HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Environmental Impact Statement

03 | Climate

Section 03 Climate

3.1 Introduction

This section of the Environmental Impact Statement (EIS) describes rainfall patterns, humidity, air temperature, wind (speed and direction), stability class and mixing height within the region of the Alpha Coal Project (Mine) (the Project). Data has been sourced from the Bureau of Meteorology (BOM) climate statistics for the Clermont Sirius Street monitoring site (Latitude: 22.82°S, Longitude: 147.64°E) (BOM, 2010), which is located in Clermont, approximately 130 Kilometres (km) northeast of the Project site.

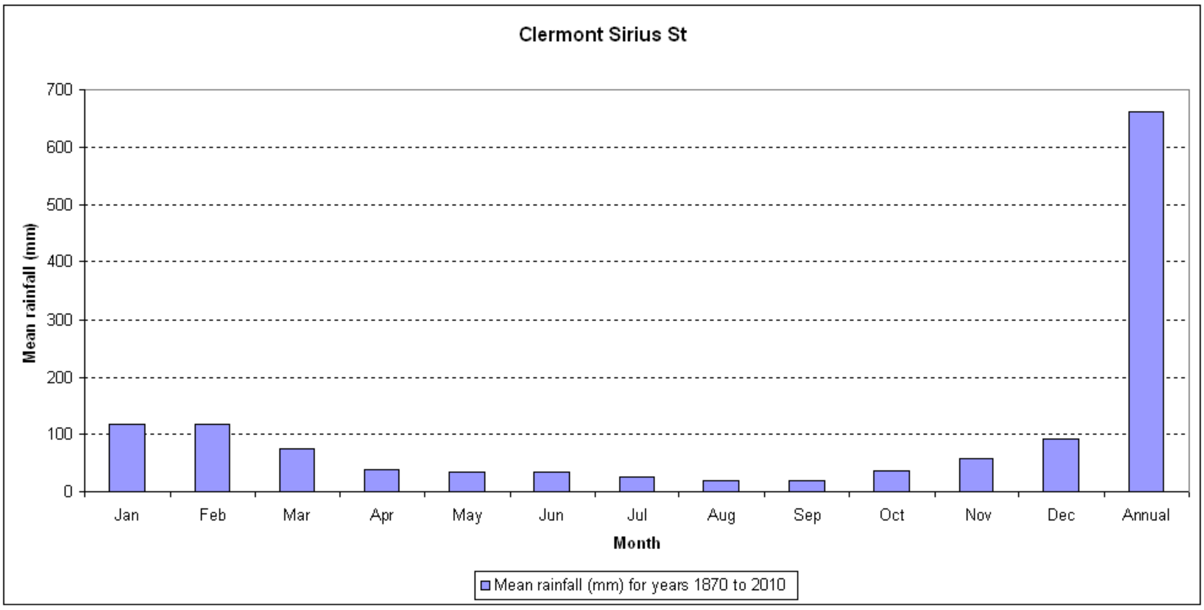
The available monitoring data have been supplemented with numerically simulated meteorological parameters for 2009 in order to provide a detailed description of the local meteorology. The simulated data were used to generate hourly records of wind speed and wind direction as the available Clermont Sirius St long-term statistics alone were not sufficient for the purposes of characterising the local meteorology due to the distance and completeness. Additionally, the model output provides site-specific parameters that were not measured, such as mixing height and stability class. Details of the setup and application of The Air Pollution Model (TAPM) (Hurley, 2005) and the CALMET (Scire et al., 2006) models used to generate the simulated meteorological parameters are provided in Section 3.3 of Volume 5, Appendix H (Air Quality Report).

This section of the EIS also provides an assessment of extreme events and the Project's vulnerability to natural or induced hazards such as flooding, drought, storm events, bushfires and climate change. The potential impacts due to climatic factors are addressed in the Soils, Topography and Land Disturbance (Volume 2, Section 5); Air Quality (Volume 2, Section 13); Surface Water (Volume 2, Section 11); and Groundwater (Volume 2, Section 12) sections of the EIS.

3.2 Rainfall

Monthly mean rainfall values for the period of record 1870 to May 2010 from the Clermont monitoring site are provided in Figure 3-1. The data presented in Figure 3-1 indicate a mean annual rainfall of approximately 662.3 mm, with approximately 49% of rainfall occurring in summer.

