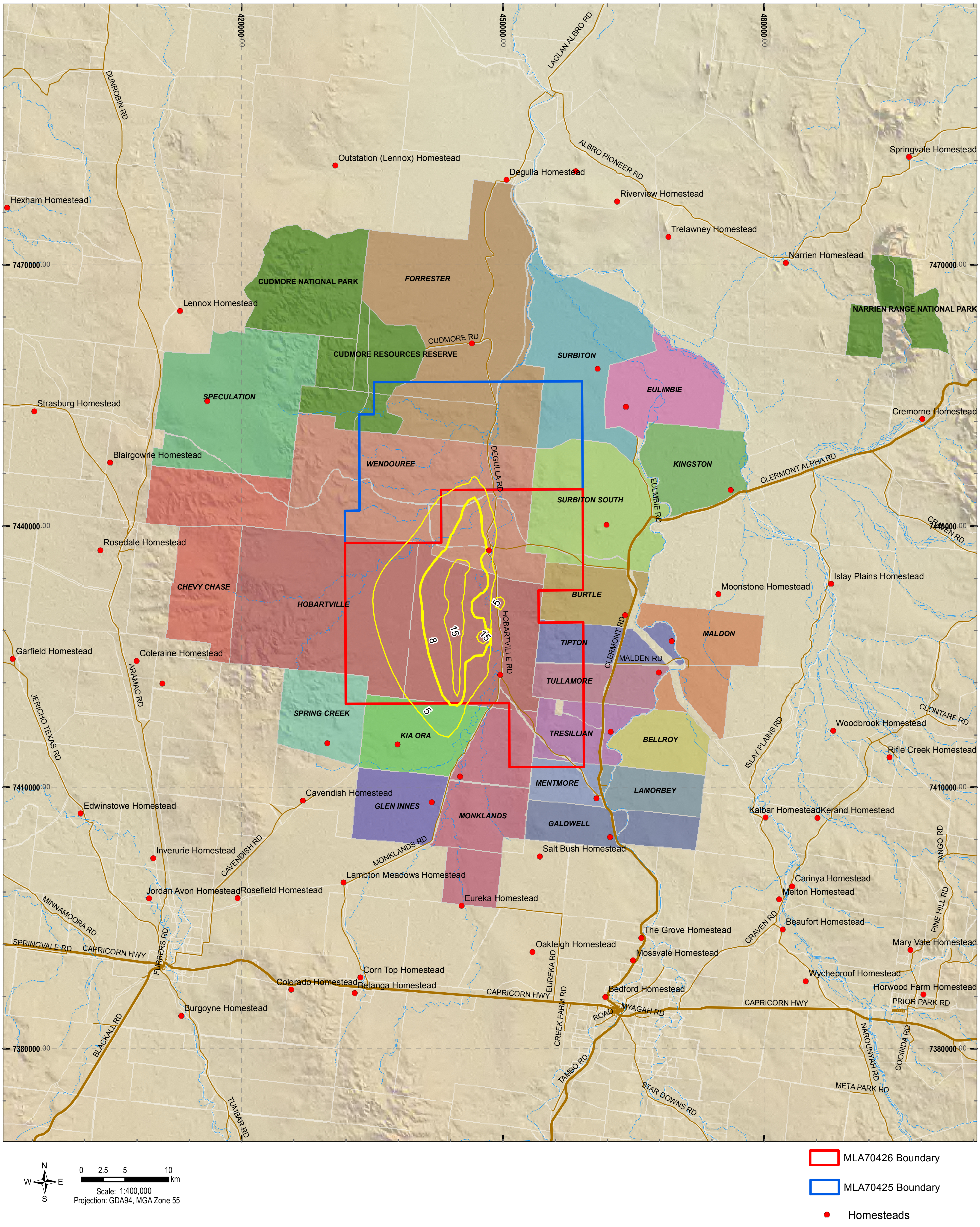
**MODEL REFINEMENTS YEAR 5**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-19**

File No: **42626680-g-606.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

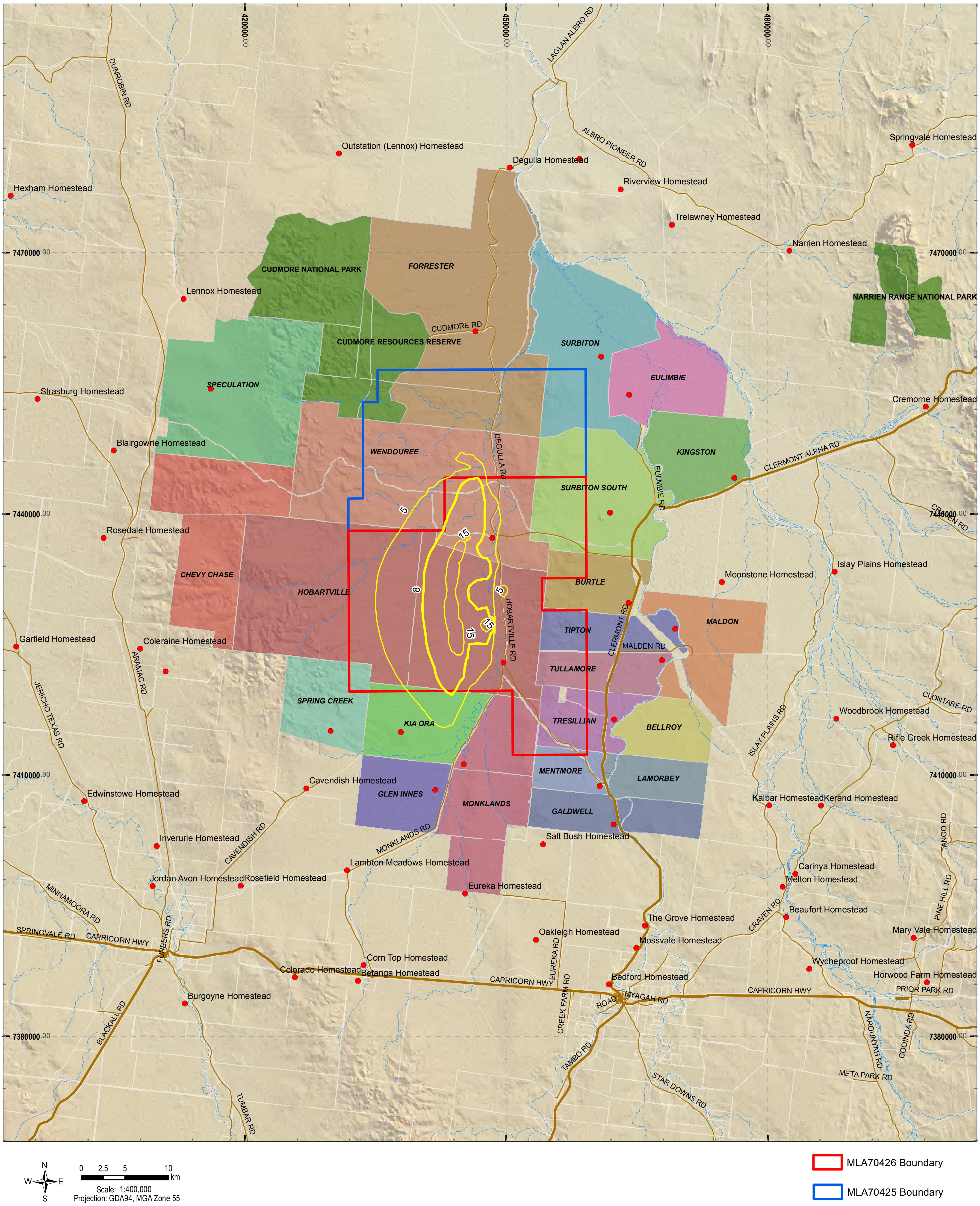
ANNUAL AVERAGE $PM_{2.5}$ (μg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8μg/m³)

**MODEL REFINEMENTS YEAR 10**

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-20**

File No: **42626680-g-607.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **D** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

ANNUAL AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8µg/m³)

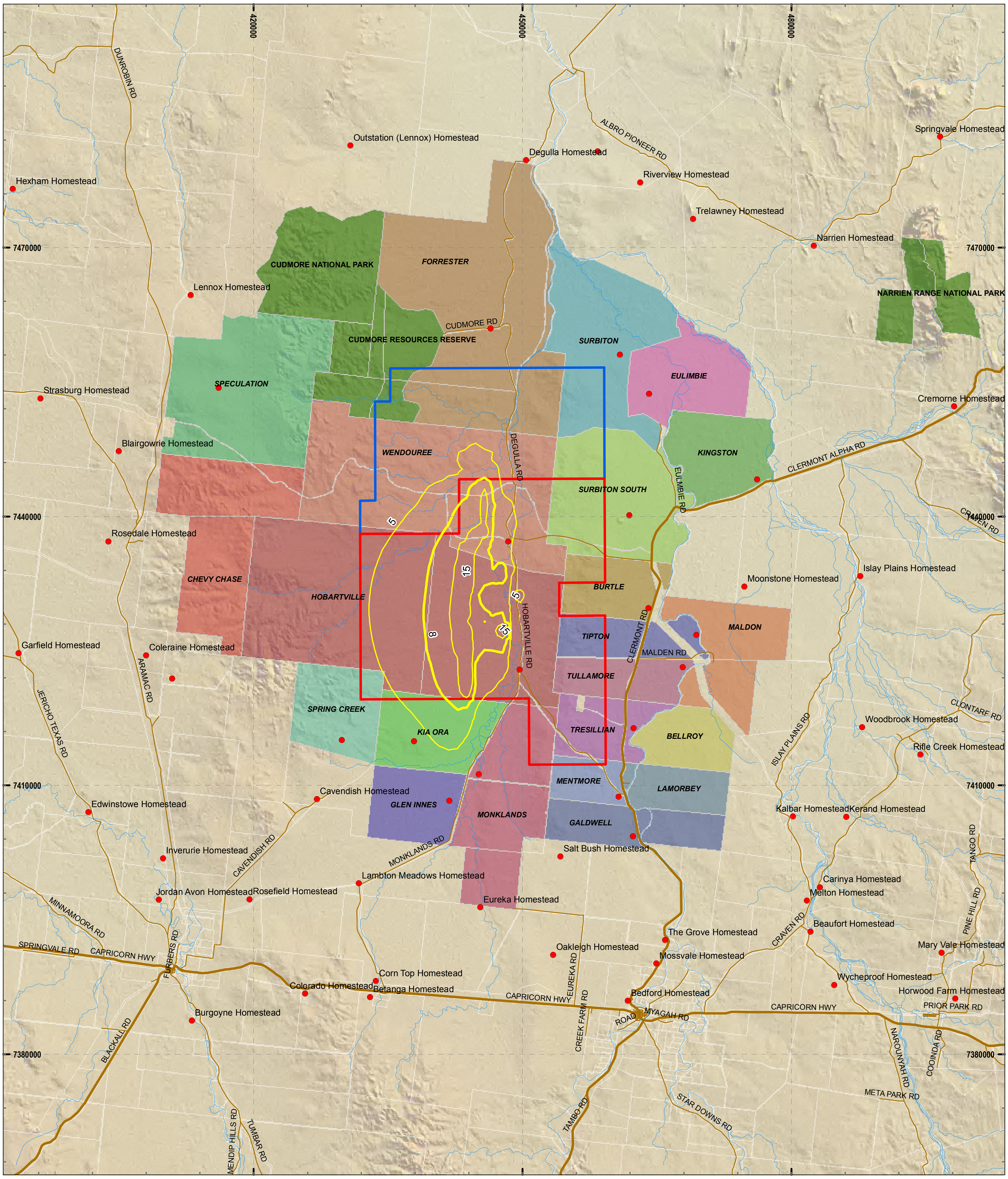
**MODEL REFINEMENTS YEAR 15**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-21**

File No: **42626680-g-608.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




N
W E
S

0 2.5 5 10 km

Scale: 1:400,000
Projection: GDA94, MGA Zone 55

MLA70426 Boundary

MLA70425 Boundary

Homesteads

8 EPP (Air) Objective

Source: Client Supplied Data



HANCOCK COAL PTY LTD

ANNUAL AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8µg/m³)

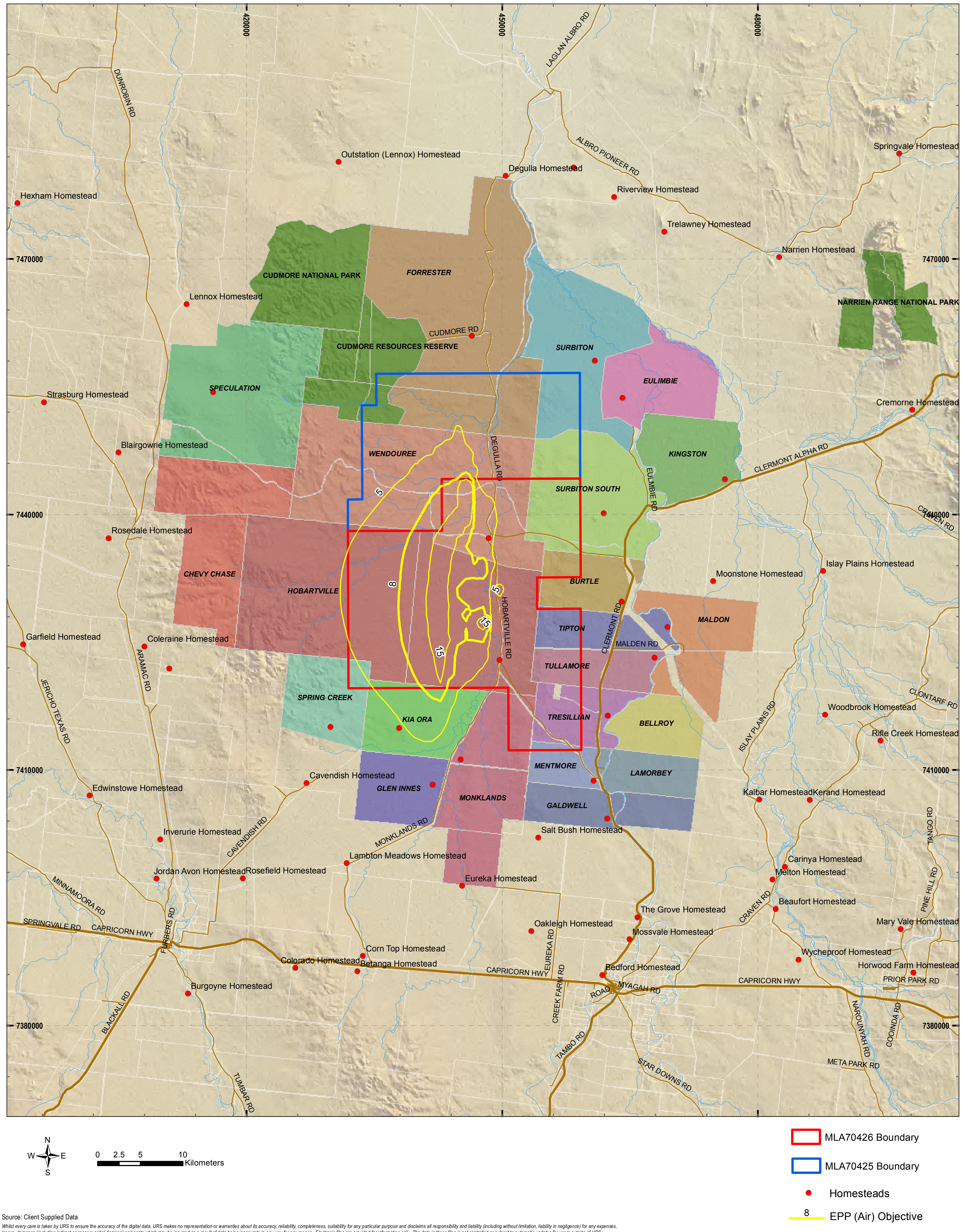
**MODEL REFINEMENTS YEAR 20**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-22**

File No: **42626680-g-609.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

ANNUAL AVERAGE $PM_{2.5}$ (µg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8µg/m³)

