

Appendix 6-C

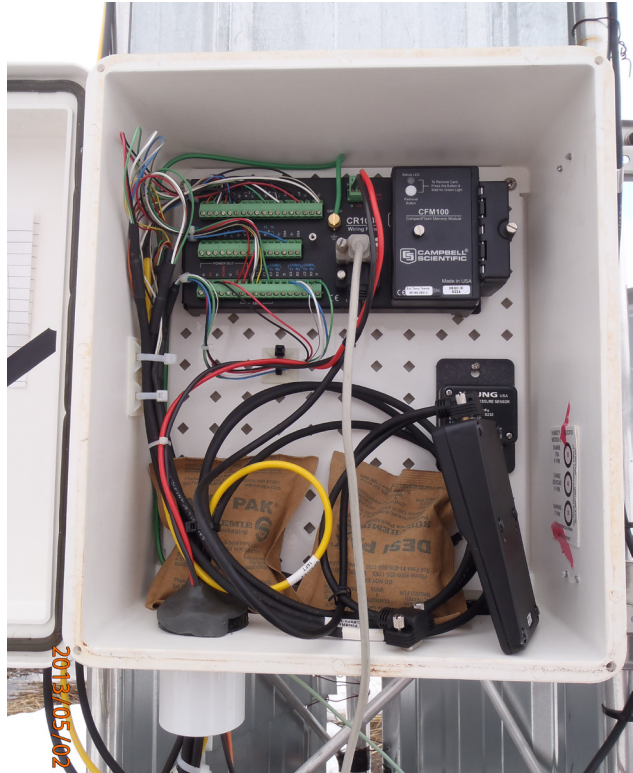
Murray River Coal Project: 2011 to 2013 Meteorology Baseline Report

MURRAY RIVER COAL PROJECT

Application for an Environmental Assessment Certificate / Environmental Impact Statement

HD Mining International Ltd.

MURRAY RIVER COAL PROJECT 2011 to 2013 Meteorology Baseline Report



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MURRAY RIVER COAL PROJECT 2011 TO 2013 METEOROLOGY BASELINE REPORT

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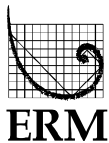
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Prepared for:



HD Mining International Ltd.

Prepared by:



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Vancouver, British Columbia

Executive Summary

Executive Summary

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia (see Figure 1-1), and consists of 57 coal licences covering an area of 16,024 hectares. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal mining, mainly from open pit mining. HD Mining is proposing to access deeper zones of the coal field (600 to 1,000 m below surface) through underground mining techniques.

To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by ERM Rescan. Project-specific studies began in 2010 and have continued through 2013. As appropriate and available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into the analysis.

This report presents a cumulative summary of all meteorological information compiled for the Project to date. Site-specific meteorological data are required for future Project planning and environmental assessment. Wind speed and direction data are usually required to select sites for stockpiles and processing facilities to accommodate predominant wind patterns and mitigate the effects of fugitive dust. Wind and air temperature data are required for predicting dispersion of air contaminants during the environmental impact assessment to determine the Project's potential air quality effects. Solar radiation and precipitation data are required for design of water management infrastructure and water balance calculations.

The region is frequently influenced by moist air from the Pacific as well as drier continental air, as it is very close to the leeward side of the Rocky Mountains' Hart Ranges. The topography of the region plays a large role in the Project's climate as precipitation, air temperature, snow depth, and wind speed and direction are highly variable within the region.

The mean daily maximum summer temperatures are above 15°C and the mean daily minimum winter air temperature falls well below -10°C. Based on the approximately 34 month reporting period (March 9, 2011 to December 31, 2013), the extreme maximum air temperature recorded at the Project's Murray River meteorological station (1,055 m) was 30.7°C (July 1, 2013) and the extreme minimum air temperature was -36.3°C (January 17, 2012).

The orographic influence due to mountains within the Regional Study Area, as well as the inflow of moist air from the Pacific meeting with drier a continental air mass, means that precipitation is highly variable over the Project Area. Total precipitation amounts, in 2013, at the Murray River station were higher than the total amounts recorded at the regional EC meteorological stations, Chetwynd A and Dawson Creek A which were 484.7 and 399.5 mm respectively. Total precipitation amounts at Murray River in 2013 were higher than all but one of the regional stations with climate normal data.