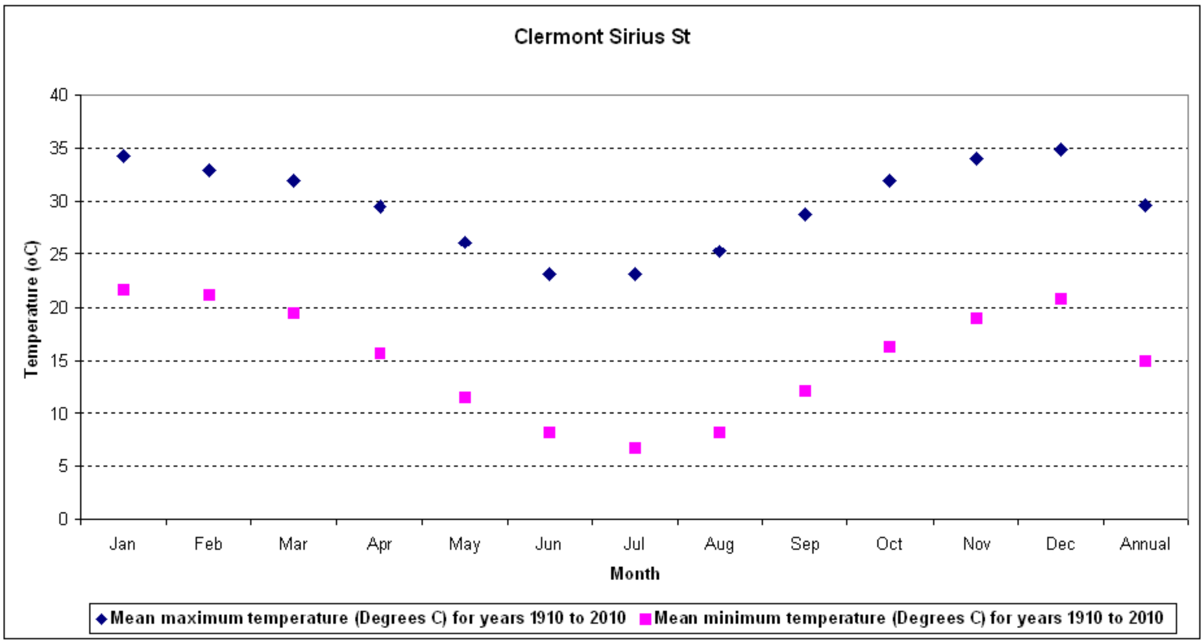
Figure 3-1: Clermont Sirius Street rainfall statistics (1870 to 2010)



3.3 Air Temperature

The region surrounding the Alpha Coal Project (Mine) typically has hot days during summer, with mean maximum daytime temperatures around 35°C falling to 23°C during the winter months. Overnight temperatures are generally cool throughout the year and cold during the winter months, with mean minimum daily temperatures of 7°C in July, rising to greater than 21°C between December, January and February. The long-term temperature statistics for the period of record 1910 to 2010 are provided in Figure 3-2.

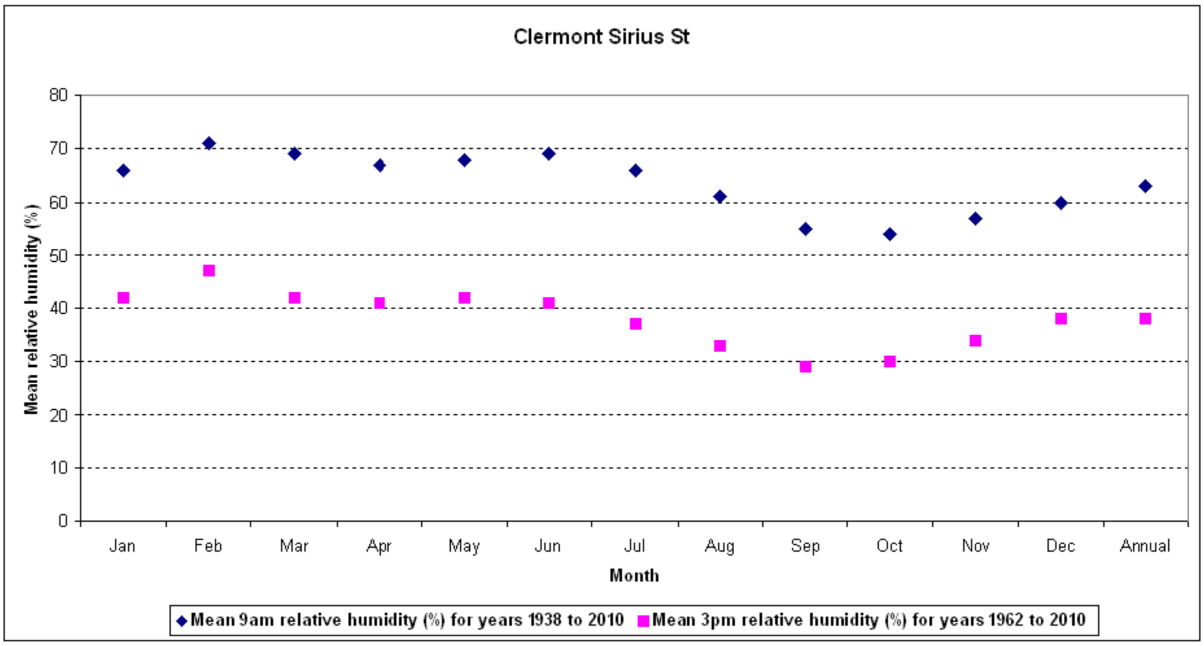
Figure 3-2: Clermont Sirius Street air temperature statistics (1910 to 2010)



3.4 Relative Humidity

Mean 9:00 am relative humidity is generally higher from February to June and lower from September to December. Mean 3:00 pm relative humidity is lower than 9:00 am relative humidity throughout the year, ranging from 29% in September up to 49% in February. The lowest 3:00 pm relative humidity is from September to October. The 9:00 am and 3:00 pm relative humidity long-term statistics for the period of record 1938 (or 1962 for 3:00 pm results) to 2010 are provided in Figure 3-3.

