

# 7 CLIMATE

## 7.1 INTRODUCTION

This chapter outlines the regional climate characteristics of the study area and details of potential impacts of climate and natural hazards on the proposed CSM western water supply pipeline (the proposed pipeline), which forms part of the Wandoan Coal Project (the Project).

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 length of the proposed pipeline (approximately 93 km), climate data has been compiled from various sources as a representation of the study area's characteristics. The climatic data sites consist of the Australian Bureau of Meteorology (BOM) weather station at Injune Post Station (which covers the western extent of the proposed pipeline) and the privately operated Jondale weather station located just outside Wandoan (representing the eastern locality of the proposed pipeline). 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 7-2 and discussed in subsequent sections.

**Table 7-1: Climate data from April 2007 to March 2008 for the eastern extent of the study area**

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean	Mean	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
	Min	Max					
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

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean	Mean	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
	Min	Max					
Dec	19.5	30.5	62.1	42.9	19.3	14.3	50.0
<b>Annual</b>	<b>14.1</b>	<b>26.7</b>	<b>62.3</b>	<b>38.0</b>	<b>14.6</b>	<b>13.7</b>	<b>553.5</b>

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

**Table 7-2: Climate data for the western extent of the study area**

Month	Temperature (°C)		Relative humidity (%)		Mean wind speed (km/h)		Rainfall (mm)
	Mean	Mean	9:00 am	3:00 pm	9:00 am	3:00 pm	Mean
	Min	Max					
Jan	19.6	33.7	59	38	9.4	10.1	90.9
Feb	19.1	32.2	65	43	9.2	9.9	86.8
Mar	16.3	30.9	61	39	9.4	9.6	61.0
Apr	11.9	27.7	64	40	7.8	8.9	40.9
May	7.9	23.5	70	42	5.9	8.4	33.7
Jun	4.4	20.3	76	45	5.4	9.1	29.9
Jul	3.1	20.0	71	40	5.8	9.3	30.3
Aug	4.4	22.2	60	33	7.6	10.1	25.6
Sep	8.0	26.1	50	28	10.2	10.6	24.7
Oct	12.8	29.5	48	31	11.1	10.4	47.1
Nov	15.7	31.4	52	35	10.4	10.2	73.1
Dec	18.0	33.2	55	37	9.8	9.7	86.6
<b>Annual</b>	<b>11.8</b>	<b>27.6</b>	<b>61</b>	<b>38</b>	<b>8.5</b>	<b>9.7</b>	<b>629.4</b>

SOURCE: Climate statistics from Injune Post Office (BOM 2008a)

### 7.3 RAINFALL

Overall, the total annual rainfall throughout the study area is quite low as seen in Tables 7.1 and 7.2. Historical data collected from the western area reported an average rainfall of approximately 629 mm per year (based on rainfall data from 1925 to the present [BOM 2008a]). The majority of these falls occur during the summer months (up to 40%), with January reporting the month of highest total rainfall. Winter and autumn have generally had the lowest total rainfalls across the study area. The eastern locality of the proposed pipeline 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°C to 33.7°C and in winter is 17.4°C to 21.9°C. The extreme temperature range recorded at Injune over the 41 years on record

is -8.0°C to 43.8°C. Slight variations occur between the eastern area data and the western extent, although this is likely due to the limited range of data available for the eastern 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 76% during the morning period. Based on the BOM data, the lowest monthly average was noted to occur in September during the afternoon period. All records (Tables 7-1 to 7-2) 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 presented for Injune represent the mean of data collected over the past 40 years. The data recorded shows slightly higher wind speeds in the spring and summer months compared to the winter months. Wind conditions in the western extent of the proposed pipeline are also depicted as wind roses in Figures 7-1-V3.3 to 7-2-V3.3. Note that figures/documents with numbering ending in V3.3, for example, refer to figures/documents contained in Volume 3, Book 3 of the EIS.

The annual Injune BOM data shows similar meteorological patterns occurring between the morning and afternoon periods with relatively low wind speeds (between 0 and 10 km/h). Wind direction in the morning is most frequently from the north-eastern direction, shifting in the afternoon to the south-eastern direction.

The closest BOM weather station describing seasonal wind patterns is located at the Taroom Post Office, approximately 60 km north of Wandoan, which showed distinct seasonal variations (refer to Figure 7-3-V3.3). 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 wind conditions observed at the site from April 2007 to March 2008. 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 7-4-V3.3). The daily patterns show contrasts between the morning (midnight to midday) and the afternoon to evening (midday to midnight) (refer to Figure 7-5-V3.3). 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 the Dawson River Catchment, which is a 43,965 km<sup>2</sup> sub-catchment within the Fitzroy 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
- 3.95 m in January 1991 (BOM 2005a).

Major flooding in the catchment 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).

### 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 (NRW, 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 both the east and the southwest of Queensland. Several years of above average rainfall are required to rectify the very long-term deficits.

### 7.7.3 BUSHFIRES

Bushfire risk maps created by the Queensland Rural Fire Brigade (2002) indicate that the bushfire risk is relatively consistent across the study area. The elevated western portion of the study area is allocated a medium bushfire hazard, whilst the central and eastern portions of the study area are allocated a low bushfire hazard.

### 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 2008b), the risk that the proposed pipeline would be impacted by cyclonic conditions is considered to be low.

### 7.7.5 EARTHQUAKES

A search of the Geoscience Australia (GA) 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 proposed pipeline study area.

## 7.8 POTENTIAL ISSUES AND IMPACTS

The climatic conditions across the western and eastern parts 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 operations of the proposed pipeline are discussed in Chapter 14 Climate Change and Greenhouse Gases.

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. sediment control measures) and nearby waterways which are discussed in Chapter 11 Water Resources and Chapter 18 Waste 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.

Additionally, natural hazards are not considered a major risk for the construction of the proposed pipeline. 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 (see Chapter 23 Hazard and Risk) 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.

## 7.9 REFERENCES

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