Snow depth data from regional stations typically ranged from 5 to 43 cm between November and March. Snow depth is highly dependent on elevation. In 2011, 2012 and 2013 the deepest snow was in November (28 cm), December (57 cm) and March (90 cm), respectively. Historically, the deepest snow was observed in February. The greatest snow depth observed at Murray River meteorological station was 90 cm on March 14, 2013 at elevation 1,055 masl.

Strong winds occur in all seasons at high elevations in the Project area, with flow predominantly from the south. Winds at low elevations are funnelled through the valleys with a light to moderate flow, again, predominantly from the south. Based on a 24 month (March 9, 2011 to March 9, 2013) dataset from the Murray River meteorological station, 1 to 2 m/s winds were the most frequent occurring 33% of the time. The frequency of calm winds was 17%, and winds over 6 m/s occurred approximately 2% of the time. The maximum gust speed recorded was 19.7 m/s (70.9 km/h) on April 8, 2011.

The highest recorded daily average solar radiation since the installation of the Project meteorological station, 353 W/m², was recorded on June 21, 2011. On average, the lowest and highest mean daily solar radiation occurs during the winter and summer, respectively. This is because the sun is lowest on the horizon during the winter and highest during the summer. The large differences in day-to-day values of mean daily solar radiation are due to differences in cloud cover. All hourly average solar radiation values recorded during night time hours were 0 W/m².

Daily barometric pressure at Murray River station remained between 98.6 and 102.7 kPa for the record period. Daily relative humidity ranged from 25 to 99%, and monthly average relative humidity ranged from 50.6 to 81.3%.

Acknowledgements

Acknowledgements

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MURRAY RIVER COAL PROJECT

2011 TO 2013 METEOROLOGY BASELINE

REPORT

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Glossary and Abbreviations

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

Climate normal	Meteorological data averaged over a timespan of at least 15 years, between 1971 to 2000.
Wind gust	The gust is the maximum or peak instantaneous single reading from the anemometer (the instrument used to observe wind speed). The duration of a gust typically corresponds to an elapsed time of 3 to 5 seconds.
MSC	Meteorological Service of Canada; a division of Environment Canada
Precipitation	Liquid or solid products of the condensation of water vapour falling from clouds, which include rain, sleet, hail, snow, and other forms of water.
Convective Weather System	A weather system driven by rising heat. Includes thunderstorms, squall lines, lake-effect snow, tropical cyclones, etc.
Mtpa	Million tonne per annum
PRC	Peace River Coalfield
HD Mining	HD Mining International Ltd.
The Project	Murray River Coal Project
Rescan	Rescan Environmental Services Ltd.
RSA	Regional study area
LSA	Local study area
BC MoE	British Columbia's Ministry of Environment
Extraterrestrial Solar Radiation	The Solar radiation incident on top of the terrestrial atmosphere
Energy Deficit	Total solar radiation absorbed from the Earth's surface is less than the heat radiated back out of space.
Energy Surplus	Total solar radiation absorbed from Earth's surface is greater than the heat radiated back out of space.
Solar radiation	The electromagnetic energy of the sun, of which 97% is confined to the spectral range 0.29 to 3.0 microns.
masl	Metres above sea level
WMO	World Meteorological Organization
kPa	Kilo Pascals

1. Introduction

1. Introduction

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia (Figure 1-1), and consists of 57 coal licences covering an area of 16,024 hectares. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal mining, mainly from open pit mining. HD Mining is proposing to access deeper zones of the coal field (600 to 1,000 m below surface) through underground mining techniques.

In October 2011, HD Mining submitted an application to the BC Ministry of Energy and Mines and Ministry of Environment seeking permission to complete a bulk sampling program as part of exploration of the property. In March 2012, HD Mining received approval to conduct a 100,000 tonne bulk sample for the purpose of conducting testing to assist in developing markets for the coal.

Beyond the bulk sample program, in order to develop a full mine at the proposed 6 Mtpa, the Project is subject to both the BC and Canadian environmental assessment processes. Development of any infrastructure for the full mine is not permitted before the requirements of these processes are met.