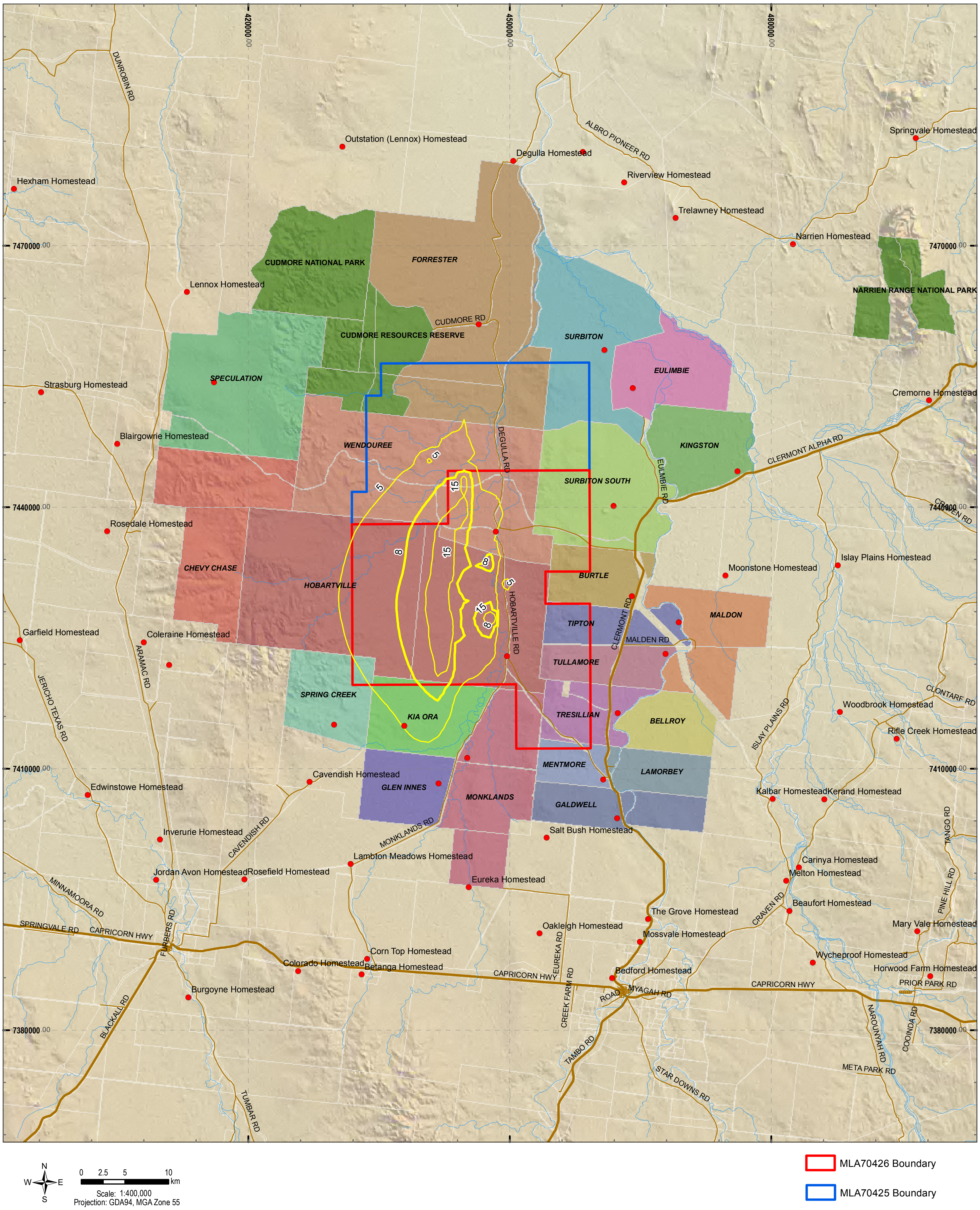
**MODEL REFINEMENTS YEAR 25**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-23**

File No: **42626680-g-610.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4




Source: Client Supplied Data



HANCOCK COAL PTY LTD

ANNUAL AVERAGE $PM_{2.5}$ (μg/m³)
(INCLUDING BACKGROUND CONTRIBUTION OF 2.8μg/m³)

**MODEL REFINEMENTS YEAR 30**

URS

**ALPHA COAL (MINE) PROJECT MODEL REFINEMENTS**

Figure: **3-24**

File No: **42626680-g-611.mxd** Drawn: **XL** Approved: **SB** Date: **22-05-2012** Rev. **E** A4

Figures 3-19 to 3-24 show that no exceedences of the annual average $PM_{2.5}$ EPP (Air) objective is predicted and therefore no further mitigation is required. However, actions to reduce $PM_{10}$ emissions are also expected to have a beneficial effect on concentrations of $PM_{2.5.}$

Table 3-3 shows the predicted maximum concentrations of $PM_{2.5}$ predicted at all receptors.

**Table 3-3 Predicted annual average ground level concentration of $PM_{2.5}$(µg/m$^3$)**

| Receptor | Y5 | | | Y30 | | |
|---|---|---|---|---|---|---|
| | Project (µg.m$^{-3}$) | Total[1] (µg.m$^{-3}$) | % of EPP (Air) | Project (µg.m$^{-3}$) | Total[1] (µg.m$^{-3}$) | % of EPP (Air) |
| 1 | 0.8 | 3.6 | 44 | 0.5 | 3.3 | 42 |
| 2 | 0.1 | 2.9 | 37 | 0.1 | 2.9 | 36 |
| 3 | 0.1 | 2.9 | 36 | 0.1 | 2.9 | 36 |
| 4 | 0.2 | 3.0 | 38 | 0.1 | 2.9 | 37 |
| 6 | 0.1 | 2.9 | 36 | 0.0 | 2.8 | 35 |
| 8 | 2.0 | 4.8 | 60 | 2.3 | 5.1 | 63 |
| 9 | 2.0 | 4.8 | 60 | 0.8 | 3.6 | 45 |
| 10 | 0.1 | 2.9 | 36 | 0.0 | 2.8 | 35 |
| 11 | 0.1 | 2.9 | 36 | 0.0 | 2.8 | 35 |
| 13 | 1.1 | 3.9 | 48 | 1.1 | 3.9 | 48 |
| 14 | 1.0 | 3.8 | 48 | 1.2 | 4.0 | 50 |
| EPP (Air) Objective | 8 | | 100 | 8 | | 100 |

Note (1): Background concentration estimated at 2.8 µg.m$^{-3}$.

Table 3-3 shows that there are no predicted exceedences of the EPP (Air) objective for annual average $PM_{2.5}$.

## 3.3 Peak or Worst Case Predicted Concentrations

Table 3-4 shows that the 5$^{th}$ highest concentration of $PM_{10}$ in comparison to the worst case or highest concentration in comparison to the EPP (Air) standard.

**Table 3-4 Worst case predicted 24-hour average ground level concentration of $PM_{10}$ (µg/m$^3$)$^{(1)}$**

| Receptor | Y5 | | | | Y30 | | | |
|---|---|---|---|---|---|---|---|---|
| | 5$^{th}$ highest day (µg.m$^{-3}$) | % of EPP (Air) | Highest day (µg.m$^{-3}$) | % of EPP (Air) | 5$^{th}$ highest day (µg.m$^{-3}$) | % of EPP (Air) | Highest day (µg.m$^{-3}$) | % of EPP (Air) |
| 1 | 52 | 105 | 60 | 119 | 47 | 95 | 50 | 100 |
| 2 | 38 | 75 | 42 | 84 | 34 | 69 | 36 | 71 |
| 3 | 36 | 71 | 41 | 82 | 33 | 66 | 36 | 72 |
| 4 | 47 | 95 | 63 | 125 | 40 | 80 | 48 | 96 |
| 6 | 35 | 69 | 42 | 84 | 31 | 62 | 36 | 71 |
| 8 | 76 | 152 | 86 | 171 | 84 | 167 | 89 | 178 |
| 9 | 103 | 205 | 119 | 238 | 59 | 118 | 66 | 132 |
| 10 | 32 | 63 | 42 | 83 | 30 | 60 | 38 | 75 |
| 11 | 31 | 63 | 48 | 97 | 30 | 61 | 40 | 81 |
| 13 | 55 | 109 | 58 | 115 | 54 | 109 | 59 | 119 |
| 14 | 53 | 106 | 58 | 115 | 54 | 109 | 55 | 110 |
| EPP (Air) Objective | 50 | 100 | 50 | 100 | 50 | 100 | 50 | 100 |

Note (1): Background concentration estimated at 27 µg.m$^{-3}$ included.

In addition to the exceedences predicted in reporting the 5th highest concentration, Table 3-4 shows that the maximum concentrations would exceed the EPP (Air) objective at receptor 4 in year 5 and receptor 1 in both years 5 and year 30. However, it should be noted that the convention generally accepted in Queensland for reporting 24-hour $PM_{10}$ concentrations is to report to report the 5th highest, which is consistent with the EPP (Air). A description of the application of the EPP (Air) to mining projects is provided in Section 2.4.1.

## 3.4 Impacts of Modelling Updates on Emissions Inventories

The SEIS emissions inventory has been updated in the refined modelling exercise. The SEIS emissions inventory is shown in Table 3-5 and the updated inventory in Table 3-6 for comparison. The reductions to the inventory are highlighted in Table 3-6 and 3-7.

**Table 3-5 SEIS $PM_{10}$ emissions during operation (kg/year) (Table 3-1 SEIS)**

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| **Topsoil** | | | | | | |
| Disturbance & Rehabilitation | 31,754 | 29,884 | 29,948 | 32,632 | 32,186 | 24,005 |
| **Overburden & In-Pit** | | | | | | |
| IPCC | - | 51,362 | 52,353 | 51,760 | 52,973 | 53,196 |
| Drilling & Blasting | 156,472 | 138,431 | 183,368 | 196,778 | 197,210 | 197,584 |
| Dragline | 302,290 | 815,659 | 890,273 | 887,162 | 901,273 | 866,758 |
| FEL of Overburden into Trucks | 68,456 | 38,917 | 47,996 | 62,261 | 71,647 | 69,605 |
| Transport of Overburden to dumps | 2,659,904 | 2,631,022 | 2,831,201 | 3,168,048 | 3,457,314 | 3,374,092 |
| Truck Dumping at Overburden Dumps | 1,996,904 | 1,979,382 | 2,131,100 | 2,399,169 | 2,639,220 | 2,576,595 |
| FEL of coal trucks | 283,610 | 298,626 | 298,734 | 303,829 | 306,115 | 309,293 |
| Dozers | 271,461 | 198,379 | 142,543 | 148,773 | 183,413 | 164,875 |
| Graders | 23,239 | 10,790 | 11,456 | 14,891 | 17,748 | 14,504 |
| **ROM Activities** | | | | | | |
| Processing | 48,779 | - | - | - | - | - |
| Truck Dumping at ROM | 151,575 | 159,600 | 159,658 | 162,381 | 163,603 | 165,301 |
| FEL at ROM | 56,722 | 59,725 | 59,747 | 60,766 | 61,223 | 61,859 |
| Dozer hours – Coal at ROM (total) | 18,669 | 19,245 | 19,359 | 19,692 | 19,478 | 19,788 |
| Wind Erosion from Stockpiles | 1,457 | 1,457 | 1,457 | 1,457 | 1,457 | 1,457 |
| **ROM to CHPP Conveyor** | | | | | | |
| Conveyors | 416 | 416 | 416 | 416 | 416 | 416 |
| Misc Transfer Points | 35,306 | 37,175 | 37,189 | 37,823 | 38,108 | 38,503 |
| **CHPP Activities** | | | | | | |
| Processing | 97,558 | 102,723 | 102,760 | 104,513 | 105,299 | 106,393 |

# 3 Results of the Refined Model

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| FEL at CHPP | 56,722 | 59,725 | 59,747 | 60,766 | 61,223 | 61,859 |
| Dozer hours – Coal at CHPP | 18,669 | 19,245 | 19,359 | 19,692 | 19,478 | 19,788 |
| Loading Stockpiles | 29,285 | 30,397 | 30,203 | 30,511 | 30,547 | 30,571 |
| Unloading from Stockpiles | 223,947 | 232,447 | 230,961 | 233,322 | 233,595 | 233,782 |
| CHPP Conveyors | 401 | 401 | 401 | 401 | 401 | 401 |
| Misc Transfer Points | 21,066 | 21,866 | 21,726 | 21,948 | 21,974 | 21,991 |
| Wind Erosion from Stockpiles | 25,773 | 25,773 | 25,773 | 25,773 | 25,773 | 25,773 |
| **Main Haul Roads** | | | | | | |
| Transport of Coal to ROM | 505,345 | 502,972 | 571,081 | 645,616 | 695,418 | 711,260 |
| Transport of Rejects to Dumps | 102,544 | - | - | - | - | - |
| **Tailing Storage Facility** | | | | | | |
| Wind Erosion from Tailings Storage Facility | 126,791 | 126,791 | 126,791 | 126,791 | 126,791 | 126,791 |
| **TOTAL (kg/year)** | **7,315,114** | **7,592,409** | **8,085,599** | **8,817,171** | **9,463,882** | **9,276,440** |

**Table 3-6 Model refinements site specific $PM_{10}$ emissions during operation (kg/year)*

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| **Topsoil** | | | | | | |
| Disturbance & Rehabilitation | 31,754 | 29,884 | 29,948 | 32,632 | 32,186 | 24,005 |
| **Overburden & In-Pit** | | | | | | |
| IPCC | - | 51,362 | 52,353 | 51,760 | 52,973 | 53,196 |
| Drilling & Blasting | 132,166 | 119,888 | 159,160 | 167,999 | 165,174 | 163,985 |
| Dragline | 117,126 | 316,036 | 344,946 | 343,741 | 349,208 | 335,835 |
| FEL of Overburden into Trucks | 8,179 | 4,650 | 5,735 | 7,439 | 8,561 | 8,317 |
| Transport of Overburden to dumps | 2,293,000 | 1,002,623 | 1,027,438 | 1,361,055 | 1,681,069 | 1,645,720 |
| Truck Dumping at Overburden Dumps | 856,365 | 359,080 | 367,027 | 499,811 | 631,744 | 618,971 |
| FEL of coal trucks | 124,006 | 130,572 | 130,619 | 132,847 | 133,847 | 135,236 |
| Dozers | 64,870 | 47,406 | 34,063 | 35,552 | 43,830 | 39,400 |
| Graders | 23,239 | 10,790 | 11,456 | 14,891 | 17,748 | 14,504 |
| **ROM Activities** | | | | | | |
| Processing | 48,779 | - | - | - | - | - |
| Truck Dumping at ROM | 75,787 | 79,800 | 79,829 | 81,191 | 81,801 | 82,651 |
| FEL at ROM | 24,801 | 26,114 | 26,124 | 26,569 | 26,769 | 27,047 |
| Dozer hours – Coal at ROM (total) | 5,155 | 5,314 | 5,346 | 5,438 | 5,379 | 5,464 |

## 3 Results of the Refined Model

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| Wind Erosion from Stockpiles | 729 | 729 | 729 | 729 | 729 | 729 |
| **ROM to CHPP Conveyor** | | | | | | |
| Conveyors | 416 | 416 | 416 | 416 | 416 | 416 |
| Misc Transfer Points | 3,934 | 4,142 | 4,143 | 4,214 | 4,246 | 4,290 |
| **CHPP Activities** | | | | | | |
| Processing | 1,951 | 2,054 | 2,055 | 2,090 | 2,106 | 2,128 |
| FEL at CHPP | 7,440 | 7,834 | 7,837 | 7,971 | 8,031 | 8,114 |
| Dozer hours – Coal at CHPP | 103 | 106 | 107 | 109 | 108 | 109 |
| Loading Stockpiles | 8,786 | 9,119 | 9,061 | 9,153 | 9,164 | 9,171 |
| Unloading from Stockpiles | 4,479 | 4,649 | 4,619 | 4,666 | 4,672 | 4,676 |
| CHPP Conveyors | 40 | 40 | 40 | 40 | 40 | 40 |
| Misc Transfer Points | 782 | 812 | 807 | 815 | 816 | 817 |
| Wind Erosion from Stockpiles | 7,732 | 7,732 | 7,732 | 7,732 | 7,732 | 7,732 |
| **Main Haul Roads** | | | | | | |
| Transport of Coal to ROM | 505,345 | 502,972 | 571,081 | 645,616 | 695,418 | 711,260 |
| Transport of Rejects to Dumps | 102,544 | - | - | - | - | - |
| **Tailing Storage Facility** | | | | | | |
| Wind Erosion from Tailings Storage Facility | 12,679 | 12,679 | 12,679 | 12,679 | 12,679 | 12,679 |
| **TOTAL (kg/year)** | **4,462,188** | **2,736,803** | **2,895,350** | **3,457,155** | **3,976,445** | **3,916,490** |