Figure 3-3: Clermont Sirius Street relative humidity statistics (1938 to 2010)

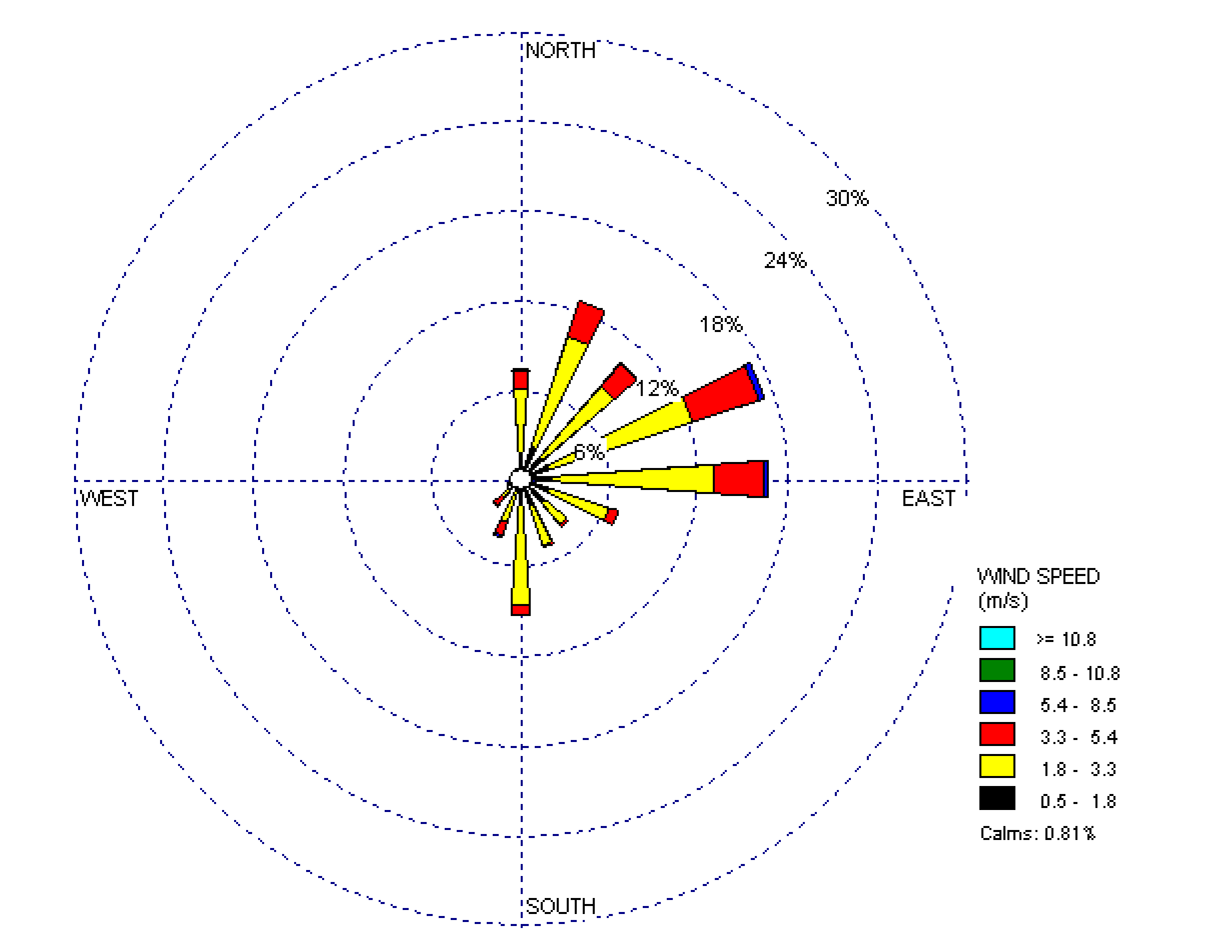


3.5 Wind

The simulated data were used to generate hourly records of wind speed and wind direction, as the available Clermont Sirius St long-term statistics in relation to wind speed and wind direction did not show good agreement with the wind statistics from the numerically simulated site-specific wind fields. Clermont Sirius St monitoring station is approximately 130 km northeast of the Project site.

Wind speed and wind direction data have been summarised for 2009, using the modelled data generated by CALMET. A wind rose that presents the wind speed and direction data for all hours is shown in Figure 3-4. Typical winds at the Alpha Coal Project (Mine) site are predominantly from the east through to northeast. The wind speed reaches 6.6 metres per second (m/s) from the east, and is on average 2.6 m/s. The site is characterised by occasional light winds from the south and southeast and very infrequent winds from the west.

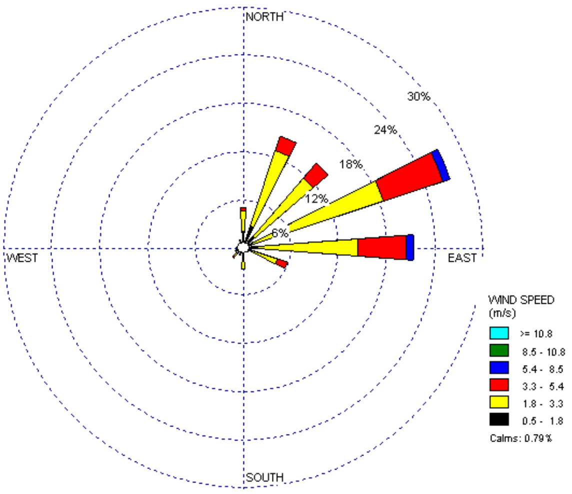
Figure 3-4: Wind rose for all hours- Alpha Coal Project (Mine), CALMET 2009



