7 CLIMATE

7.1 INTRODUCTION

This chapter outlines the regional climate characteristics of the Wandoan district (the study area) and details of potential impacts of climate and natural hazards on the MLAs area.

Climate is commonly understood as the weather averaged over a period of time, whereas weather is in reference to day-to-day changes. Climate also includes statistics other than the average, including such measures as the magnitudes of season-to-season and year-to-year variations. Such relationships allow for better understanding of the environmental nature of an area. Once these climatic conditions are understood, variables and variations across weather dependent elements of environmental impact assessment can be better assessed and understood.

7.2 METHODOLOGY OF ASSESSMENT

Given the large size of the study area, climate data has been compiled from various sources as a representation of the area's characteristics. The climatic data sites consist of the Australian Bureau of Meteorology (BOM) weather stations at Taroom and Miles post offices (which cover the northern and southern extents respectively) and the privately operated Jondale weather station located just outside Wandoan (representing the central locality of the Project). Climate statistics provided from the BOM weather stations are mean values calculated using historical data while Jondale data was only available from April 2007 to March 2008. Relevant data from these weather stations are presented in Tables 7-1 to 7-3 and discussed in subsequent sections.

Table 7-1: Climate data for the northern extent of the study area

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean Min	Mean Max	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
Jan	20.6	33.7	64	41	9.7	10.2	98.9
Feb	20.4	32.9	67	45	8.7	9.9	87.1
Mar	18.2	31.7	66	42	8.1	9	62.5
Apr	14.2	28.7	67	40	6.6	8.1	35.2
May	9.8	24.5	72	43	6.3	9	40.9
Jun	6.3	21.4	76	45	6.1	9.2	36.4
Jul	5	20.9	74	42	6.4	9.8	33.5
Aug	6.4	22.9	67	38	7.4	10.7	28.2
Sep	10.3	26.7	58	33	10.2	11.2	30.9
Oct	14.7	29.9	56	34	10.8	11	55.4
Nov	17.4	31.8	57	37	10.1	10.5	75.0
Dec	19.5	33.4	60	38	9.5	9.5	89.4
Annual	13.6	28.2	65	40	8.3	9.8	673.4

Source: Climate statistics from Taroom Post Office (BOM 2008a)

Table 7-2: Climate data from April 2007 to March 2008 for the central extent of the study area

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean Min	Mean Max	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
Jan	20.1	30.2	67.7	51.2	17.2	14.7	119.0
Feb	18.2	29.7	65.4	48.8	14.0	13.6	108.5
Mar	14.9	29.4	56.3	30.4	16.7	12.1	1.0
Apr	15.5	29.6	57.8	25.5	14.6	10.7	10.0
May	14.0	26.6	66.2	34.9	13.0	12.0	19.5
Jun	6.9	17.4	75.4	50.5	10.0	13.3	94.0
Jul	5.0	19.2	62.1	32.2	10.2	15.1	0.0
Aug	9.6	21.9	66.7	42.2	13.6	14.4	53.0
Sep	11.2	25.4	57.1	33.3	14.3	14.3	4.0
Oct	16.3	30.9	54.1	27.0	15.8	15.7	53.0
Nov	17.7	29.1	56.1	37.2	16.2	14.5	41.5
Dec	19.5	30.5	62.1	42.9	19.3	14.3	50.0
Annual	14.1	26.7	62.3	38.0	14.6	13.7	553.5

Source: Climate statistics from the Jondale weather station (WJV, 2008)

Table 7-3: Climate data for the southern extent of the study area

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean Min	Mean Max	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
Jan	19.5	33.2	60	41	11.1	10.6	95.2
Feb	19.3	32.3	64	42	11.5	11.5	75.1
Mar	17	30.8	63	40	11.7	11.7	59.1
Apr	12.4	27.5	64	41	10.1	10.9	36.8
May	7.9	23.2	71	46	8.7	10.1	39.3
Jun	5	19.8	75	48	8.5	11.5	39.6
Jul	3.6	19.3	72	44	8.9	11.2	37.5
Aug	4.9	21.4	63	38	10.9	12.5	29.4
Sep	8.5	25.1	55	34	13.5	12.5	30.8
Oct	13.1	28.6	53	34	13.9	12.4	54
Nov	16.3	31.2	53	35	12.9	12.1	66
Dec	18.4	32.9	56	37	12.3	11.4	88.6
Annual	12.2	27.1	62	40	11.2	11.5	651.7

Source: Climate statistics from Miles Post Office (BOM 2008b)

7.3 RAINFALL

Overall, the total annual rainfall throughout the study area is quite low as seen in Tables 7-1 to 7-3. Historical data shows that the northern area received on average approximately 673 mm per year (based on rainfall data from 1870 to the present (BOM 2008a)), and the southern area received on average 650 mm per year (based on rainfall data from 1885 to the present (BOM 2008b)). The majority of these falls occur during the summer months (up to 40%), with January consistently being the month of highest total rainfall. Winter and autumn have generally had the lowest total rainfalls across the study area. The central locality of the Project showed similar seasonal rainfall trends compared to the BOM values. However, a lower annual rainfall was measured due to the drought conditions that prevailed at the time the data was collected.