* The blue shaded rows indicate where changes have been made to the emissions inventory

**Table 3-7 Percentage reduction in the SEIS site specific PM10 emissions inventory as a result of the model refinements***

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| **Topsoil** | | | | | | |
| Disturbance & Rehabilitation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Overburden & In-Pit** | | | | | | |
| IPCC | | 0 | 0 | 0 | 0 | 0 |
| Drilling & Blasting | 16 | 13 | 13 | 15 | 16 | 17 |
| Dragline | 61 | 61 | 61 | 61 | 61 | 61 |
| FEL of Overburden into Trucks | 88 | 88 | 88 | 88 | 88 | 88 |
| Transport of Overburden to dumps | 14 | 62 | 64 | 57 | 51 | 51 |
| Truck Dumping at Overburden Dumps | 57 | 82 | 83 | 79 | 76 | 76 |
| FEL of coal trucks | 56 | 56 | 56 | 56 | 56 | 56 |
| Dozers | 76 | 76 | 76 | 76 | 76 | 76 |
| Graders | 0 | 0 | 0 | 0 | 0 | 0 |
| **ROM Activities** | | | | | | |
| Processing | 0 | | | | | |
| Truck Dumping at ROM | 50 | 50 | 50 | 50 | 50 | 50 |
| FEL at ROM | 56 | 56 | 56 | 56 | 56 | 56 |
| Dozer hours – Coal at ROM (total) | 72 | 72 | 72 | 72 | 72 | 72 |
| Wind Erosion from Stockpiles | 50 | 50 | 50 | 50 | 50 | 50 |
| **ROM to CHPP Conveyor** | | | | | | |
| Conveyors | 0 | 0 | 0 | 0 | 0 | 0 |
| Misc Transfer Points | 89 | 89 | 89 | 89 | 89 | 89 |
| CHPP Activities | | | | | | |
| Processing | 98 | 98 | 98 | 98 | 98 | 98 |
| FEL at CHPP | 87 | 87 | 87 | 87 | 87 | 87 |
| Dozer hours – Coal at CHPP | 99 | 99 | 99 | 99 | 99 | 99 |
| Loading Stockpiles | 70 | 70 | 70 | 70 | 70 | 70 |
| Unloading from Stockpiles | 98 | 98 | 98 | 98 | 98 | 98 |
| CHPP Conveyors | 90 | 90 | 90 | 90 | 90 | 90 |
| Misc Transfer Points | 96 | 96 | 96 | 96 | 96 | 96 |
| Wind Erosion from Stockpiles | 70 | 70 | 70 | 70 | 70 | 70 |
| **Main Haul Roads** | | | | | | |
| Transport of Coal to ROM | 0 | 0 | 0 | 0 | 0 | 0 |
| Transport of Rejects to Dumps | 0 | | | | | |
| **Tailing Storage Facility** | | | | | | |

| Activity | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 | Year 30 |
|---|---|---|---|---|---|---|
| Wind Erosion from Tailings Storage Facility | 90 | 90 | 90 | 90 | 90 | 90 |
| **TOTAL (kg/year)** | **39** | **64** | **64** | **61** | **58** | **58** |

* The blue shaded rows indicate where changes have been made to the emissions inventory

Tables 3-5, 3-6 and 3-7 show that the total annual emissions inventory has been reduced in the Refined Model from 7,315,114 to 4,462,188 kg in year 5 (39%) and by 9,276,440 to 3,916,490 kg in year 30 (58%). The majority of sources have been reduced in the Refined Model. The largest contribution to the reduction is from the handling of overburden material both from road haulage and truck dumping at overburden dumps. The reduction in dust generation from overburden handling contributes 53% of the reduction in Year 5 and 69% in Year 30.

In the EIS and SEIS, $PM_{2.5}$ emissions were calculated from $PM_{10}$ predicted concentrations and so no inventory was reported.

## 3.5 Impacts of Modelling Updates on Predicted Concentrations

Tables 3-8 to 3-10 show the concentrations predicted at each receptor in the EIS, SEIS and Refined Model (RM). Also shown are the percentage reductions in the Refined Model and the Refined Model predictions as a percentage of the standard.

**Table 3-8 A comparison of predicted concentrations of 24-hour average $PM_{10}$ between the EIS, SEIS and Refined Model (1)**

| Receptor | Year 5 | | | | | Year 30 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard |
| 1 | 78 | 116 | 52 | 122 | 105 | 76 | 133 | 47 | 181 | 95 |
| 2 | 51 | 64 | 38 | 70 | 75 | 50 | 63 | 34 | 84 | 69 |
| 3 | 49 | 57 | 36 | 60 | 71 | 49 | 57 | 33 | 73 | 66 |
| 4 | 82 | 98 | 47 | 107 | 95 | 82 | 86 | 40 | 116 | 80 |
| 6 | 48 | 53 | 35 | 53 | 69 | 48 | 46 | 31 | 47 | 62 |
| 8 | 123 | 198 | 76 | 161 | 152 | 199 | 327 | 84 | 291 | 167 |
| 9 | 166 | 286 | 103 | 179 | 205 | 131 | 175 | 59 | 197 | 118 |
| 10 | 37 | 43 | 32 | 36 | 63 | 38 | 40 | 30 | 34 | 60 |
| 11 | 38 | 43 | 31 | 37 | 63 | 38 | 43 | 30 | 42 | 61 |
| 13 | 81 | 124 | 55 | 127 | 109 | 119 | 167 | 54 | 206 | 109 |
| 14 | 133 | 238 | 53 | 349 | 106 | 142 | 249 | 54 | 360 | 109 |

Note (1): Background concentration estimated at 27 $\mu g.m^{-3}$ included

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**Table 3-9 A comparison of predicted concentrations of 24 hour average $PM_{2.5}$ between the EIS, SEIS and Refined Model (1)**

| Receptor | Year 5 | | | | | Year 30 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard |
| 1 | 20 | 28 | 12 | 138 | 48 | 19 | 31 | 10 | 205 | 40 |
| 2 | 14 | 16 | 8 | 87 | 34 | 13 | 14 | 7 | 96 | 28 |
| 3 | 13 | 15 | 8 | 83 | 33 | 14 | 14 | 7 | 96 | 29 |
| 4 | 25 | 30 | 13 | 138 | 50 | 28 | 25 | 10 | 159 | 38 |
| 6 | 12 | 16 | 8 | 88 | 34 | 11 | 13 | 7 | 88 | 28 |
| 8 | 27 | 46 | 17 | 171 | 68 | 45 | 73 | 19 | 284 | 76 |
| 9 | 38 | 70 | 24 | 194 | 95 | 30 | 43 | 13 | 225 | 53 |
| 10 | 11 | 16 | 8 | 88 | 33 | 11 | 16 | 8 | 109 | 30 |
| 11 | 11 | 20 | 10 | 107 | 39 | 10 | 18 | 8 | 121 | 32 |
| 13 | 26 | 27 | 12 | 131 | 46 | 28 | 40 | 12 | 234 | 48 |
| 14 | 21 | 51 | 12 | 325 | 46 | 31 | 59 | 11 | 436 | 44 |

Note (1): Background concentration estimated at 5.4 $\mu g.m^{-3}$ included

**Table 3-10 A comparison of predicted concentrations of annual average $PM_{2.5}$ between the EIS, SEIS and Refined Model (1)**

| Receptor | Year 5 | | | | | Year 30 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard | EIS ($\mu g.m^{-3}$) | SEIS ($\mu g.m^{-3}$) | RM ($\mu g.m^{-3}$) | SEIS to RM % reduction | RM % of standard |
| 1 | 4 | 6 | 4 | 53 | 44 | 4 | 5 | 3 | 64 | 42 |
| 2 | 3 | 3 | 3 | 14 | 37 | 3 | 3 | 3 | 10 | 36 |
| 3 | 3 | 3 | 3 | 10 | 36 | 3 | 3 | 3 | 7 | 36 |
| 4 | 4 | 4 | 3 | 17 | 38 | 4 | 3 | 3 | 17 | 37 |
| 6 | 3 | 3 | 3 | 3 | 36 | 3 | 3 | 3 | 7 | 35 |
| 8 | 7 | 10 | 5 | 104 | 60 | 11 | 15 | 5 | 188 | 63 |
| 9 | 7 | 10 | 5 | 102 | 60 | 6 | 6 | 4 | 69 | 45 |
| 10 | 3 | 3 | 3 | 3 | 36 | 3 | 3 | 3 | 7 | 35 |
| 11 | 3 | 3 | 3 | 3 | 36 | 3 | 3 | 3 | 7 | 35 |
| 13 | 5 | 7 | 4 | 66 | 49 | 7 | 8 | 4 | 115 | 49 |
| 14 | 6 | 9 | 4 | 125 | 48 | 6 | 9 | 4 | 125 | 50 |

Note (1): Background concentration estimated at 2.8 $\mu g.m^{-3}$.

In general, all the tables show that differences in the modelling approach between the EIS and SEIS caused an increase in predicted concentrations at each of the sensitive receptors. However, the differences to the modelling approach adopted in the Model Refinements from the SEIS (Section 4) produced a significant reduction in predicted concentrations at each of the sensitive receptors to levels lower than the original EIS modelling. The largest actual and proportional reduction between the SEIS and Refined Model were predicted to occur at receptors 8, 9, 13 and 14.

## 3.6 Non-Particulate Emissions

Although combustion pollutants $NO_x$, CO and $SO_2$ from blasting for open cut mining may only contribute a small proportion of total emissions, the rapid release and high concentration that may be associated with such activities could pose a health risk should the resulting plume not dissipate rapidly and sufficiently before reaching human populations. Therefore, in its role as statutory consultee on the

## 3 Results of the Refined Model

Alpha Coal Mine Project, Queensland Health has highlighted that these emissions have not been quantified in the SEIS and the potential impact of their release on human health not properly assessed[7].

Emissions of particulate matter from blasting were assessed in the SEIS using the average blast area, the number of expected blasts per year and an emission factor (kg/hour) from US EPA-AP42 volume 1, 5th edition Section 13.2.2. However, the scope of the assessment excluded non-particulate emissions from blasting associated with the combustion of Ammonia Nitrate Fuel Oil (ANFO), Heavy Ammonium Nitrate Fuel Oil (HANFO) and associated emulsion agents. Therefore, in response to the concerns from Queensland Health, this section of the Addendum reports on the assessment of $NO_x$, CO and $SO_2$ emissions from open cut pit blasting at the Alpha Coal Mine. The assessment scope covers those emissions which can be expected under 'normal' blast conditions where the explosive fuel is completely combusted and 'upset blasting conditions' which have the potential to produce clouds of visible noxious gas outside the standard blasting exclusion zone ('fume events'). These have the potential to impact upon human health during short periods of exposure.

### 3.6.1 Normal Blasting Conditions

In the assessment of air quality impacts 'screening' is a preliminary emissions dispersion assessment approach applied to determine whether a more detailed assessment is required. In this assessment, the US EPA screening dispersion model SCREEN3 was used to estimate worst-case ground level concentrations for non-particulate, gaseous emissions from blasting. A description of the SCREEN3 model and the methodology used to assess normal blast emissions is provided in Appendix D.

The scenarios modelled in SCREEN3 were as follows:

- Pit 1 (single source) – a single blast from Pit 1
- Pit 1 (two sources) – two blasts from Pit 1
- Pit 1 (two sources) plus Pit 2 (two sources) two blasts from Pit 1 and two blasts from Pit 2

Tables 3-11 to 3-13 show the predicted concentrations from SCREEN3 for $NO_2$, CO and $SO_2$:

**Table 3-11 Carbon monoxide (excluding background)**

| Scenario | Distance to Pit (km) | 1-hour average concentration ($\mu g.m^{-3}$) | % of standard |
|---|---|---|---|
| Pit 1 (single source) | 6.7 | 65.7 | <1 |
| Pit 1 (two sources) | 6.7 | 74.3 | <1 |
| Pit 1 (two sources)<br>Pit 2 (two sources) | 6.7<br>10.5 | 140 | 1.2 |
| **EPP(Air) standard (8-hour average)** | | **11000** | |

[7] Health Protection Directorate. Submission on the environmental impact statement-Alpha Coal Addendum. 23/12/2011.

**Table 3-12 Nitrogen dioxide (excluding background)**

| Scenario | Distance to Pit (km) | 1-hour average concentration ($\mu g.m^{-3}$) | % of standard |
|---|---|---|---|
| Pit 1 (single source) | 6.7 | 10.0 | 4 |
| Pit 1 (two sources) | 6.7 | 9.8 | 4 |
| Pit 1 (two sources)<br>Pit 2 (two sources) | 6.7<br>10.5 | 18.8 | 8 |
| **EPP(Air) standard** | | **250** | |

**Table 3-13 Sulphur dioxide (excluding background)**

| Scenario | Distance to Pit (km) | 1-hour average concentration ($\mu g.m^{-3}$) | % of standard |
|---|---|---|---|
| Pit 1 (single source) | 6.7 | 1.6 | <1 |
| Pit 1 (two sources) | 6.7 | 2.3 | <1 |
| Pit 1 (two sources)<br>Pit 2 (two sources) | 6.7<br>10.5 | 4.4 | <1 |
| **EPP(Air) standard** | | **570** | |

Tables 3-11 to 3-13 show that all pollutants are predicted to be under the EPP (Air) objectives at the closest receptor excluding background concentrations. The results produced by SCREEN3 are inherently conservative in that they represent the peak hour concentration from the worst dispersion conditions in the year. The conditions under which the predictions were made were of a wind speed of 1 m/s under stable (class F) conditions. Note that these conditions only occur at night and blasting would only take place during the day. Under these conditions, it would take approximately 2 hours for any pollutant to travel 6.7 km to the Kia-Ora Homestead. By this time it is likely that the pollutant will be well mixed in the atmosphere which is represented in the concentrations predicted using SCREEN3. Exceedences at human receptors are considered to be highly unlikely under normal blasting conditions.

### 3.6.2 Upset Blasting Conditions

Fume events occur when a non-ideal explosive reaction generates a cloud of visible, toxic pollution which moves outside the standard blast exclusion zone. This cloud of visible pollution consists of $NO_2$, nitric oxide (NO), and CO which are harmful to human health. The standard blast exclusion zone is designed to provide protection from projections and blast overpressure.

It is difficult to quantitatively assess emissions during fume events due to the uncertainty in emissions factors. The rate of generation of $NO_2$, NO and CO during a fume event depends on a number of variables such as:

- Under or over fuelled Ammonium Nitrate (AN);
- Fuel AN mixture;
- Density of loaded explosives;
- Degree of confinement of explosives;
- Exposure of explosives to water;
- Ground conditions e.g. fissures, voids can result in explosives forming without critical diameter for an ideal explosive reaction causing fume; and
- Manufacture and specification of explosive ingredients including AN

Therefore, the assessment of emissions during fume events has been undertaken qualitatively with a focus on the length of the potential downwind exclusion distance and the best practice management approaches recommended in the Department of Employment, Economic Development and Innovation (DEEDI) guidance note QGN 20 v3[8].

Table 3-14 shows the distance of each sensitive receptor in the study to the nearest edge of the nearest pit.

**Table 3-14 Distance of sensitive receptors to the nearest pit**

| Receptor | Distance of receptor to pit (m) |
|---|---|
| 1. Forrester Homestead | 17,100 |
| 2. Surbiton Station | 19,200 |
| 3. Eullmbie Station | 18,900 |
| 4. Surbiton Homestead | 13,300 |
| 6. Burtle Homestead | 16,900 |
| 8. Kia Ora Homestead | 6,700 |
| 9. Monklands Homestead | 8,000 |
| 10. Mentmore Homestead | 18,500 |
| 11. Tressillian Homestead | 16,500 |
| 13. Spring Creek Homestead | 16,900 |
| 14. Glenn Innes Homestead | 11,000 |

Table 4.1 of the QGN 20 v3, indicates the length of potential exclusion distance downwind with several different wind conditions covering daytime stability classes. The table indicates that the largest blasts (fume category 5) with an initial plume of 500 ppm would require a downwind exclusion distance of 5000 m to maintain a short term exposure limit (STEL) concentration of 5 ppm under worst case dispersion conditions. The closest receptor, 8, is located at a distance of 6,700 m. However, the modeling indicates that this exclusion zone will vary from 1600 to 5000 m depending on the meteorological conditions. A 500 m zone would only be required under worst-case conditions for the largest blasts.