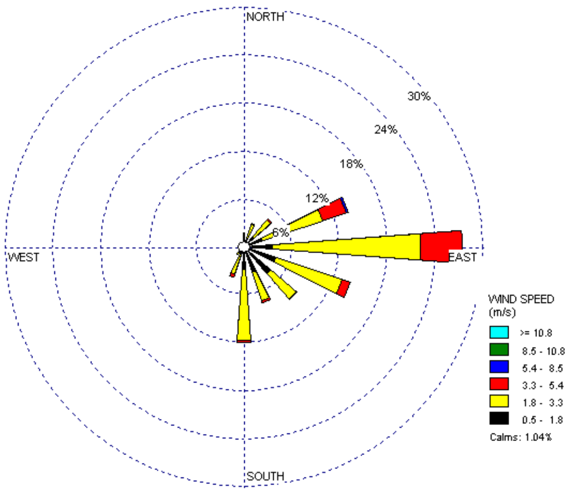
Analysis of wind speed and direction data for each season in 2009 is shown as wind roses in Figure 3-5. The data show that average winter wind speeds were 2.4 m/s, with wind directions varying from the north, northeast and southerly directions. Average spring wind speeds were 2.9 m/s, with a predominant northeast wind direction. Summer winds tend to be from the northeast through to the east direction, with an average wind speed of 2.7 m/s. Average wind speed in the region in autumn was 2.4 m/s, with the majority of winds from the east.

Figure 3-5: Seasonal wind rose- Alpha Coal Project (Mine), CALMET 2009

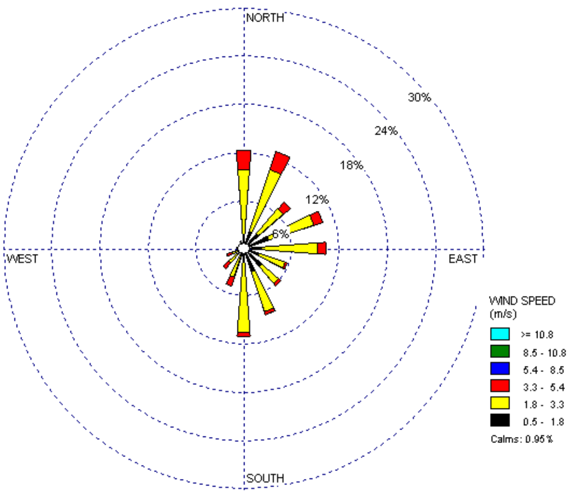
Summer (D-J-F)



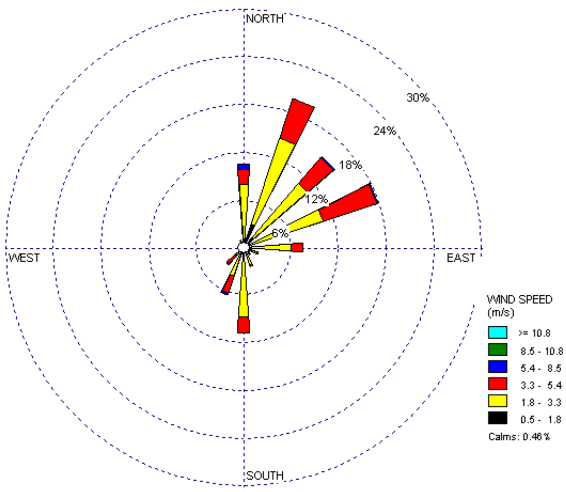
Autumn (M-A-M)



Winter (J-J-A)