7.4 TEMPERATURE

The temperatures recorded across the study area are relatively consistent. The average daily maximum temperature range in summer is 29.1^{o}C to 33.7^{o}C and in winter is 17.4^{o}C to 26.6^{o}C. The extreme temperature range over the 47 years on record is -6.1^{o}C (recorded at Miles) to 44^{o}C (recorded at Taroom). Slight variations occur between the central area data and the southern and northern extents, although this is likely due to the limited range of data available for the central area. The coldest months are generally June and July, with the warmer extremes occurring within December and January.

7.5 HUMIDITY

The relative humidity within the study area peaks in June with mean monthly maximums measured at 75% during the morning period. Based on the BOM data, the lowest monthly averages were noted to occur in September during the afternoon periods. All records (Tables 7-1 to 7–3) show that the morning periods are higher in relative humidity when compared to the afternoon periods, with the greatest variations occurring during the winter period.

7.6 WIND CONDITIONS

The wind conditions measured for Taroom and Miles represent the mean of data collected over the past 50 years. The data recorded for both locations show slightly higher wind speeds in the autumn and winter months when compared to the summer months. Wind conditions in the northern and southern extents of the Project area are depicted as wind roses in Figures 7-1-V1.3 to 7-4-V1.3. Note that figures with numbering ending in V1.3 refer to figures contained in Volume 1, Book 3 of the EIS.

The annual Miles BOM data shows distinct patterns occurring between the morning and afternoon periods. Wind speeds within the mornings are noted to be relatively low (between 0 and 10 km/h) with the wind direction predominately from the north-western to north-eastern direction. The wind speeds are slightly higher in the afternoon period (with a higher frequency between 10 to 30 km/h) and wind direction is far more variable.

Within the annual Taroom BOM data, the meteorological patterns between the morning and afternoon periods are less distinct. Both periods have very wide and variable wind directions, with the most frequent wind speed relatively mild (between 0 and 10 km/h).

Seasonal wind conditions were available for the Taroom station (refer to Figure 7-5-V1.3) which showed distinct seasonal variations. Wind direction was primarily from the south-western to southern direction in the winter, with wind speeds increasing in the afternoon period. These conditions dissipate in spring and shift to prevailing winds from the north and north-east. In the summer, the wind directions are most frequently from the northern to eastern directions in the morning shifting to the south-eastern direction in the afternoon.

Wind conditions from the Jondale weather station were also analysed. The Jondale wind roses represent annual, and mean six hourly winds. The annual patterns recorded show prevailing, moderate to strong wind conditions from the east-north-east arcing clockwise to the south-south-west (refer to Figure 7-6-V1.3). The daily patterns show contrasts between the morning (midnight to midday) and the afternoon to evening (midday to midnight) (refer to Figure 7-7-V1.3). The mornings consist of moderate to strong winds from the north to south-east, whereas these winds lessen in frequency and become far more variable in the afternoon period.

7.7 NATURAL HAZARDS

7.7.1 FLOOD

The study area is situated within two major catchments. The northern and central extents of the study area are largely situated in the Dawson River Catchment, which is a 43,965 km^2 sub-catchment within the Fitzroy River Basin. The southern extents are located within the northern sub-catchments (catchment size of 43,112 km^2) of the Condamine River basin.

Due to its immense size and fan-like shape, the Fitzroy River catchment is capable of producing severe flooding following heavy rainfall events. Major floods can result from either the Dawson or the Connors-Mackenzie Rivers. Flood gauge heights at Taroom recorded the following peaks during recent significant floods: 8.15 m in January 1918, 4.08 m in January/February 1978, 7.46 m in May 1983 and 3.95 m in January 1991 (BOM 2005a).

Within the Condamine River catchment, major floods do not necessarily develop in the headwater areas of the catchment but can result from heavy rainfall in any of the large tributaries that enter the main Condamine River. While large scale flooding within the main towns of the catchment is not a regular occurrence, major floods occur regularly and on average every two years. The worst recorded flooding occurred in 1942, 1950, 1956, 1975, 1976, 1983 (twice), 1988 and 1996. However, major floods generally only occur in the first half of the year and occasionally in late spring (BOM 2005b).