Although this 5 ppm exclusion zone should not be used as a proxy for the protection of human health in the same way as the EPP (Air) $NO_2$ standard of 250 µg/m$^3$ is devised (as the STEL is an occupational exposure limit), it indicates that the sensitive receptors in the study are likely to lie outside the typical exclusion zone of the most intense blasts. The Accommodation Village is 2,500 m away from this maximum exclusion zone and the majority of the sensitive receptors beyond 10,000 m.

HCPL will operate a FMZ around the pits where emissions from blasting will be carefully managed in compliance with the best practice recommendations in guidance note QGN 20 v3. This will include the following preventative, management and incidence reporting measures:

- Adherence to best practice in the storage and preparation of explosives including minimization of water contamination and the use of a ratio of fuel oil to ANFO of 6%[9];
- Adherence to best practice in the preparation of the blast site, including consideration of blast confinement and the presence of water;
- A pre-firing review including the definition of a FMZ for each blasting event;
- Consideration of the ideal conditions to prevent fume events such as the time of day and meteorology;
- Development of a monitoring plan for blasting events; and

[8] DEEDI (2011). Queensland Guidance Note QGN 20 v3 Management of oxides in nitrogen in open cut blasting
[9] Factors affecting ANFO fumes production by Rowland, J H Mainiero, R J.; 2000; p. 63-174. IN: Proceedings of the 26th Annual Conference on Explosives and Blasting Technique.- Anaheim, CA: International Society of Explosives Engineers;

- Incidence reporting, investigation of fume events and ongoing audit and review.

All controls put in place by HCPL for prevention and control of fume events will be vigorously applied and all HCPL personnel will ensure that these controls are firmly embedded and maintained for blasting operations.

# 4 Technical Description of Key Model Refinements

## 4.1 Availability of New Data

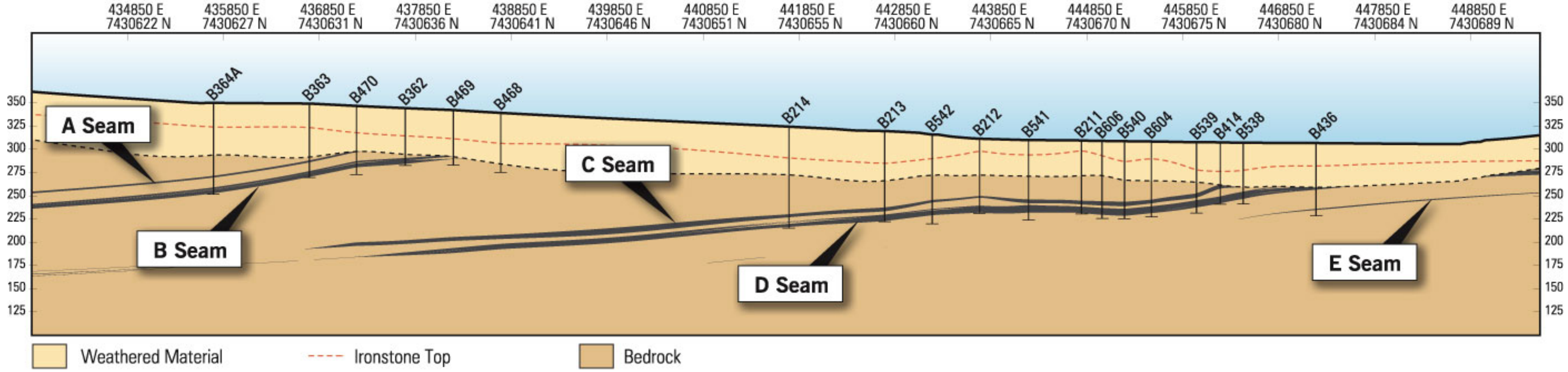
### 4.1.1 Moisture Content Conceptual Model

In the Refined Model, the moisture contents of overburden and product coal were updated on the release of the Bank Feasibility Study (BFS) Design Criteria Coal Handling and Preparation Plant (CHPP) 'BFS Criteria Report' (Hancock Coal, 2010). The document shows that Alpha coal is a lower rank bituminous thermal coal with a relatively high level of both air dry and total product moisture. A series of sized coal samples for each main seam section (C, DU and DL) were tested for moisture by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and are described in the BFS Design Criteria Report. These tests were developed for the Australian Coal Industry and have been proven to provide accurate estimates of product moisture for higher rank thermal and coking coals from existing operations. Estimates of Run of Mine (ROM) or plant feed moisture were based on work from another Australia Coal Industry Research Program (ACIRP) study on in-situ moisture.

To estimate overburden moisture content, a simple conceptual model of the pit geology has been developed on the basis of a review of available borehole data.  A typical cross section is shown in Figure 4-1.

# 4 Technical Description of Key Model Refinements

**Figure 4-1 Typical Mine Cross Section**



The key assumptions are as follows:

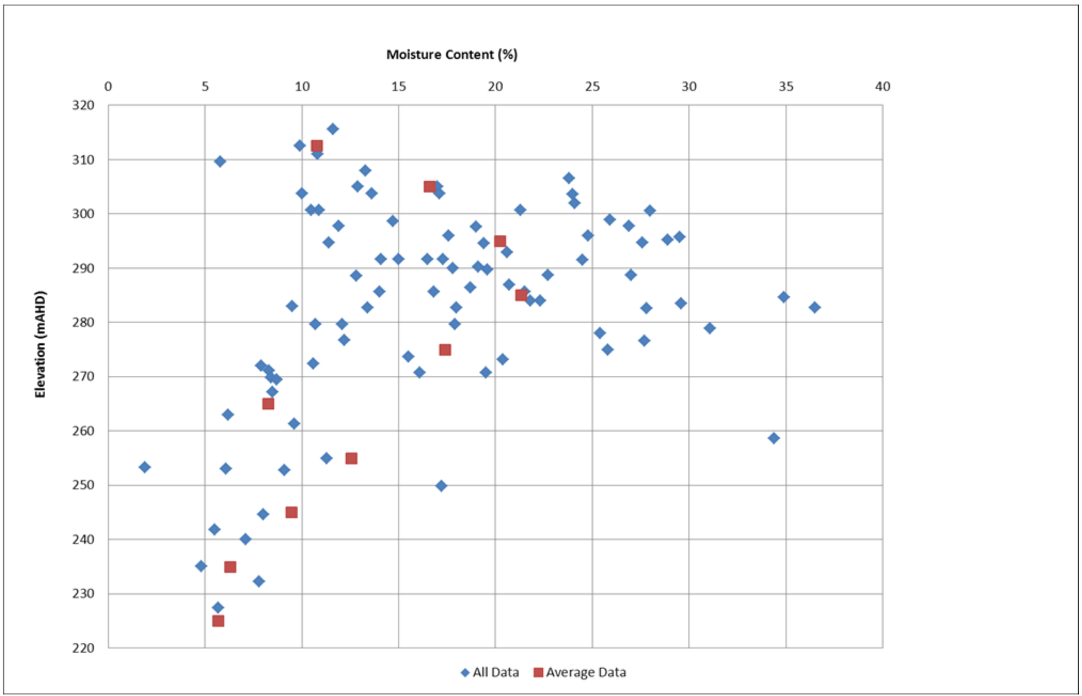
- There are two layers, being tertiary weathered material and Bandanna formation sandstone bedrock;
- The tertiary layer has a constant depth of 50m along the profile of the pit;
- The depth of sandstone is 25m in year 5 and 125m in year 30; and
- There is a linear progress through the cross section over time.

Although the mine plan indicates that progress through the pit depends on specific location, these assumptions are considered to provide a reasonable estimate of the relative proportions of overburden coming from each of the layers in any given year.

Moisture content data from the BFS (see Figure 4-2) were analysed to determine the moisture content in each of the layers. Moisture content data from the test pit were found to be consistent with this data set. An average of all data points in each layer would introduce an unintentional bias because samples are not regularly distributed with depth. To alleviate this, data were placed into 10m sample groups and the arithmetic mean moisture content was calculated for each group (shown as Average Data in Figure 4-2). The geometric mean of these data was calculated for each layer, resulting in moisture content estimates of 16.8% for the tertiary layer (assumed to be down to 270m Australian Height Datum (AHD) in the test pit data) and 8.1% for the Bandanna Formation (assumed to be below 270m AHD in the test pit data).

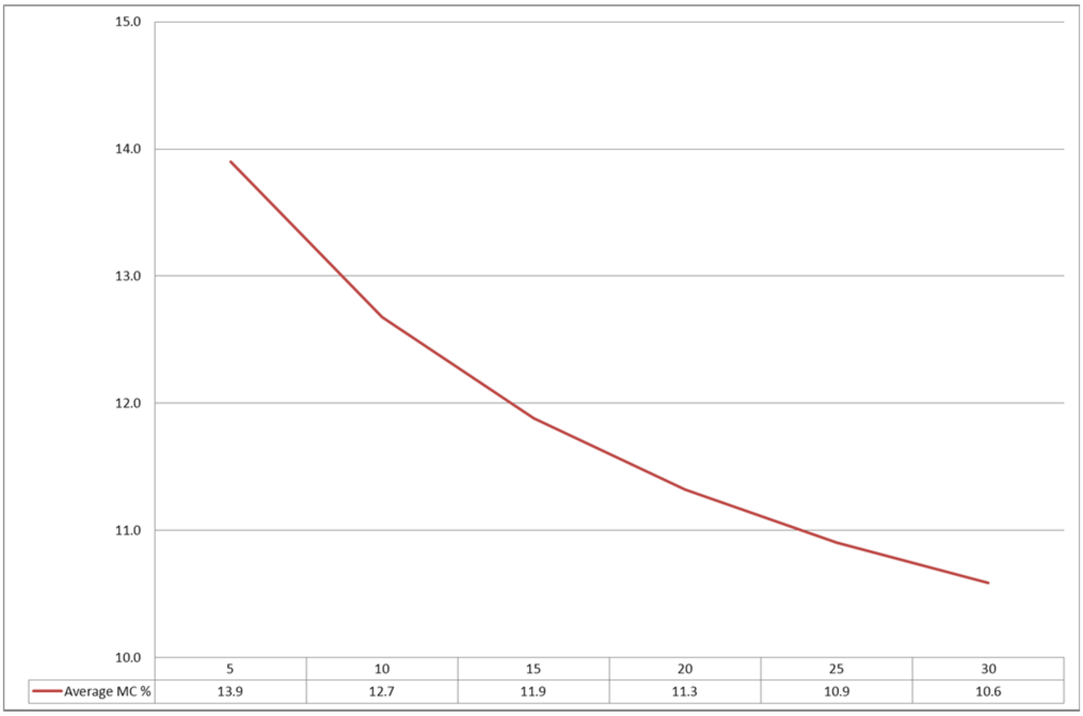
Following this, the depth of each layer to be handled in each year and the resulting annual average moisture content were calculated according to the assumptions above. The results are shown in Figure 4-3.

**Figure 4-2 Moisture Content Depth**



# 4 Technical Description of Key Model Refinements

**Figure 4-3 Calculated Moisture Content by Year of Operation**




A summary of the overburden moisture contents applied in the model refinements is shown in Table 4-1 and Table 4-2.

**Table 4-1 Overburden moisture contents applied in Model Refinements**

| Layer | Year | | | | | |
|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 |
| Tertiary/Weathered Material (m) (moisture content 16.8%) | 50 | 50 | 50 | 50 | 50 | 50 |
| Bandanna/Sandstone (m) (moisture content 8.1%) | 25 | 45 | 65 | 85 | 105 | 125 |
| **Weighted Average Moisture Content (%)** | **13.9** | **12.7** | **11.9** | **11.3** | **10.9** | **10.6** |

**Table 4-2 ROM and product coal moisture contents applied in the studies**

| Coal | Moisture Content (%)# | |
|---|---|---|
| | SEIS (air dried basis) | Refined Model* (as received basis) |
| Coal – in-situ | 5 | 14 |
| Coal – ROM | 6.9 | 14 |
| Coal – product | 6.9 | 17.3 |
| Miscellaneous | 6.9 | 14 |

* From non-centrifugal moisture testing by CSIRO (product) and ACARP study on in-situ moisture (ROM) (Hancock Coal Pty Ltd (2010)).

# Moisture content in the EIS and SEIS was assumed to be on the highly conservative air dried basis. Information provided to URS has confirmed that the more realistic as received basis figures should be used for coal handling at the mine.

A sensitivity analysis of the generation of dust to variations in the moisture contents shown in Table 4-2 is reported in Section 4.4.

## 4.2 Adoption of New Dust Mitigation Methods

### 4.2.1 US EPA AP42 Emission Factors

For Front End Loading (FEL) of trucks, under the National Pollutant Inventory (NPI) no effective mitigation is listed and so a control factor cannot be applied on this basis. However, the default NPI emission factor makes no allowance for moisture content and is based on research studies in the Hunter Valley, where the moisture content of overburden is significantly lower than found in this study. The NPI Emissions Estimation Technique Manual (EETM) for Mining notes at section 1.1.1 that a moisture content of 1% would be plausible for the Hunter Valley. The US EPA AP42 (Section 13.2.4-3)[10] emission factor equation for FEL of Trucks suggests that increasing moisture content by a factor of two results in a reduction in $PM_{10}$ emissions of more than 60%. Although the calculated AP42 emission factor is considered in the NPI Manual to be unrealistically low for Australian (Hunter Valley) conditions, it is reasonable to assume that the very high moisture content of overburden at the Alpha Coal Mine would significantly reduce particulate emissions from this source. This principle has been applied to the mitigation of emissions from truck dumping of overburden.

### 4.2.2 Dragline drop height

The drag-line drop heights have been reduced from 15 m to 6 m in the emissions inventory, which is a more realistic approach to the representation of emissions from this source based on proposed mining techniques. A sensitivity analysis of the generation of dust to variations in dragline drop height is reported in Section 4.4.

### 4.2.3 CHPP activities moisture contents

The emissions inventory has been reduced for all activities beyond the CHPP as the material will be in the form of a ‘slurry’ with a moisture content in excess of the 15.7% threshold for dust generation described in the Hancock Prospecting Pty Ltd ‘Dustiness Moisture Relationship Report’ (ACIRL, 2010). No significant dust emissions are, therefore, predicted from these sources. These mitigation controls are summarised in Table 4-6.