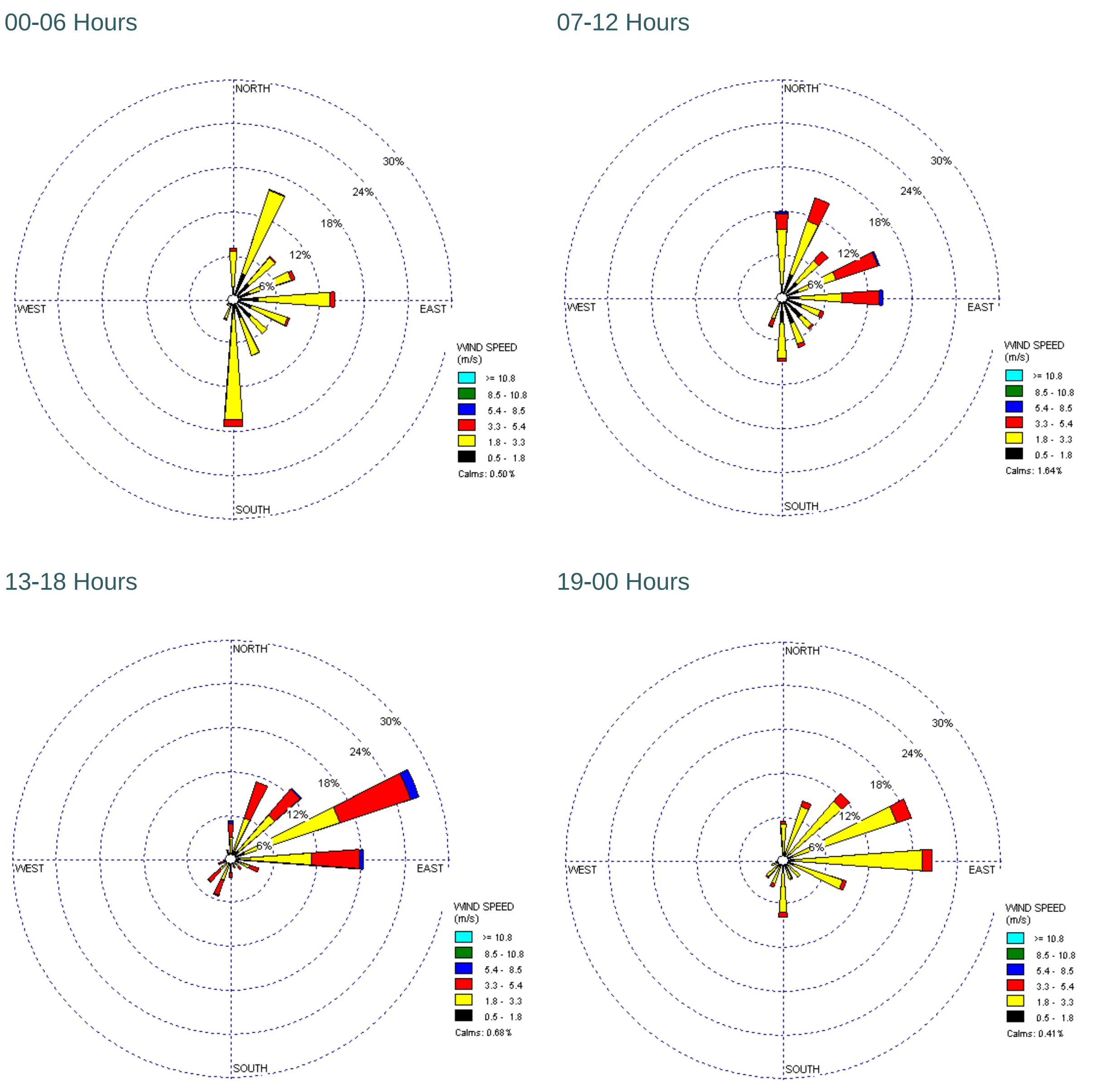


Spring (S-O-N)



The wind patterns through the day are presented in Figure 3-6. Early morning winds are characterised by low to moderate wind speeds, predominantly below 3.3 m/s, with wind directions mainly from the south or northeast. Mid-morning winds show increasing strengths of predominately up to 5.4 m/s, and predominantly from the north to east. Winds in the afternoon are characterised by the easterly direction, with wind strengths of up to 6.7 m/s. Night-time winds are associated with wind speeds of up to 5.4 m/s from the east-northeast direction.

Figure 3-6: Wind rose by hour of day- Alpha Coal Project (Mine), CALMET 2009



3.6 Stability Class

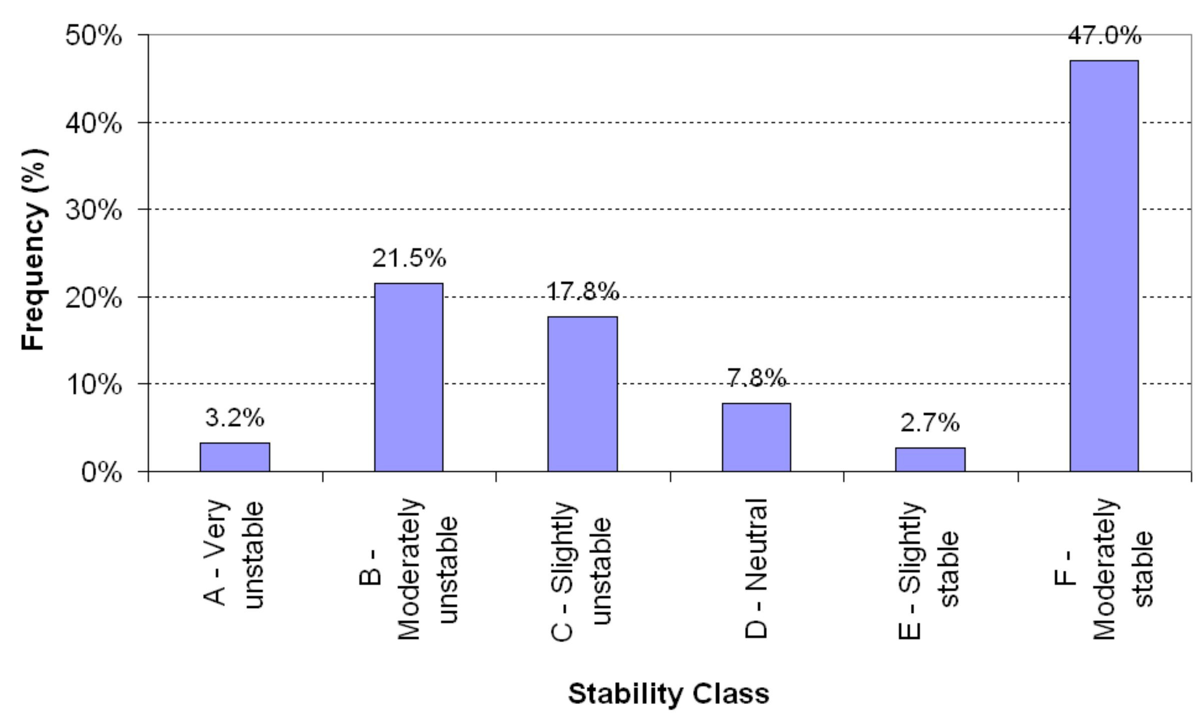
Stability of the atmosphere is determined by a combination of horizontal turbulence caused by the wind and vertical turbulence caused by the solar heating of the ground surface. Stability cannot be measured directly; instead it must be inferred from available data, either measured or model-generated data.