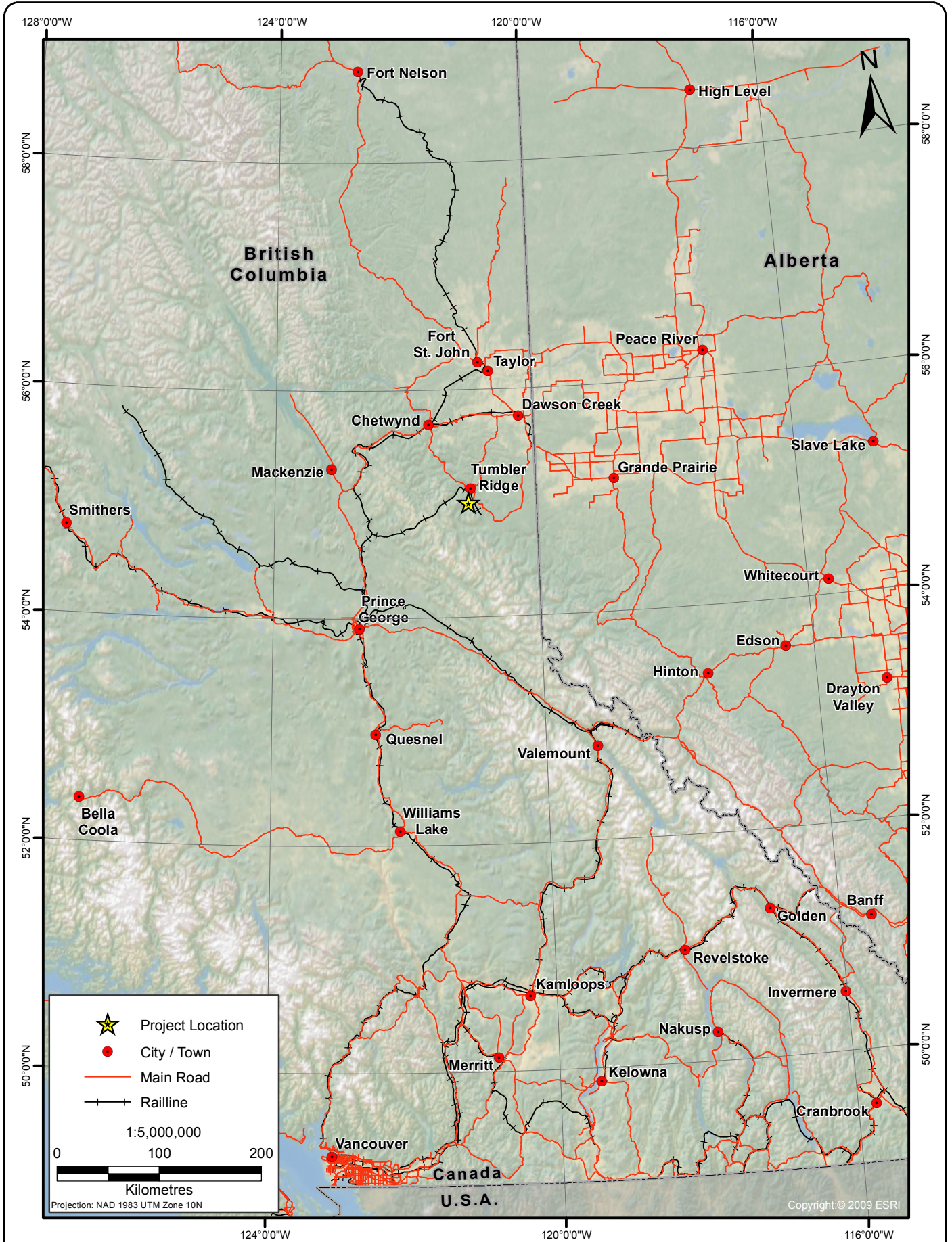
To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by ERM Rescan. Project-specific studies began in 2010 and have continued through 2013. As appropriate and available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into the analysis.

In order to help guide the scope of baseline studies, regional and local study areas (RSA and LSA, respectively) have been developed (Figures 1-2 and 1-3). The RSA is intended to encompass an area beyond which effects of the Project would not be expected. It is also intended to be ecologically relevant based on the home range of key wildlife species known to inhabit the region. The LSA encompasses an area surrounding the proposed Project infrastructure within which direct effects from the Project may be anticipated. Its boundary has also been developed following natural terrain and drainage boundaries in order to be ecologically relevant.

Site-specific meteorology data are required for future Project planning and environmental assessment. Wind speed and direction data are required to select sites for stockpiles and processing facilities to accommodate predominant wind patterns and mitigate the effects of fugitive dust. Wind and air temperature data are required for predicting dispersion of air contaminants during the environmental impact assessment to determine the Project's potential air quality effects. Solar radiation and precipitation data are required for design of water management infrastructure and water balance calculations.