## 4.3 Adjustments to SEIS Model

### 4.3.1 Reduction in Overburden Haulage

A review of the emissions inventory identified an over-estimation of overburden haulage emissions. In the Refined Model, these emissions have been reduced by making the following adjustments to the emissions inventory:

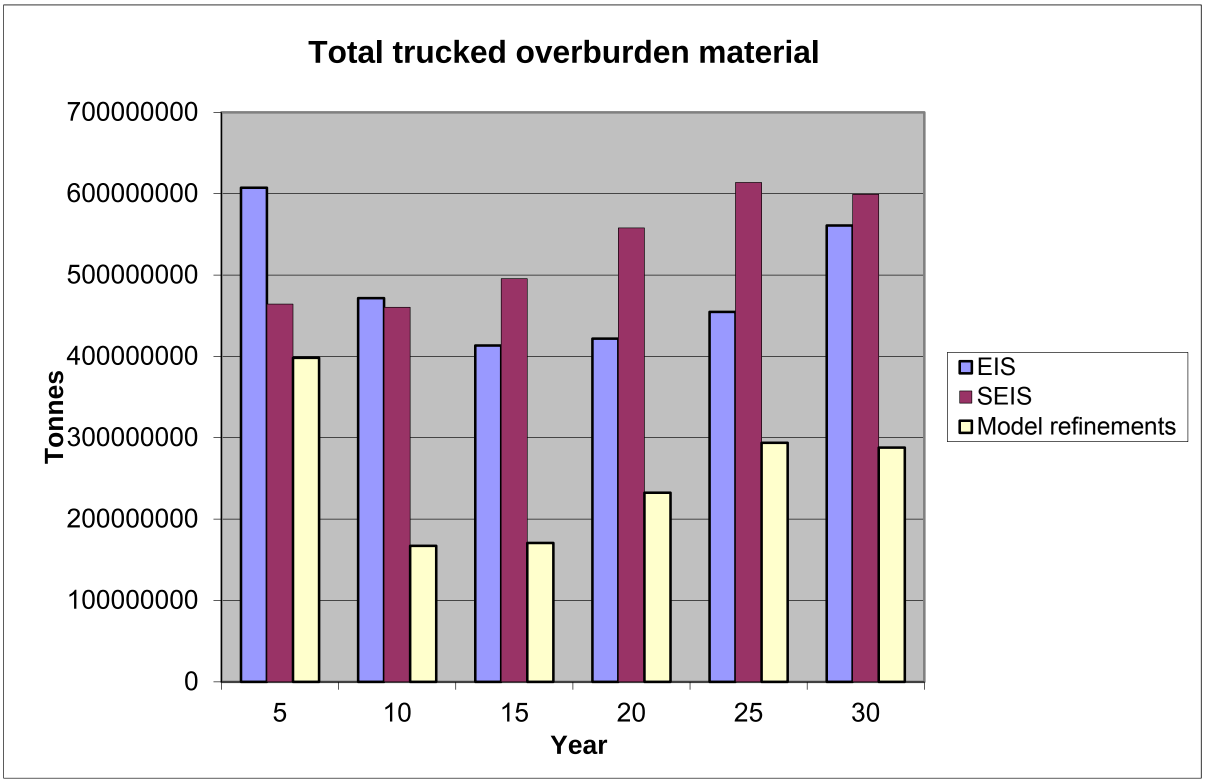
- Reducing the overburden material transported by haul road as a result of the introduction of In-Pit Crushing and Conveying (IPCC); and

[10] http://www.epa.gov/ttnchie1/ap42/

- Reducing the overburden material transported by haul road to account for the overburden material removed by dragline. This was double counted in the SEIS inventory.

Figure 4-4 shows a comparison of the total trucked overburden waste between in the EIS, SEIS and model refinement inventories. The table shows that in the Refined Model, the amount of overburden material removed by road is reduced in all modelled years. In years 10, 15, 20, 25 and 30 this reduction is by approximately 50% in comparison to the SEIS inventory.

**Figure 4-4 Update to total trucked overburden material**




The impact of this reduction to trucked overburden material is shown in Tables 3-6 and 3-7.

## 4.4 Technical Description of Sensitivity Analyses

The DERM advice and draft recommended conditions letter provided in relation to the SEIS[11], and to the independent peer review comments received from AED[12] both recommend that the worst case conditions for the handling of material via dragline, and for overburden and product moisture content be considered with respect to emissions of particulate matter. As such, a sensitivity analysis was undertaken comparing the total $PM_{10}$ generation in years 5 and 30 of mining activities, for the following two scenarios:

[11] Page 6 of letter dated 20 December 2011 / Ref. CTS 2202/11.
[12] Comment no. 2 of the '*Memorandum: Peer Review of Alpha Coal Project SEIS Air Quality Re-Modelling*', dated 20 November 2011.

- **Modelled conditions** - Dragline drop height of 6m (in accordance with proposed mining technique), weighted average overburden moisture content, and ROM / product coal moisture as determined from the respective ACARP and CSIRO research.
- **Worst case conditions** – Dragline drop height of 15m (maximum possible drop height commensurate to proposed technique), worst case moisture content conditions of overburden material and ROM / product coal.

### 4.4.1 Dragline drop height

The sensitivity of predicted $PM_{10}$ generation to a change in dragline drop height from 6 m (modelled) to 15 m (worst case) for year 5 and year 30 is presented in Table 4-3.

**Table 4-3 Sensitivity of $PM_{10}$ generation to dragline drop height**

| Year | Source | $PM_{10}$ generation (kg) at dragline height (m) | | % difference |
|---|---|---|---|---|
| | | 6 m | 15 m | |
| 5 | Dragline | 117,126 | 222,438 | +90% |
| | **Total inventory** | **4,462,188** | **4,567,501** | **+2%** |
| 30 | Dragline | 364,283 | 691,827 | +90% |
| | **Total inventory** | **3,966,958** | **4,294,502** | **+8%** |

A 90% increase in $PM_{10}$ generation from the dragline source would be predicted for an increase in drop height from 6 m to 15 m, for both assessment years. With respect to the total $PM_{10}$ generation from all sources, this would represent a relatively small increase of 2% and 8% in years 5 and 30 respectively. These figures assume that the dragline drop height would be maintained at 15 m for the entire year of operation, which would be considered unrealistic given HCPL proposed operational procedures relating to drop heights as follows:

"*All draglines will be uncovering coal using the standard "extended bridge" method, which requires the dragline to extend its dumping reach by building a "bridge" towards the spoil side. Most of this bridge material comes from the key cut near the high-wall. The key material will not be hoisted any higher than is required to clear the previously dumped area at the bridge end. Once the bridge is finished, the dragline will move on to the bridge and proceed to dig the remainder of the block and dump it to the final spoil pile. No high hoisting will be undertaken in order to reduce the hoisting time.*

*Hoisting material up is costly and time consuming, hence all efficient dragline operations try to minimise over-hoisting. This ensures that dragline drop heights are as low as possible. HCPL will operate its draglines so that the drop height does not exceed 6 m in order to minimise cycle time and maximise dragline production.*"[13]

In the event that the drop height is increased above 6 m, it would be reasonable to expect that it would not be maintained at an excess height for extended periods throughout an operational year. In this case, a total inventory increase in $PM_{10}$ of well below 2% (year 5) and 8% (year 30) would be anticipated. As such, no variation to the existing conclusions for $PM_{10}$ emissions from mining activities is considered necessary, with respect to the dragline source.

[13] E-mail correspondence from Hancock Coal Pty Ltd (10 February 2012) confirming dragline operational procedures – received from Min Planning & Technical General Manager (Martti Kankkunen)

### 4.4.2 Overburden moisture content

The sensitivity of predicted $PM_{10}$ generation to a change in overburden moisture content from 13.9% (modelled) to 8.1% (worst case) for year 5 and year 30 are demonstrated in Table 4-4.

**Table 4-4 Sensitivity of $PM_{10}$ generation to overburden moisture content**

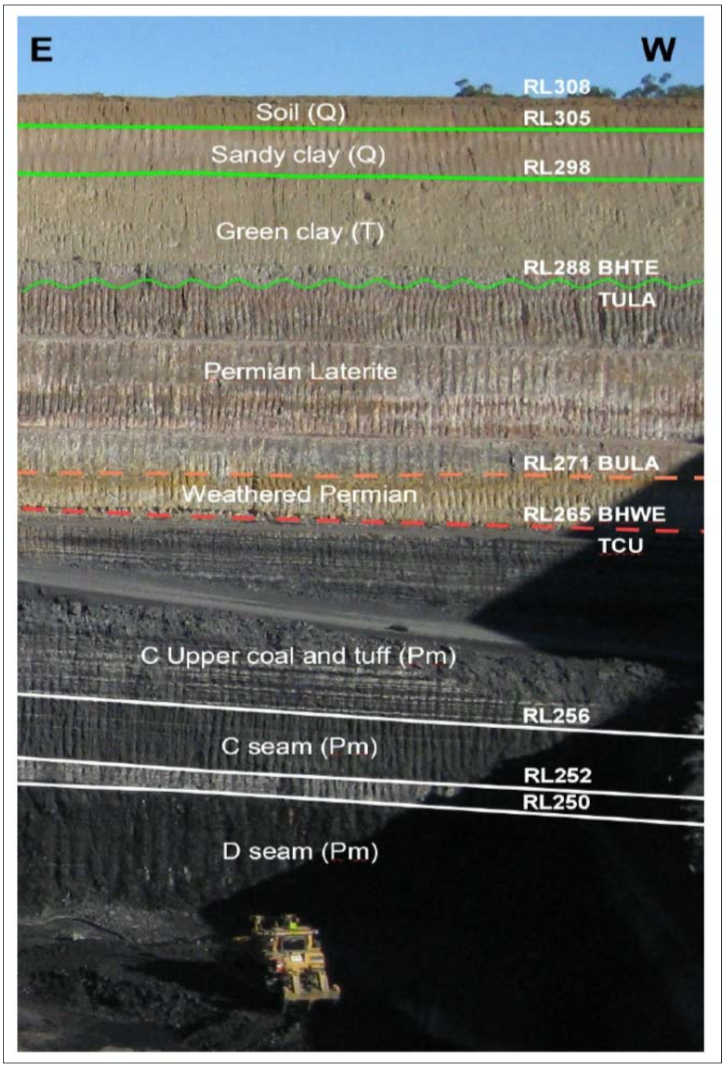
| Year | Source | $PM_{10}$ generation (kg) at moisture content (%) | | % difference |
|---|---|---|---|---|
| | | 13.9% (yr 5) 10.6% (yr 30) | 8.1% | |
| 5 | Dragline | 117,126 | 137,724 | +17% |
| | FEL of Overburden into Trucks | 8,179 | 17,420 | +112% |
| | **Total inventory** | **4,462,188** | **4,565,318** | **+2%** |
| 30 | Dragline | 364,283 | 394,898 | +8% |
| | FEL of Overburden into Trucks | 12,155 | 17,712 | +46% |
| | Dozers | 57,582 | 83,914 | +46% |
| | **Total inventory** | **3,966,958** | **4,029,463** | **+2%** |

An increase in $PM_{10}$ generation would be predicted from all relevant sources with a lower overburden moisture content. In year 5, the use of the dragline and FEL would be expected to increase $PM_{10}$ generation by 17% and 11%, respectively, for a lower moisture content (8.1%). In year 30, a lower moisture content is predicted to result in an 8% (dragline) and 46% (FEL) increase, with the use of dozers incurring a 46% increase. However, a reduction in overburden moisture is predicted to result in a relatively low increase in total $PM_{10}$ generation, with a 2% increase in both year 5 and year 30.

The moisture content data contained within the BFS analysis (see Table 4-2) were found to be consistent with the observed moisture content from the test pit. In addition, the near surface layer of sandy clay within the Tertiary weathered strata (see Figure 4-5) is prevalent throughout the site, which acts as an aquiclude preventing the transmission of water. As such, low seasonal variation in moisture content below this upper layer would be expected. A geological cross section is presented in Figure 4-6, which spans a distance of approximately 14 km, demonstrates that there is little spatial variation in the depth of the Tertiary weathered material above the Permian strata. Therefore, it would be reasonably expected that the moisture content would not vary significantly both spatially and temporally. This supports the weighted average moisture content approach used within the Refined Model assessment, providing the most appropriate representation of moisture content for each layer being removed, for each respective mining year. Notwithstanding, the use of a worst case moisture content (8.1%), which represents the lowest Bandanna sandstone formation moisture content, results in a predicted 2% increase in total $PM_{10}$ generation over the respective mining year. It considered that such an increase would not alter the conclusions of the assessment.

# 4 Technical Description of Key Model Refinements

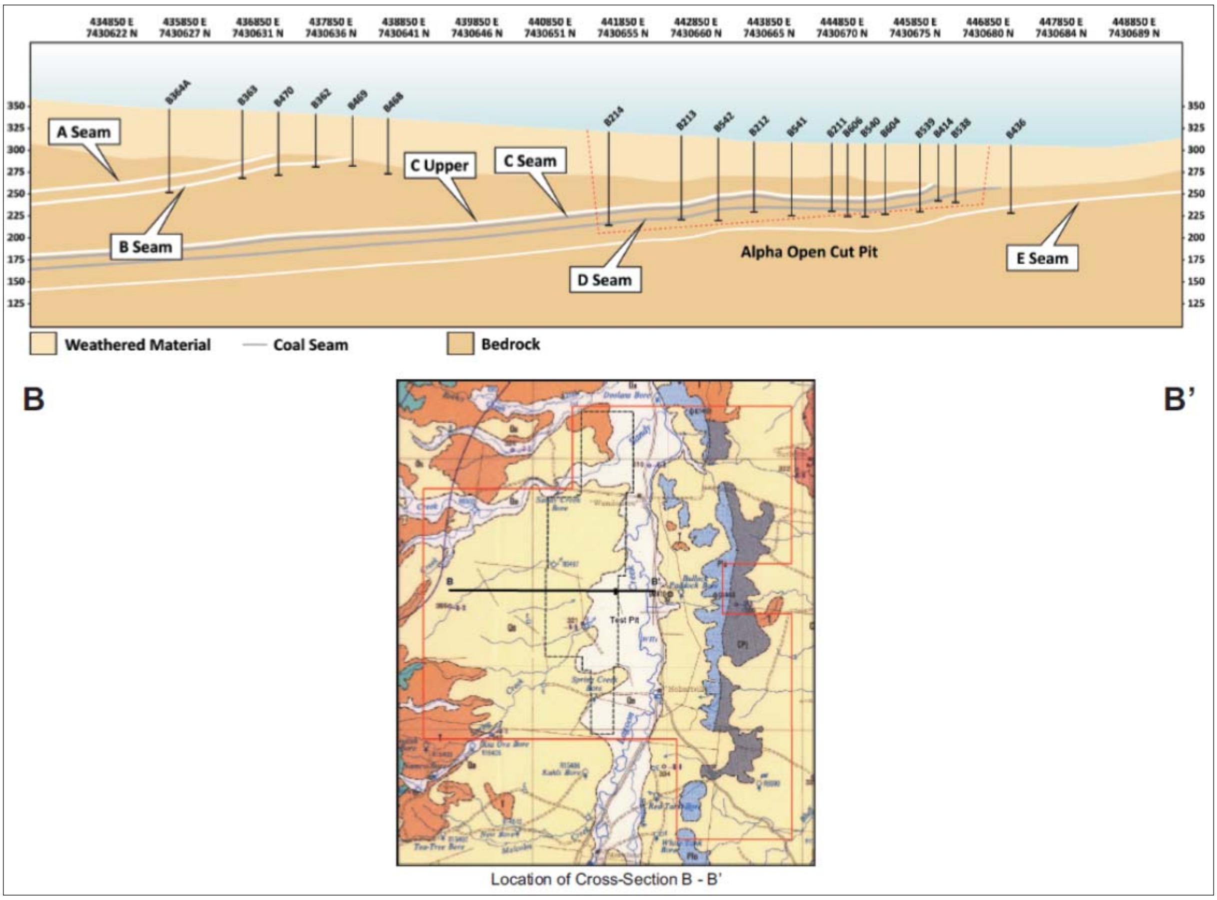
**Figure 4-5 - Annotated photograph depicting main geological units within Alpha test pit[14]**




[14] Hancock Prospecting Pty Ltd (February 2012) '*Summary of Groundwater level Data: Alpha Test Pit*' (Draft); JBT Consulting

# 4 Technical Description of Key Model Refinements

**Figure 4-6 - Geological cross-section[15]**




### 4.4.3 Product moisture content

The sensitivity of predicted $PM_{10}$ generation to the change in product moisture content for year 5 and year 30 are presented in Table 4-5.

**Table 4-5 Sensitivity of $PM_{10}$ generation to product moisture content**

| Year | Source | $PM_{10}$ generation (kg) at moisture content (%) | | % difference |
|---|---|---|---|---|
| | | In-situ coal moisture 14%, ROM coal moisture 14%, product coal moisture 17.3% | In-situ coal moisture 5.9%, ROM coal moisture 6.9%, product coal moisture 6.9% | |
| 5 | FEL of Coal Trucks | 124,006 | 283,609 | +128% |
| | FEL of ROM | 24,801 | 56,721 | +128% |
| | FEL at CPP | 7,440 | 17,016 | +128% |
| | Dozer hours - Coal at CPP | 103 | 373 | +262% |
| | **Total inventory** | **4,462,188** | **4,677,072** | **+5%** |
| 30 | FEL of Coal Truck | 135,236 | 309,293 | +128% |
| | FEL of ROM | 27,047 | 61,858 | +128% |

[15] Hancock prospecting Pty Ltd (October 2010) '*Alpha Coal project Environmental Impact Statement*' – Figure 4-3.