The Pasquill-Gifford scale defines stability on a scale from A to G, with stability class A being the least stable, occurring during strong daytime sun, and stability class G being the most stable condition, occurring during low wind speeds at night. For any given wind speed the stability category may be characterised by two or three categories depending on the time of day and the amount of cloud present.

In air quality models such as CALMET, the stability classes F and G are combined. Stability class data for 2009 have been summarised using the modelled data generated by CALMET. This showed that for the Project, stability class F (Figure 3-7) occurred most frequently (47.0%) in 2009, indicating that the dominant conditions were moderately to very stable, with very little lateral and vertical diffusion. Typically under class F stability, the wind direction tends to deviate by only a small amount, frequently resulting in poor dispersion conditions.

The frequency of strongly convective (unstable) conditions at the site of the Alpha Coal Project (Mine), represented by stability class A, is relatively low, at 3.2% of hours in the year.

Figure 3-7: Frequency of stability class for Alpha Coal Project (Mine), CALMET 2009

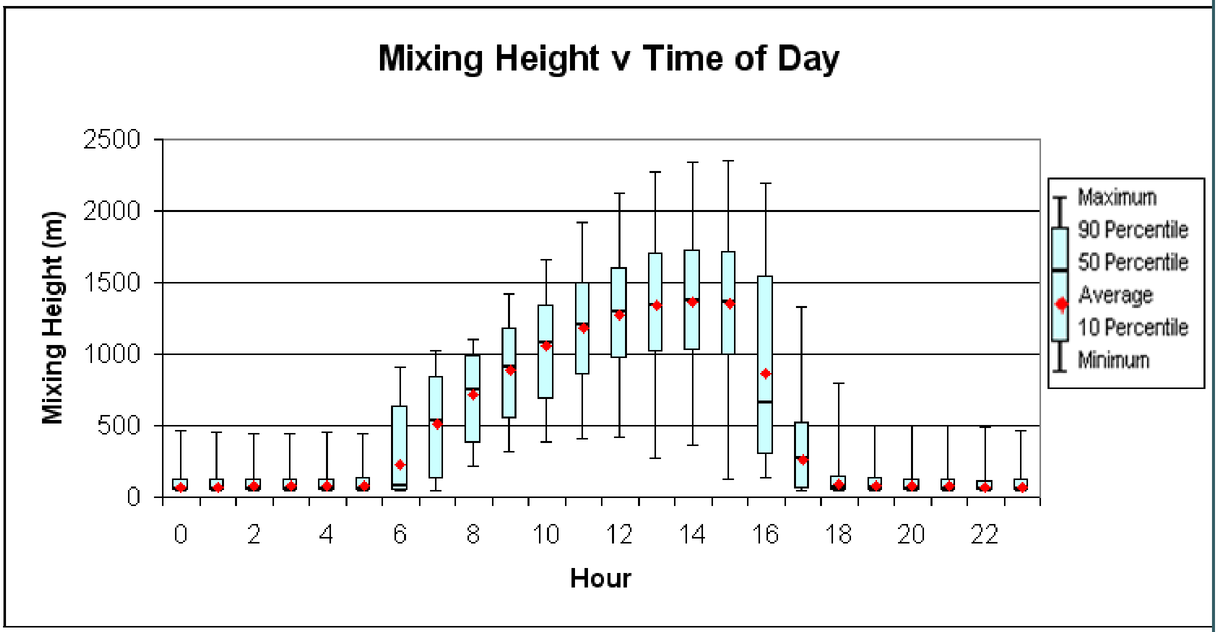


3.7 Mixing Height

Mixing height quantifies the vertical height of mixing in the atmosphere and is a modelled parameter that is not typically measured. Mixing height data have been summarised for 2009 using the modelled data generated by CALMET. Figure 3-8 represents the mixing height against time of day for the Alpha Coal Project (Mine). The graph represents the typical growth of the boundary layer, whereby mixing height is generally lowest late at night/early morning and highest during early afternoon (in this case 2:00 pm). The mixing height decreases in the afternoon, and particularly after sunset, due to the change from surface heating from the sun to a net heat loss overnight.

On average, mixing heights during the morning hours range from 225 m to 1,275 m above ground level, while the average afternoon mixing heights range from 1,366 m to 261 m above ground level. Low mixing heights typically translate to stagnant air with low vertical motion, whilst high mixing heights are associated with vertical mixing and effective dilution of pollutants.

Figure 3-8: Mixing height by time of day for Alpha Coal Project (Mine), CALMET 2009