Major flooding in both catchments requires a large scale rainfall event over the catchment. Average catchment rainfalls in excess of 200 mm in 48 hours within the Dawson River catchment may cause significant moderate to major flooding and traffic stoppages, particularly in the middle to lower reaches downstream of Taroom (BOM 2005a). While average catchment rainfalls in excess of 300 mm in 48 hours may cause significant major flooding. If average catchment rainfalls exceed 25 mm within the Condamine River catchment, with isolated 50 mm falls in 24 hours, stream rises and the possibility of minor flooding may occur (BOM 2005b). If it is in excess of 50 mm, with isolated 75 to 100 mm falls in 24 hours, significant stream rises with the possibility of moderate to major flooding may occur (BOM 2005b).

7.7.2 DROUGHT

Although some regions in the far west, south and north of Queensland are considered to have a reasonable chance (30 to 50%) of exceeding median rainfall in the winter season of 2008, over 60% of Queensland is drought declared under state processes (NRMW, 2008). Rainfall deficiencies over 2006 and 2007 have resulted in the study area being considered within either the category of ‘Serious’ to ‘Severe’ deficiency with significantly low rainfall averages. These deficiencies have been occurring against a backdrop of decade-long rainfall lows and record high temperatures that have severely stressed water supplies in the both the east and the southwest of Queensland. Several years of above average rainfall are required to remove the very long-term deficits.

7.7.3 BUSHFIRES

Bushfire risk maps created by the Queensland Rural Fire Brigade (2002) indicate that the majority of the Project area and surroundings is classified as being of ‘low bushfire hazard’. Small patches to the west and portions to the east of the Project area are classified as being ‘medium bushfire hazard’ due to shrub and tree cover.

7.7.4 CYCLONES

Relatively few cyclones have been experienced in the past 100 years near the study area, with the last tropical cyclone occurring in the mid-1990’s (tropical cyclone Gertie, 17–24 December 1995). This is mainly due to the study area’s location which is approximately 300 km inland of the Wide Bay-Burnett Coast of Queensland.

Tropical Cyclone Althea has been one of the most severe cyclones to affect the area. It crossed the coast north of Townsville in December 1971 with wind gusts over 200 km/h. The intensity of the cyclone reduced as it continued its path through Queensland, crossing directly through the study area before going back out to sea.

Tropical Cyclone Wanda passed over the coast in January 1974 near Maryborough and continued through Queensland and dissipating into a low pressure system to the south of the study area. Cyclone Wanda caused heavy rains across southeast Queensland which resulted in one of Australia's greatest flood events in the last 50 years.

With only two out of a total of 207 recorded impacts associated with tropical cyclones along the east coast (since 1858) having severely affected the study area (BOM 2008c), the risk that the Project would be impacted by cyclonic conditions is considered to be low.

7.7.5 EARTHQUAKES

A search of the Geoscience Australia earthquake database indicated that only one earthquake has been recorded in close proximity to the study area between 1840 and August 2008 (GA, 2008). The earthquake occurring on May 11 2001 was located approximately 20 km north of Miles. The magnitude of the tremor is considered relatively minor as it only registered 2.2 on the Richter scale.

Based on historical data, it is considered unlikely that an earthquake of a magnitude that could cause damage to mine related infrastructure would occur in the Project area.

7.8 POTENTIAL ISSUES AND IMPACTS

The climatic conditions across the northern, central and southern extents of the study area are generally similar for all seasons. The small variations that do occur are considered natural and normal under seasonal variations. Potential climate change scenarios forecast for the future operational phase of the Project are discussed in Chapter 14 Greenhouse gases and climate change.

Based on the historical data, the total annual rainfall for the study area is quite low. Potential impacts of rainfall on soil erosion are discussed in Chapter 9 Geology, Mineral Resources, Overburden and Soils. Storm events also have the potential to impact on waste containment systems (e.g. site bunding and tailings dams) and nearby waterways which are discussed in Chapters 18 Waste Management and 11 Water Supply and Management, respectively.

The wind condition data obtained for the study area indicated that wind speeds are generally low with variable daily and seasonal prevailing directions. Potential impacts caused by wind conditions at the study area are discussed in Chapter 13 Air quality and Chapter 15 Noise.

Natural hazards are not considered a major risk for the study area. However, both flood and drought events may become an issue at some point during the expected life of the Project. These issues are considered further in Chapter 11 Water resources. Additionally, an Emergency Management Plan which will address all foreseeable site specific risks, such as cyclones, fire and flood including appropriate contact details of emergency services agencies will be prepared prior to commencement of construction activities. The risk of natural hazards is considered as part of the business risk management process, with appropriate controls and monitoring under an Emergency Management Plan being a fundamental part of the risk management (refer Chapter 23 Hazard and Risk).

7.9 REFERENCES

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