## 4 Technical Description of Key Model Refinements

| Year | Source | $PM_{10}$ generation (kg) at moisture content (%) | | % difference |
|---|---|---|---|---|
| | | **In-situ coal moisture 14%, ROM coal moisture 14%, product coal moisture 17.3%** | **In-situ coal moisture 5.9%, ROM coal moisture 6.9%, product coal moisture 6.9%** | |
| | Dozer hours - Coal at ROM | 5,464 | 19,787 | +262% |
| | FEL at CPP | 8,114 | 18,557 | +128% |
| | Dozer hours – Coal at CPP | 109 | 395 | +262% |
| | **Total inventory** | **3,966,958** | **4,200,880** | **+6%** |

The lower moisture contents are representative of the air dried figures used within the SEIS, which are considered conservative values and thus represent worst case moisture conditions. The Refined Model moisture contents provide 'as received' figures based on CSIRO testing (product) and ACARP study (ROM), considered to provide a more realistic representation of the coal moisture content at source. The 'as received' values and air dried values correspond to those presented in Figure 5.6.3_1 of the '*Resource Estimate & Geological Report*' undertaken by Salva Resources (May 2010). Furthermore, the laboratory analyses used in classifying these moisture content values were undertaken in accordance with the JORC Code (2004). This ensures that consistency is maintained through all coal testing procedures.

It is evident from Table 4-5 that sources of $PM_{10}$ specific to the handling of product coal would be predicted to generate relatively more $PM_{10}$ in both year 5 and year 30, given a lower moisture content. The total $PM_{10}$ generated from all activities is predicted to be higher by 5% (year 5) and 6% (year 30), respectively using the highly conservative moisture contents from the EIS and SEIS. The sampling data indicates that it is unlikely that such additional dust will be generated. As such, no variation to the conclusions of the assessment is considered necessary.

### 4.4.4 Discussion

The sensitivity analysis has demonstrated that the worst case conditions relating to the moisture content of overburden material and product coal, in addition to material handling by the dragline drop height, would not reasonably be expected to alter the conclusions of the air quality assessment.

In year 5 of mining operations, the worst case annual $PM_{10}$ generation for dragline drop height, overburden moisture content, and product coal moisture content represent 5%, 3%, and 8%, respectively, of the total $PM_{10}$ generation inventory. The year 30 equivalent figures are 16% (dragline), 12% (overburden moisture), and 10% (product moisture). The contribution to the year 5 total inventory from road haul generated dust is between 62-64%, and for year 30 it is 56-59%. This demonstrates that the emission sources which depend on moisture data and relate to dragline drop heights are relatively small in comparison to emissions from road haulage. This reinforces the statement provided by the independent peer review that "…*I do not anticipate that the outcomes of a more detailed investigation of the sensitivity of the results to the overburden percentage moisture content will significantly alter the learning's of the assessment…*"

It is demonstrated that the site specific moisture data for overburden material, used within the Refined Model assessment, is commensurate to the spatial extent of the site and would not be expected to significantly fluctuate temporally or spatially. Similarly, the 'as received' moisture content of the product coal is considered reliable given that the coal testing was undertaken in accordance with the JORC code guidelines, thereby reducing the level of uncertainty. The 'as received' moisture content of the product coal is considered most likely to represent the source conditions, with use of air dried moisture content values considered overly conservative.

The HCPL operational procedures relating to the dragline state that a drop height of 6 m would not be exceeded in order to minimise cycle time and maximise dragline production. Therefore, the results of a worst case 15 m drop height assessment are considered to be overly conservative for the assessment of $PM_{10}$ generation from this activity.

In conclusion, whilst the Refined Model approach is considered appropriate and as robust as possible for the assessment of $PM_{10}$ generation from mining activities, it is considered that the application of the worst case input data would not significantly alter the assessment findings.

## 4.5 Model Refinements Overview

Table 4-6 is a summary of the refinements made to the SEIS atmospheric dispersion model and new mitigation controls. In all instances, the mitigation applied is new mitigation i.e. additional controls to the level 2 watering applied to sources of wheel generated dust in the SEIS.

**Table 4-6 Model Refinements Summary**

| Refinement Reason | Source Group | Sources Impacted | Model Refinement | Notes and justification |
|---|---|---|---|---|
| **New data** | Overburden and In-Pit | FEL of coal trucks<br>Dozers | Increase to product and overburden moisture contents based on information from BFS and test pit borehole sampling | • Coal moisture contents available from BFS Design Criteria.<br>• New overburden moisture content data from test pit sampling.<br>• A single average for overburden moisture for the whole profile is applied unique to each year, depending on the proportion of material in each layer. |
| | ROM Activities | Truck dumping at ROM<br>FEL at ROM<br>Dozer hours (coal at ROM) | | |
| | CHPP Activities | FEL at CHPP<br>Dozer hours (coal at CHPP)<br>CHPP conveyor transfer points | | |
| **New mitigation** | Overburden & In Pit | Drilling | 99% control applied to total emission and 70% to the remainder | • Drills to be fitted with hydraulic dust control curtains, water sprays (70% control) and dust cyclones (99% control). |
| | | • Dragline | • Changed drop height from 15m to 6m | • 6 m is considered a more realistic estimate of drop height |
| | | • FEL of | • 50% control | • No specific controls are proposed in |

## 4 Technical Description of Key Model Refinements

| Refinement Reason | Source Group | Sources Impacted | Model Refinement | Notes and justification |
|---|---|---|---|---|
| | | overburden into trucks | for $PM_{10}$ | Table 4 of the NPI EETM for mining for FEL of overburden into trucks. However, the USEPA AP42 (Section 13.2.4-3) emission factor takes account of moisture content. Although this emission factor is considered in the NPI Manual to be unrealistically low for Australian conditions, it is reasonable to assume that the very high moisture content of overburden at the Alpha Coal Mine would significantly reduce particulate emissions from this source. Calculations using the USEPA equation indicate that an increase in moisture content by a factor of 2 would be expected to result in a 62% reduction in emissions of $PM_{10}$, so a 50% control factor is applied. |
| | | Truck dumping at overburden dumps | 50% control for $PM_{10}$ | • USEPA AP42 uses the same equation as for truck loading, therefore, the same rationale as for FEL of overburden into trucks applies.<br>• NPI allows a 70% control for water sprays, confirming the relevance of moisture content for this dust source. |
| | ROM Activities | Truck dumping at ROM | 50% control for $PM_{10}$ | • NPI control factor for water sprays |
| | | Wind erosion from coal stockpiles | 50% control for $PM_{10}$ | • NPI control factor for water sprays |
| | ROM to CHPP Conveyor | Miscellaneous transfer points | 70% control for $PM_{10}$ | • Partial enclosure and moisture will be lower than CPP conveyor |
| | CHPP Activities | CHPP Processing | 98% inventory reduction for $PM_{10}$ | • Coal (-50mm) during processing/washing is mostly in slurry form with a high total moisture content and are therefore almost entirely removed as a source. |
| | | FEL at CPP | 70% inventory reduction for $PM_{10}$ | • FEL activities can generate fines and increase potential for dusting. However, this activity is low volume with total moistures > 17%. |
| | | Dozer hours-coal at CPP | 98% inventory reduction for $PM_{10}$ | • Dozing operations are less likely to generate as many fines as FEL and is also low volume with total moistures > 17%. |
| | | Loading stockpiles | 98% inventory reduction for $PM_{10}$ | • Loading stockpiles is by stacking equipment and can generate fines if drop heights are not managed. However, the material will be wet and dust sprays will be in operation which allowed for 50% control in NPI. |
| | | Unloading from | 98% inventory | • Unloading stockpiles is by bucket |

| Refinement Reason | Source Group | Sources Impacted | Model Refinement | Notes and justification |
|---|---|---|---|---|
| | | stockpiles | reduction for $PM_{10}$ | wheel reclaiming equipment and unlikely to generate many fines. |
| | | CHPP conveyors | 90% inventory reduction for $PM_{10}$ | • Conveyors in the CHPP are shorter and wider than in the raw coal area and transfer material with total moistures between 17 and 23%. The material is so wet this amounts to the same using water sprays in the NPI. |
| | | Miscellaneous transfer points | 90% inventory reduction for $PM_{10}$ | • The transfer points in the CHPP are partially enclosed, have dust sprays and transfer material with total moistures between 17 and 23%. The material is so wet this amounts to the same using water sprays in the NPI. |
| | | Wind erosion from stockpiles | 70% inventory reduction for $PM_{10}$ | • Product stockpiles are built for minimum exposure to prevailing winds with low batter angles to minimise wind erosion. |
| **Adjustments to SEIS** | Tailings Dams | Tailings Dams | Area reduced to 10% of SEIS | • Estimated from aerial photography of tailings dams for other projects. |
| | Overburden and In-Pit | Wheel generated dust - transfer of overburden to dumps | Wheel generated dust - transfer of overburden to dumps reduced | • Total overburden waste removed from site by vehicle included all Dragline and Conveyed waste in the SEIS. The VKT are therefore significantly reduced under the model refinements. |

## 4.6 Carbon Emissions from Land Clearance

The National Carbon Accounting System (NCAS) FullCAM tool was used to estimate carbon emissions associated with proposed land clearing at the Alpha Coal Mine. The proposed works would result in a total disturbed ground area of approximately 20,680 hectares (ha).

FullCAM integrates a range of models that simulate carbon cycles spatially to track the greenhouse gas (GHG) emissions and carbon stock changes (i.e. biomass, litter and soil) associated with land use and management. The model generates project-based results on a similar basis to Australia's official recording of greenhouse emissions trends for land use and land use change.

A multilayer, mixed system plot (forest and agriculture) was used, as recommended by the Department of Climate Change and Energy Efficiency (DCCEE) for deforestation modelling. Trees, crop species, and management information are contained on the FullCAM databases. A simple model was set up to measure the carbon mass of plants only, including above ground biomass and roots, from 1915 until mining activities commence in 2015. Based on the vegetation type options defined within FullCAM, tropical eucalyptus open woodlands were selected from the available native forest groups to represent the existing land use at the Project site.

The aim of the assessment was to simulate the growth cycles and maturation of a forest over a 100 year period (1915 – 2015), using a number of input parameters within FullCAM. The output from this simulation was used to represent the amount of carbon released to the atmosphere through the proposed land clearing in 2015. Presented in Table 4-7 is an overview of the FullCAM model input parameters used in this assessment. It must be noted that input parameters not included in the table were set as model default values, in the absence of site-specific data.

**Table 4-7 FullCAM Model Inputs**

| FullCAM input | Parameter | Description | Justification |
|---|---|---|---|
| **Configuration** | Plot | Multilayer mixed (forest and agriculture system) | Land use is mixed according to terrestrial ecology surveys which can be found in the ecology section of the EIS. It is also recommended by DCCEE |
| | Simulate | Carbon | Elemental carbon required to determine $CO_2$-e emission |
| | Tree Production | Tree yield formula | The tree yield formula is the most appropriate growth information to use for this plot |
| **Timing** | Simulation steps | Yearly | Yearly simulation steps were chosen to demonstrate one material movement from one pool to the next pool with each step simulating the same amount of time |
| | Start and End | 1915-2015 | Clearing initially mature vegetation on the site via a fire event at the commencement of the simulation (1915) The vegetation then naturally regenerates and grows over the 100 year period preceding the construction phase of the mine |
| **Data Builder** | Spatial data | 446462 m (E), 7460888 m (N) | UTM location representative of the Project site |
| | Tree Species | Native Groups: Eucalyptus Open Woodland | The dominant woodland found at the Project site |
| **Site** | Maximum Above Ground Biomass | The above ground mass of the trees i.e. stems, branches, bark and leaves | By entering the maximum value of 764 tonnes of dry matter per hectare (tdm/ha) it presumes no impediment in the growth for the site and allows the vegetation to grow from a cleared state throughout the 100 year period |
| **Events** | 1915 – Forest Fire 100% 2015 – Thin Clearing | Each simulation step consists of continuous processes punctuated by any events that occur during that step | Commencing with existing vegetation, then burning and allowing natural regeneration. In combination with default parameters, the plot simulation represented the growth based on the standard growth functions developed by DCCEE |

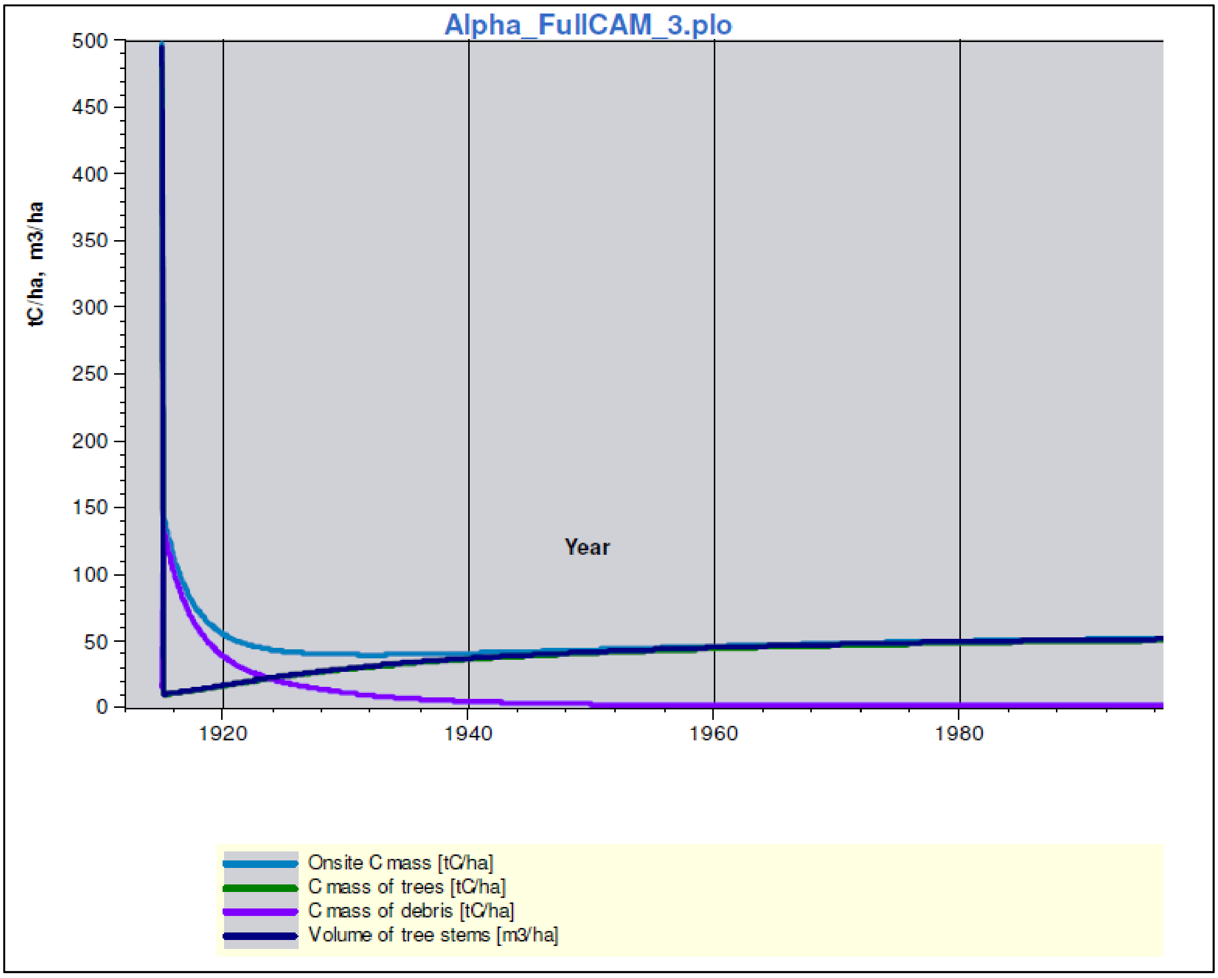
The FullCAM simulation output plot, illustrated in Figure 4-5, presents the 100 year life cycle of the modelled vegetation. It indicates that by removing initially mature vegetation, at the commencement of the model simulation (1915) via a fire event, and allowing the vegetation to regenerate and grow over a 100 year period, it produces an annual net carbon output of 53.7 tC/ha in 2015. This elemental carbon emission factor was then converted to emissions of carbon dioxide equivalent ($CO_2$-e) by multiplying a standard factor[16].