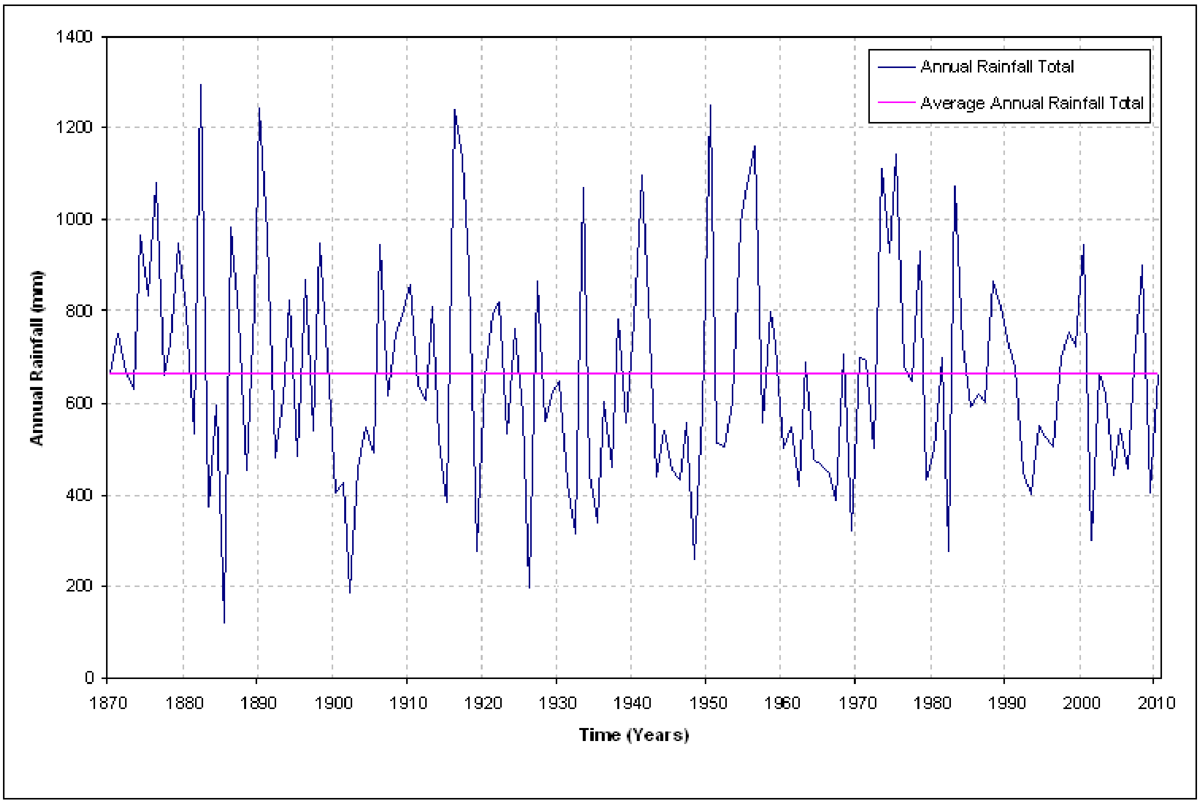
3.8 Extremes of Climate

This section describes the Project's vulnerability to natural hazards such as drought, flooding, bushfires, storm events and climate change.

3.8.1 Drought

Recent periods of long-term droughts (consecutive years of below average rainfall) in the region of the Project include 1985–1987, 1992–1996 and 2001–2006. In addition to these drought periods, there is also evidence of longer periods where there is generally low rainfall (Figure 3-9). In these periods, not every year is dry; however, the rainfall is below the long-term average.

Figure 3-9: Annual rainfall totals (1870 – 2010) (Bureau of Meteorology, 2010)



3.8.2 Flooding

The Project area is located within the Sandy Creek catchment, forming the south-westerly portion of the Belyando River system, covering an area of approximately 7,700 km^2. The Sandy Creek catchment is bounded by the Great Dividing Range (GDR) to the west and a north-south line of low hills to the east, and extends to the south of the Capricorn Highway and northward to around Wendouree.

The existing landform is predominantly flat with wide floodplains flanking well-defined creeks and some smaller tributaries, including Lagoon Creek, Spring Creek, (upper) Sandy Creek (locally referred to as Greentree Creek and located to the north of the Project), Little Creek, Rocky Creek, Middle Creek and Well Creek. The floodplains are vegetated with tall native grass, bushes, sparse trees and dense vegetation around the creeks and water courses. All creeks in the Project area are ephemeral upland freshwater creeks.

A detailed surface water study was completed for the Project (refer to Volume 5, Appendix F). The study included an assessment of the hydrology of the Project's catchment area, flood modelling and a geomorphologic impact assessment. Hydrological and hydraulic models were developed and used to determine flood behaviour for frequent and large design floods.

The key findings of the flood impact assessment are highlighted below.

- The majority of flood level impacts are contained within the Project Mining Lease Application (MLA) 70426, with some limited impacts evident outside MLA 70426. The impacts outside MLA 70426 are generally minor (< 150 mm) in nature and do not affect any surrounding properties.
- The development of the mine and its associated works will not adversely affect the flood risk of the area.
- The maximum predicted increase in upstream flood levels is 150 mm. This increase is predicted to occur at the upstream boundary of the Proponent's MLA 70426 in the vicinity of the Lagoon Creek and the adjoining floodplain. The increased water levels do not affect any existing dwellings and are therefore considered to be minor in nature.
- Predicted increase in flood levels downstream of the Proponent's property boundary is 100 mm. This increase is due to the loss of flood storage and redistribution of flows. The increased water levels do not affect any existing dwellings and are therefore considered to be minor in nature.
- Predicted flood level increases over the majority of floodplain upstream of the MLA 70426 area are generally small (< 50 mm).
- The impacts of the Project on floodplain and creek flow velocities are moderate and there is no significant increase in scour risk.

3.8.3 Storm Events

The Sandy Creek catchment area is subject to frequent storm activity; and as part of the flood impact assessment a range of design event durations were modelled to determine the critical duration of storm events. The critical storm duration was determined by examining a range of design flood events with storm durations of 1 to 48 hours for the storm events. The results of the design floods produced from the modelled storm events are shown in Table 3-1.