An average emission factor of 197 t$CO_2$-e/ha per annum, obtained by applying the elemental conversion factor to the net carbon output, when multiplied with the amount of land to be cleared (20,860 ha), equates to 4,109,237 t$CO_2$-e released due to land clearing activities.

[16] This factor was determined as the ratio of molecular weights of $CO_2$ (44) and carbon (12).

## 4 Technical Description of Key Model Refinements

**Figure 4-5 FullCAM output simulation plot**




A summary of GHG scope 1[17] and scope 2[18] emissions are outlined below in Table 4-8. This includes the annual average emissions for the project and the total $CO_2$-e emissions over the 30-year project life (refer to Appendix Q of the SEIS). In terms of land clearing activities, the emission presented is representative of the $CO_2$-e over the life of the mine, as land clearing will be considered a one-time event occurring during the construction phase of the project.

[17] **Scope 1** – Emissions derived from the National Greenhouse Account methodology as published in the National Inventory report (DCCEE, 2010a). Emissions from mining activities are estimated for a particular location of the mine by multiplying a physical quantity of ROM coal extracted by an emission factor.

18 **Scope 2 - E**stimation of a total stock of gas available for release as emissions from the mine extraction area. This is determined by sampling the gas content of coal and non-coal strata layers in the area, adjusted for past quantities of gas captured for combustion, flared or transferred off-site.

## 4 Technical Description of Key Model Refinements

**Table 4-8 $CO_2$-e emissions summary**

| Scope | Source | Minimum Emissions (t $CO_2$-e / yr) | Maximum Emissions (t $CO_2$-e / yr) | Average Emissions (t $CO_2$-e / yr) | Life of Mine Emissions (t $CO_2$-e) |
|---|---|---|---|---|---|
| 1 | Fugitive Emissions | 1,400 | 20,071 | 10,547 | 337,494 |
| 1 | Diesel Combustion | 40,986 | 368,381 | 201,533 | 6,449,066 |
| 1 | Diesel- Explosives | 24 | 7,504 | 4,384 | 140,296 |
| 1 | Land Clearance | --- | --- | 136,975 | 4,109,237 |
| | **Annual Scope 1** | **42,410** | **395,956** | **353,439** | **11,036,093** |
| 2 | Purchased Electricity | 128,880 | 751,824 | 549,448 | 17,582,321 |
| | **Annual Scope 1 and 2** | **171,290** | **1,147,780** | **932,887** | **28,618,414** |

--- one-off emission calculated for land clearance, therefore a maximum and minimum not calculated. Average based on 30-year life of mine.

A comparison of total land clearance emissions from the mine against total project GHG emissions in Australia and Queensland was undertaken. Australia's net GHG emissions across all sectors totalled 565 million tonnes (Mt) $CO_2$-e in 2009, with the energy sector (including mining) emitting 417 Mt $CO_2$-e. Table 4-9 presents annual average land clearance emissions, based on a 30 year life of mine, as a percentage of annual Australian total and mining sector emissions. The table also presents land clearance emissions of the mine as a percentage of the Queensland total (155 Mt) and the Queensland energy sector (97 Mt) 2009 annual emissions. These values were sourced from the National Greenhouse Gas Inventory 2009 and the State and Territory Greenhouse Gas Inventories 2009 (DCCEE, 2011).

**Table 4-9 Comparison of annual average land clearance emissions with Australia and Queensland State annual greenhouse gas emissions (2009)**

| Source | Percentage of Australian Mining Sector | Percentage of Australian Total | Percentage of Queensland Mining Sector Total | Percentage of Queensland Total |
|---|---|---|---|---|
| Land Clearance | 0.03 | 0.02 | 0.14 | 0.09 |

When viewed in both an Australian and Queensland context, the land clearing emissions from the Project represent relatively small contributions to the national and state inventories. Annual averaged land clearance emissions represent less than 0.1% of the national GHG inventory, and represent less than 0.2% of the Queensland inventory. The Queensland Government has proposed to reduce GHG emissions by 60% by 2050 based on 2000 levels, in accordance with the national target. This equates to a reduction of approximately 98 Mt $CO_2$-e. HCPL have developed a strategy for off-setting carbon emissions through commitments to revegetation during the life of the project which are outlined in the Project's EM Plan.

The values generated from this modelling approach should be regarded as conservative. It is recommended that these be used as an indicative guide and that field surveys be completed and samples collected during later stages to more accurately quantify the biomass and carbon content of the site.

## 4.7 Wind Erosion from Exposed Areas

Peer review identified wind erosion from exposed areas as a potential emission source which had not been included in the inventory, and therefore, the cause of a potential underestimation of peak concentration events under worst case meteorology (comment 3 of Appendix A and comment 3 of Appendix C).

This source of emission was not included in the inventory on the rationale that once exposed areas have been disturbed, the loose particulate material will be removed after the first elevated wind event meaning exposed areas are no longer sources of dust. The NPI emission factor for wind erosion from stockpiles is designed for emission sources that are constantly disturbed which is not the case for exposed areas. To make this material available as a source to all high wind events during the year would therefore be overly conservative. It is not possible to demonstrate the contribution that wind erosion from exposed areas has to peak events during the course of the year, because this source was not included in the dispersion model. However, to demonstrate the significance of wind erosion from other sources to peak events, the model information pertaining to the meteorological conditions on the highest ten of the 142 (receptor 8) and 90 (receptor 9) predicted exceedences of the 24-hour $PM_{10}$ objective were extracted from CALMET for year 5. This is consistent with the recommendation of the peer reviewer in comment 3 of Appendix C.

In Section C.2.2 of the SEIS, the emission factor for the determination of the critical wind speed at which wind erosion will occur is described as:

$$u_0 = 5.4\ln(\frac{10 - z_0}{z - z_0})$$

where:

$u_0$ is a wind speed threshold velocity;
z is the root mean square height of a stockpile (m); and
$z_0$ is the surface roughness (0.05 m)

The wind speed threshold velocity $u_0$, which is the wind speed at which dust is raised by the wind, is calculated based on a critical wind speed of 5.4 m/s at the root mean square height of the source, corrected to 10 m based on a logarithmic wind speed profile. The 10 m equivalent critical wind speeds at which wind erosion from the modelled sources product stockpiles, tailings dams and exposed areas will occur is 5.4 m/s and from ROM stockpiles 5.07 m/s.

The frequency of hours and the wind direction range for which these wind speed thresholds are met for the top ten exceedence days are shown in Tables 4-10 for receptor 8 and Table 4-11 for receptor 9.

# 4 Technical Description of Key Model Refinements

**Table 4-10 Meteorological data prevalent for the ten highest exceedence days at receptor 8**

| Julian exceedence day | Concentration (µg/m$^3$) | Hours with wind speeds > 5.07 m/s | Hours with wind speeds > 5.4 m/s | Daily wind direction range (degrees) |
|---|---|---|---|---|
| 256 | 204.4 | 0 | 0 | 27-49 |
| 257 | 199.3 | 0 | 0 | 12-64 |
| 22 | 197.1 | 0 | 0 | 14-70 |
| 23 | 172.8 | 0 | 0 | 9-47 |
| 40 | 171.2 | 0 | 0 | 25-63 |
| 202 | 170.7 | 0 | 0 | 5-43 |
| 62 | 166.0 | 0 | 0 | 10-65 |
| 258 | 165.2 | 0 | 0 | 6-90 |
| 222 | 161.0 | 0 | 0 | 17-32 |
| 260 | 158.9 | 0 | 0 | 10-37 |

**Table 4-11 Meteorological data prevalent for the ten highest exceedence days at receptor 9**

| Julian exceedence day | Concentration (µg/m$^3$) | Hours with wind speeds > 5.07 m/s | Hours with wind speeds > 5.4 m/s | Daily wind direction range (degrees) |
|---|---|---|---|---|
| 235 | 322.8 | 0 | 0 | 2-18 |
| 263 | 295.8 | 0 | 0 | 359-36 |
| 182 | 281.1 | 0 | 0 | 291-25 |
| 233 | 273.3 | 0 | 0 | 353-12 |
| 262 | 258.9 | 0 | 0 | 356-36 |
| 236 | 257.6 | 0 | 0 | 3-16 |
| 224 | 253.7 | 0 | 0 | 292-17 |
| 264 | 243.9 | 0 | 0 | 3-25 |
| 41 | 234.1 | 0 | 0 | 353-18 |
| 241 | 228.6 | 0 | 0 | 354-14 |

Tables 4-10 and 4-11 show that neither the 5.07 m/s or 5.4 m/s thresholds for wind erosion were met for any hour during the top ten exceedence days at receptors 8 and 9. Therefore, wind erosion from the sources in the model did not contribute to any the top ten peak events at each receptor. As expected, when these exceedences are predicted, the wind is predominantly blowing in the direction of receptors 8 and 9 from the site. This shows that when peak concentrations are predicted the wind blows in the direction of the site but not under elevated wind speed conditions. Therefore, the worst case meteorology for the generation of dust emissions from the mine is based on wind direction and wind speeds less than approximately 5 m/s, which would not result in dust emissions from exposed areas.

It should be noted that in both the peer review of the technical modelling and the Addendum report, AED were in *'general agreement with the revised [modelling] methodology particularly with respect to the majority of the additional controls that have been adopted.'* Furthermore, in its review of a draft of this report shown in Appendix C, AED commented that '*It is natural that industry specialists will have differing opinions as to some aspects of the application of the technical work'* and that *'Issues that were raised by AED were noted for consideration and not expressed as fatal flaws of the assessment undertaken by URS.'* HGPL is therefore of the opinion that the exclusion of wind erosion from exposed areas is unlikely to significantly impact peak concentration predictions and that all modelling and reporting work is robust and consistent with standards for the industry.

# 5 Summary and Conclusions

URS has completed a reassessment of particulate emissions from the Alpha Coal Project (Mine). The refinements made to the SEIS air quality assessment in this study consist of the incorporation of new datasets to the emissions inventory, introduction of new dust source mitigation controls and the update of the inventory to remove double counting of key inventory sources.

For 24-hour average $PM_{10}$, the study has shown that in Year 5, both the SEIS and model refinement 50 $\mu g.m^{-3}$ contours extend outside MLA70426. It has been shown that in the SEIS, exceedences were predicted at all sensitive receptors. The Refined Model shows that although the number of exceedence days is reduced, exceedences are still predicted at the Forrester, Kia Ora and Glenn Innes Homesteads for the life of the mine. If the EPP (Air) objective exceedence allowance of 5 days is considered, it is predicted that exceedences will be removed from most other receptors almost entirely for the life of the mine.

The 24-hour and annual average $PM_{2.5}$ footprints are reduced in all directions in the Refined Model. No exceedences of the EPP (Air) objectives are predicted and therefore no mitigation on the grounds of exceedence of either $PM_{2.5}$ EPP (Air) objective is required.

It is the responsibility of HCPL to take all reasonably practicable actions to ensure that the EPP (Air) guidelines are met at sensitive receptor locations. The mitigation actions required to control dust emissions will be implemented through the Environmental Management Plan (EM Plan) which HCPL will develop and submit to DERM for approval prior to receiving consent to commence mining operations. The EM Plan is supplemented by a series of internal, non-statutory operational procedures which HCPL will follow to meet the commitments made in the EM Plan. Such operational procedures will be followed where practicable and have been developed in consideration of best practice for the coal mining industry.

The Project will be subject to Environmental Authority conditions imposed by DERM as the administering authority under the Environmental Protection Act 1994. These conditions are actions which HCPL must take to be able to operate the Project. These conditions are legally binding commitments which will be negotiated and accepted by HCPL prior to commencement of the Project.

# 6 References

Hancock Coal Pty Ltd (2010). Alpha Coal Project. BFS Design Criteria. Coal Handling and Preparation Plant. HC-TSV-30000-RPT-00001_C

ACIRL (2010). Report: Dustiness Moisture Relationship Determination – Hancock Resources Pty Ltd. 2000-9307.

# 7 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Hancock Coal Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 14th October 2011 (42626880-VAR-001).

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between the 2nd November 2011 and 24th May 2012 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

A

# Appendix A AED Peer Review Comments (modelling)

# Advanced Environmental Dynamics

## Specialist Consultants

## Memorandum

**To:** Rob Storrs (URS)

**From:** Darlene Heuff

**Date:** 20 November 2011

**Subject:** Peer Review of Alpha Coal Project SEIS Air Quality Re-Modelling

At the request of Hancock Coal, I have conducted a review of the remodelling of the impacts of dust emissions associated with the Alpha Coal Project which was undertaken by URS in support of the Alpha Cola Project supplementary EIS and have prepared this memo outlining my findings.

My review focused on an assessment of the methodology with some examination of model input files including dust emission estimations. However, I have not undertaken what I would describe as a detailed technical review of the modelling work. Additionally, I have reviewed the URS Report *Alpha Coal Mine Project Air Quality Assessment – Model Refinements*, dated 17 November 2011.

In summary, the standard and methodology of the assessment is consistent with similar studies undertaken recently for mining projects in Queensland including (but not limited to):

- BHPBilliton Mitsubishi Alliance's Caval Ridge Mine Project.
- Xstrata Coal's Wandoan Coal Project.

Additionally, I am in general agreement with the revised methodology particularly with respect to the majority of the additional controls that have been adopted. However, I do have a number of comments which may warrant consideration:

1. **Comment**: It is likely that the correction to the error in the calculation of overburden transport associated with the SEIS has resulted in a significant reduction of predicted impacts. Revised SEIS results based on this correction have not been presented so it is not possible to quantify the level of reduction in predicted impacts that is associated with the correction and that which is attributable to the refinement in parameter values such as overburden moisture content, dragline drop height, coal moisture content, engineering controls (such as dust curtains on drills, water sprays), etc. This insight would have been informative but is not critical to the interpretation of the results presented.

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2. **Comment:** The revised model has incorporated new site-specific data that has become available since the SEIS. In particular, sampling of the moisture content of overburden (OB) is a significant contribution to the project-specific data set. This data set has been used to identify two key layers of overburden material, namely (URS Table 2-1): tertiary/weathered material (16.8% moisture content) and; Bandanna/Sandstone material (8.2% moisture content). Depending on the scenario modelled (i.e. Year 5, Year 10, through Year 30) a weighted average OB moisture content was developed and applied. This approach is consistent with the methodology that is applied to a number of on-site dust generating activities such as overburden hauling for which annual averages are calculated and then used to predict 24-hour average ground-level concentrations at receptor locations for comparison with regulatory criteria. This notwithstanding however, it is important to acknowledge that emission factors for overburden handling by draglines, front end loaders and dozers are all dependent on the value adopted for the OB percentage moisture. As these activities are associated with a significant portion of the site's overall dust emissions inventory, it is important that consideration is given to potential dust emissions associated with the handling of the Bandanna/sandstone layer over a 24-hour period as it is recognised that the handling of this material (as opposed to the weathered material) is more likely to lead to elevated levels of dust. Either an estimate of the sensitivity of the results to OB moisture content or an estimate of the likelihood of a combination of worst-case meteorology and the handling of material in Bandanna/sandstone layer would assist in quantifying the likelihood that the results presented based on an annual average moisture content has led to conservative results for the 24-hour average ground level impacts at receptor locations. Nonetheless, I do not anticipate that the outcomes of a more detailed investigation of the sensitivity of the results to the OB percentage moisture content will alter significantly the learnings of the assessment, i.e. that impacts at Kia Ora homestead and Monklands homestead will require the implementation of additional mitigation measures under adverse meteorological conditions. Impacts at other receptor locations are likely to remain manageable under the proposed level of dust controls.

3. **Comment:** Although wind erosion associated with disturbed areas (i.e. pre-striping), stockpiles and tailings dams has been included in the assessment, one significant emission source that has not been included is wind erosion from exposed areas. As the footprint of exposed areas is typically on the order of the footprint of the mine itself, this dust emission source can form a significant part of the site-emissions inventory. The omission of this emission source could potentially be demonstrated not to have a significant impact on the results presented if it can be demonstrated that worst-case meteorology is not associated with periods of elevated wind speeds.