Table 3-1: Peak flows for various Average Recurrence Interval (ARI) events

Event (years ARI)	Interpolated flow (m^3/s)*	Calibrated peak discharge (m^3/s)*	% difference between results
2	28	28	0%
5	100	131	31%
10	190	225	18%
20	321	311	-3%
50	576	583	1%
100	846	880	4%
1000	N/A	2,512	-
3000	N/A	3,496	-

* (m^3/s) = cubic metres per second

Table 3-1 highlights that the modelling conservatively overestimates peak storm-related flows. For higher frequency events, the relative difference tends to be larger. This overestimate of peak discharge means that the storm event impacts predicted for the Project are likely to be overestimated.

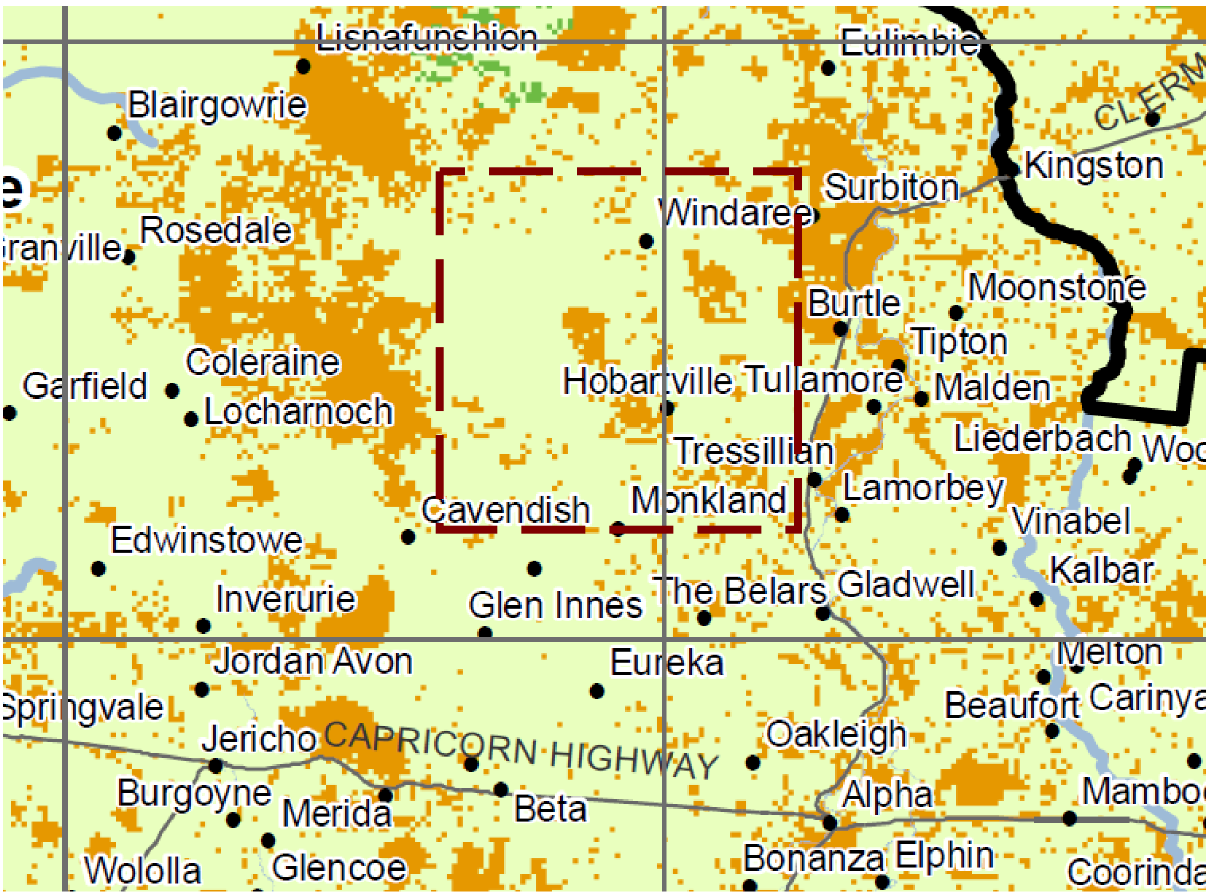
The impacts of storm events on the capacity of wastewater containment systems (e.g. site bunding and stormwater management infrastructure) are addressed in Volume 2, Section 11 with regard to contamination of waterways.

3.8.4 Bushfires

The climate factors that exert most influence over bushfire weather are temperature, winds, and humidity (BOM, 2009). A combination of high temperature, high winds, and low humidity increases fire danger. In Queensland, spring (particularly late spring) brings a combination of these climate factors that constitute the fire season. During winter, the temperatures and rainfall are low. In summer, while the temperatures are at their hottest, the rainfall also increases, reducing the risk of a significant fire. In the period between winter and summer, the fuel is very dry from the lack of rainfall during the winter months, and the temperatures increase.

The Rural Fire Service (RFS) and Queensland Fire and Rescue Service have modelled the bushfire risk for Barcaldine Regional Council (RFS, 2008) (refer to Figure 3-10). The Project area is primarily classified as having a low to medium bushfire risk. This risk modelling examined factors of slope, aspect and vegetation.

Figure 3-10: Bushfire risk for the general Project location (Rural Fire Service, 2008)



3.8.5 Climate Change

The Project's vulnerabilities to climate change have been addressed by conducting a risk assessment on the impacts of reduced rainfall, increased temperatures, increased rainfall intensity, increased storm severity, increased number of windy days, and increased risk of flooding. The methodology and results of this assessment are presented in Volume 2, Section 14. The proposed risk management strategies are also presented to allow the Project to adapt to future climate change.