4. **Comment:** It is not clear where the revised ROM and product coal moisture contents have been derived from. It is assumed that these have been provided by Hancock Coal. It is noted however that the values presented in Table 2-2 are higher (i.e. the coal is more moist) than expected.

5. **Comment**: It is not clear which activities associated with the CHPP are acting on ROM coal, raw coal and/or product coal and thus we have not been able to assess the appropriateness of the applied controls. However, based on the percentage moisture for coal presented in Table 2-2, significant dust emissions would not be expected in relation to activities associated with the CHPP.

6. **Comment**: It is not clear whether or not a pit retention factor for TSP (50%) and $PM_{10}$ (5%) has been applied which would reduce predicted impacts of dust emissions from the site.

7. **Comment**: If using CALMET derived rainfall in association with wind speed dependent emission factors to estimate wind erosion, the predicted rainfall should be validated against reliable monitoring data in order to ensure that rain is input into the system during the correct times of the year and for durations and volumes consistent with that observed. Else a conservative approach should be adopted that is based on wind speed only and assumes no reduction due to rainfall.

Kindest Regards,

Darlene Heuff.

Director and Principal Scientist
Advanced Environmental Dynamics

# Appendix B URS Response to Peer Review Comments

This Appendix outlines URS's response to the comments provided by Dr. Darlene Heuff of AED Consultants in her role as external peer reviewer of the Alpha Model Refinements re-modelling and technical report. Her comments are provided in memo *'Peer Review of Alpha Coal SEIS Air Quality Re*-Modelling' dated 20th November 2011.

**Table 1 – summary of peer review responses and resultant actions**

| Comment | URS Response |
|---|---|
| 1 | Figure 2-4 which shows the reduction to the overburden material removed by haul road provides an indication of the magnitude of reduction to this source attributable to the double counting of drag-line waste and removal of material by conveyor. |
| 2 | It is agreed that a detailed assessment of the sensitivity of the results to overburden moisture content would not significantly alter the conclusions of the assessment. However, URS is of the opinion that the representation of overburden moisture content should vary on annual basis if test data are available. It is considered overly conservative to apply the lowest overburden moisture content from the driest layer for the year because mining activities are transient and likely to be happening at different depths, including both of the identified layers of the pit at any given time. For this reason, a depth-weighted approach to the derivation of annual average overburden moisture content is considered more likely to realistically represent the 24-hour peak. |
| 3 | Model analysis carried out by URS has shown that wind speed dependant sources do not contribute significantly to peak dust events. This indicates that the worst-case meteorological conditions are not associated with high wind speeds. |
| 4 | Coal moisture parameters are based on non-centrifugal moisture testing by CSIRO for product coal and an additional ACARP study on in-situ moisture for ROM. The % moisture contents reported are adapted from the Hancock Coal CHPP BFS Design Criteria Report. |
| 5 | All mitigation controls applied to CHPP activities have been approved by the Hancock CHPP Operations Advisor. |
| 6 | A pit retention factor has not been applied. It is not expected that a 5% reduction in $PM_{10}$ generation would alter the conclusions of the assessment. |
| 7 | URS agrees that such a validation study would be of interest to investigate whether peak emissions have been incorrectly dampened down. However, subsequent source apportionment studies have shown that wind generated sources form a relatively minor component of peak emissions in comparison to wheel generate sources, dumping or draglines. Such a study is therefore unlikely to change the conclusions of the report at this stage. |

# Appendix C AED Peer Review Comments (scope of the external peer reviewer, modelling and reporting)

## Memorandum

**To:** Rob Storrs (URS)

**From:** Darlene Heuff

**Date:** 22 March 2012

**Subject:** Peer Review of Alpha Coal Project SEIS Air Quality Re-Modelling - Update

At the request of Hancock Coal Pty Ltd (HCPL), I conducted a review of the modelling of the impacts of dust emissions associated with the Alpha Coal Project which was undertaken by URS in support of the Alpha Cola Project supplementary EIS (SEIS).

A memo dated 20 November 2011 (AED, 2011) was prepared outlining my findings of a peer review of the air quality modelling as outlined in URS Report *Alpha Coal Mine Project Air Quality Assessment – Model Refinements*, dated 17 November 2011 (URS, 2011). The AED peer review memo was included as Appendix A to the URS report (URS, 2011) which was submitted to the statutory consultees including the Department of Environment and Resource Management (DERM), Queensland Health and the Office of the Coordinator-General via the Queensland Department of Employment, Economic Development and Innovation (DEEDI). Included as Appendix B to the URS (2011) report is a response to issues raised in the AED (2011) memo.

In response to comments from DERM, Queensland Health and DEEDI, URS has prepared an addendum report: *Alpha Coal Mine Project Air Quality Assessment – Model Refinements (post consultation update)*, dated 20 February 2012 (URS, 2012). The URS (2012) report addendum has been provided to AED for review and comment.

This document updates the status of the issues raised in the AED (2011) memo.

In summary, The AED (2011) peer review memo indicated that the standard and methodology of the post-SEIS air quality model was consistent with similar studies undertaken for recent mining projects in Queensland including (but not limited to):

- BHPBilliton Mitsubishi Alliance's Caval Ridge Mine Project.
- Xstrata Coal's Wandoan Coal Project.

It was further noted (AED, 2011) that I was in general agreement with the revised methodology particularly with respect to the majority of the additional controls that have been adopted.

The AED (2011) memo did raise a number of comments which were noted to be worthy of some consideration. These comments are re-iterated here with an update provided:

1. ***Comment****: It is likely that the correction to the error in the calculation of overburden transport associated with the SEIS has resulted in a significant reduction of predicted impacts. Revised SEIS results based on this correction have not been presented so it is not possible to quantify the level of reduction in predicted impacts that is associated with the correction and that which is attributable to the refinement in parameter values such as overburden moisture content, dragline drop height, coal moisture content, engineering controls (such as dust curtains on drills, water sprays), etc. This insight would have been informative but is not critical to the interpretation of the results presented*.

   **Update**: This comment has been sufficiently addressed by way of the sensitivity analysis presented in Section 4.4 of the URS (2012) report. It is noted however, that the sensitivity analysis would have provided more insight if the sensitivity of the parameters investigated (dragline drop height, overburden moisture etc.) focused on the impact to predicted ground-level concentrations at receptor locations rather than on the variation to the over-all site emissions inventory. The latter approach masks the importance of specific activities on impacts at specific locations as not all activities affect all receptors equally. Nonetheless, it is re-iterated that the conclusions reached regarding the nature and extent of proposed mitigation options is not likely to differ significantly from that already identified through the findings of the URS studies to date.

2. **Comment:** *The revised model has incorporated new site-specific data that has become available since the SEIS. In particular, sampling of the moisture content of overburden (OB) is a significant contribution to the project-specific data set. This data set has been used to identify two key layers of overburden material, namely (URS Table 2-1): tertiary/weathered material (16.8% moisture content) and; Bandanna/Sandstone material (8.2% moisture content). Depending on the scenario modelled (i.e. Year 5, Year 10, through Year 30) a weighted average OB moisture content was developed and applied. This approach is consistent with the methodology that is applied to a number of on-site dust generating activities such as overburden hauling for which annual averages are calculated and then used to predict 24-hour average ground-level concentrations at receptor locations for comparison with regulatory criteria. This notwithstanding however, it is important to acknowledge that emission factors for overburden handling by draglines, front end loaders and dozers are all dependent on the value adopted for the OB percentage moisture. As these activities are associated with a significant portion of the site's overall dust emissions inventory, it is important that consideration is given to potential dust emissions associated with the handling of the Bandanna/sandstone layer over a 24-hour period as it is recognised that the handling of this material (as opposed to the weathered material) is more likely to lead to elevated levels of dust. Either an estimate of the sensitivity of the results to OB moisture content or an estimate of the likelihood of a combination of worst-case meteorology and the handling of material in Bandanna/sandstone layer would assist in quantifying the likelihood that the results presented based on an annual average moisture content has led to conservative results for the 24-hour average ground level impacts at receptor locations. Nonetheless, I do not anticipate that the outcomes of a more detailed investigation of the sensitivity of the results to the OB percentage moisture content will alter*

*significantly the learnings of the assessment, i.e. that impacts at Kia Ora homestead and Monklands homestead will require the implementation of additional mitigation measures under adverse meteorological conditions. Impacts at other receptor locations are likely to remain manageable under the proposed level of dust controls*.

**Update:** This comment has been sufficiently addressed in Table 1 of Appendix B of URS (2011) and Section 4.1.1 of the URS (2012) report which includes a detailed discussion of the methodology that has been applied in relation to the use the percentage moisture of overburden as mining progresses westward.

3. **Comment:** Although wind erosion associated with disturbed areas (i.e. pre-striping), stockpiles and tailings dams has been included in the assessment, one significant emission source that has not been included is wind erosion from exposed areas. As the footprint of exposed areas is typically on the order of the footprint of the mine itself, this dust emission source can form a significant part of the site-emissions inventory. The omission of this emission source could potentially be demonstrated not to have a significant impact on the results presented if it can be demonstrated that worst-case meteorology is not associated with periods of elevated wind speeds.

   Update: To date, this comment has not been sufficiently addressed. The comment included in Table 1 of Appendix B of URS (2011) states:

   *Model analysis carried out by URS has shown that wind speed dependant sources do not contribute significantly to peak dust events. This indicates that the worstcase meteorological conditions are not associated with high wind speeds.*

   This argument presented in Table 1 of Appendix B *URS, 2011) is poorly concluded: since the emissions have been significantly underestimated it is not surprising that they 'do not contribute significantly' however this does not demonstrate the importance (or otherwise) of elevated wind events. To address this issue it would have been more appropriate to extract the model information pertaining to the meteorological conditions on the model-predicted worst-case days and show that these are not associated with elevated wind conditions.

   Nonetheless, it is noted that the findings of the air quality assessment including wind erosion from the overburden dumps and bare areas within the mine site would not differ significantly from that presented in URS (2011) and URS (2012).

4. ***Comment**: It is not clear where the revised ROM and product coal moisture contents have been derived from. It is assumed that these have been provided by Hancock Coal. It is noted however that the values presented in Table 2-2 are higher (i.e. the coal is more moist) than expected.*

   **Update:** This comment has been sufficiently addressed. The source of the information has been provided.

5. **Comment**: It is not clear which activities associated with the CHPP are acting on ROM coal, raw coal and/or product coal and thus we have not been able to assess the appropriateness of

the applied controls. However, based on the percentage moisture for coal presented in Table 2-2, significant dust emissions would not be expected in relation to activities associated with the CHPP.

**Update:** This comment has been sufficiently addressed in Table 1 of Appendix B of the URS (2011) report.

6. **Comment**: It is not clear whether or not a pit retention factor for TSP (50%) and $PM_{10}$ (5%) has been applied which would reduce predicted impacts of dust emissions from the site.

   **Update:** This comment has been sufficiently addressed in Table 1 of Appendix B of the URS (2011) report.

7. **Comment**: If using CALMET derived rainfall in association with wind speed dependent emission factors to estimate wind erosion, the predicted rainfall should be validated against reliable monitoring data in order to ensure that rain is input into the system during the correct times of the year and for durations and volumes consistent with that observed. Else a conservative approach should be adopted that is based on wind speed only and assumes no reduction due to rainfall.

   **Update:** This comment has been sufficiently addressed in Table 1 of Appendix B of the URS (2011) report. However, it is also noted that the URS conclusions regarding the importance of elevated wind events has not been adequately demonstrated (see Issue 3).

Finally, I would like to make the following comments:

- It is natural that industry specialist will have differing opinions as to some aspects of the application of the technical work. In the AED (2011) memo it was summarised that the work undertaken by URS for the Alpha Coal Project was of a similar standard to that used for other recent studies. Issues that were raised by AED were noted for consideration and not expressed as 'fatal flaws' of the assessment undertaken by URS on behalf of HCPL. AED considers differences of opinion in relation to technical matters to be a healthy part of the technical industries strive for continual improvement and continuing growth.

- The data set of overburden moisture content is considered to be a significant addition to the work undertaken for the Alpha Coal Project as such site-specific data is seldom (if ever) available. The data set would have been further complemented by percentage silt analysis of the overburden samples as both percentage moisture and percentage silt are important variables in the emission factor formulas.

- In general, it is AED's opinion that the role of the dispersion modelling is to:

  - Aid in the identification of the relative risk of adverse air quality impacts at receptor location(s) and to identify the highest risk receptors;

  - Provide advice to the proponent as to the potential level of risk to future operations as the requirement to maintain an acceptable level of air quality will be a regulatory requirement at all identified receptor locations of interest to the regulators.

  - Aid in the development of an effective and sufficiently comprehensive ambient air quality monitoring program;

  - Aid in the development of a hierarchy of effective mitigation options (above and beyond standard industry practice) that can be implemented during adverse meteorological conditions in order to ensure the preservation of environmental values.

  It is my opinion that the objectives of all four of these bullet points have been sufficiently achieved by the works undertaken by URS for the Alpha Coal Project.

- As noted in the last set of bullet points, HCPL will be required to contribute to the maintenance of an acceptable standard of air quality at nearby sensitive receptor locations. Thus the frequency of model-predicted exceedences of ambient air quality at the affected receptor location(s) will have an impact on operations at the Alpha Coal mine. Depending on the level of impact that is realised in practice, infrequent to frequent additional dust control measures/actions may be required with air quality outcomes managed through the site-based air quality management plan.

In conclusion, it is my expressed opinion that the air quality assessment undertaken by URS for the Alpha Coal Project meets current industry standards and expectations and has provided sufficient information to inform HCPL during future operations.

Kindest Regards,

Darlene Heuff.

Director and Principal Scientist
Advanced Environmental Dynamics

# Appendix D Blasting Emissions Assessment Methodology

SCREEN3 is a single source Gaussian plume screening model which provides maximum ground-level concentrations for point, area, flare, and volume sources, as well as concentrations in the cavity zone, and concentrations due to inversion break-up and shoreline fumigation. It is commonly used in the field of air quality to determine if the regulatory standards set for the protection of human health have the potential to exceeded.

### Emissions Estimation

Emission rates of $NO_x$, CO and $SO_2$ from blasting were estimated using SCREEN3 and emission factors from the Australian National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Explosives Detonation and Firing Ranges. The emission factors applied in the screening assessment are shown below:

**Uncontrolled Emission Factors for the Detonation of Explosives (Australian NPI) (kg/tonne)**

| Explosive | Carbon Monoxide (CO) | Nitrogen Oxides ($NO_x$) | Sulphur Dioxide ($SO_2$) |
|---|---|---|---|
| ANFO | 34 | 8 | 1 |

The total amount of ANFO/HANFO mix (tonnes) required for each year of the life of the mine was derived from the total area being blasted. As each blast 'strip' was estimated by HCPL to measure 500 x 70 x 15m, the number of blasts required per year per pit was determined. The screening model emission rates in (g/s) for each pit were then derived from the product of the tonnes of explosive per pit and NPI emission factors for each species shown in Table 1.

In SCREEN3, emissions from blasting were represented as volume sources with the same dimensions as a single blasting 'strip' of 500 x 70 x 15 m.

### Sensitive Receptors

As the most proximate receptor to any of the Project site, Kia-Ora Homestead was selected as the receptor at which screening estimates would be made. The distance to the nearest point of Pit 1 was estimated from the mine plans as 6.7 km. At its nearest point, Kia-Ora Homestead was estimated to be 10.5 km from the next nearest pit, Pit 2.

### Modelling Scenarios

The impacts from blasting at Kia-Ora Homestead were predicted in three increasingly conservative modeling scenarios to ensure that under the most extreme circumstances the Project Criteria are not likely to be exceeded. These scenarios were:

- One strip from Pit 1 (most realistic);
- Two strips from Pit 1 (conservative); and
- Two strips from Pit 1 and two from Pit 2 (highly conservative).

## Appendix D - Blasting Emissions Assessment Methodology

### Meteorology

To ensure predictions were made under the worst dispersion conditions, SCREEN3 was configured to predict concentrations in consideration of all wind speeds and stability classes. It was determined that the most conservative dispersion conditions were under stability class F with light wind speeds of 1 m/s in the direction of Kia-Ora Homestead. Note that such conditions only occur at night and blasting will be undertaken during the day, when improved dispersion conditions will be experienced.

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