The main objective of the meteorology baseline program was to document baseline meteorology conditions to a suitable level of detail to support the Project planning, engineering, and environmental assessment. There are two main study components to meet this objective:

- collection of site specific meteorological data, including air temperature, precipitation, snow depth, wind speed and direction, solar radiation, barometric pressure and relative humidity;
- and assessment of climate using climate normal data from suitable meteorological stations in the region, operated by the Meteorological Service of Canada (MSC).



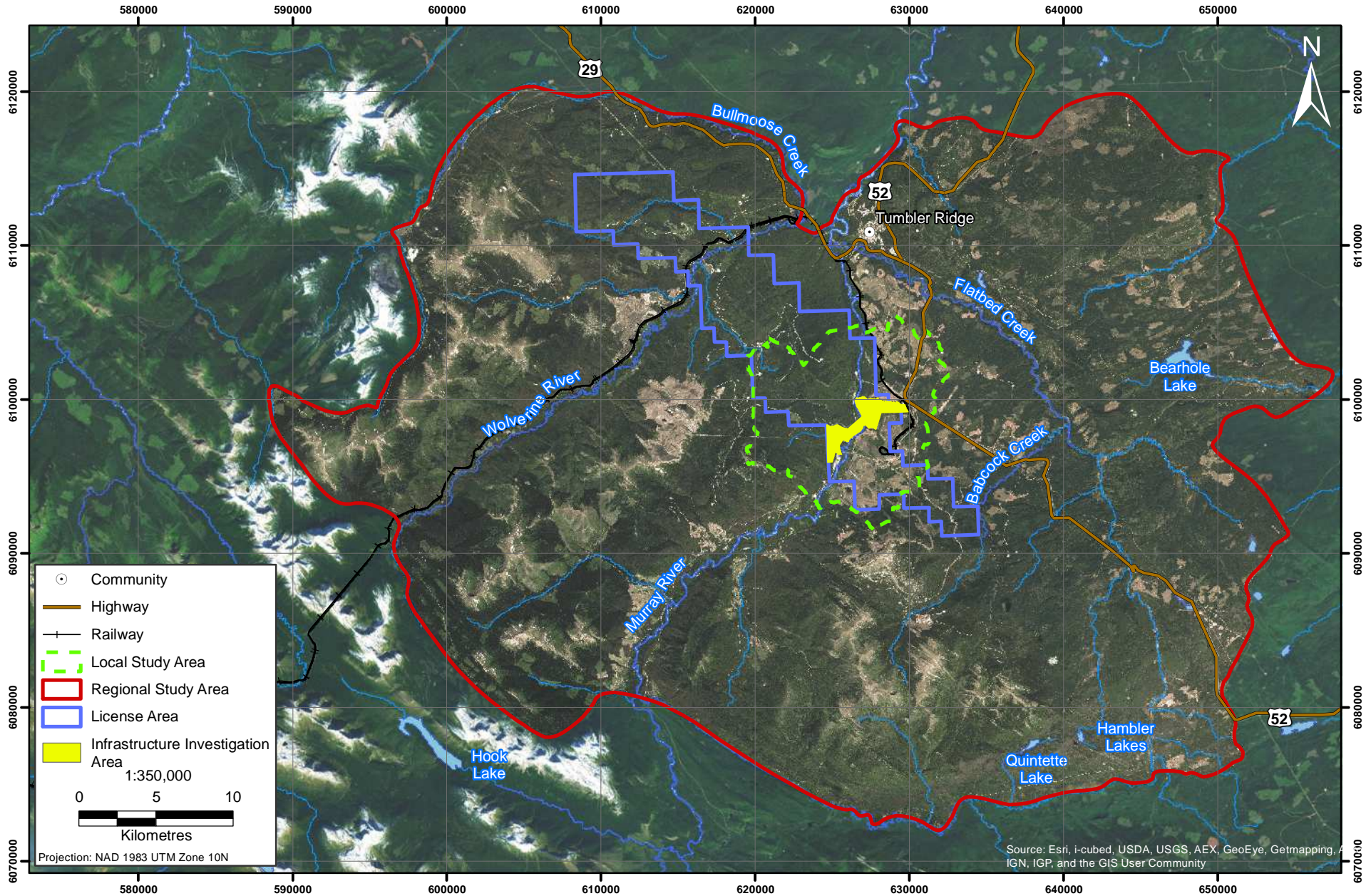


Figure 1-2



MURRAY RIVER COAL PROJECT

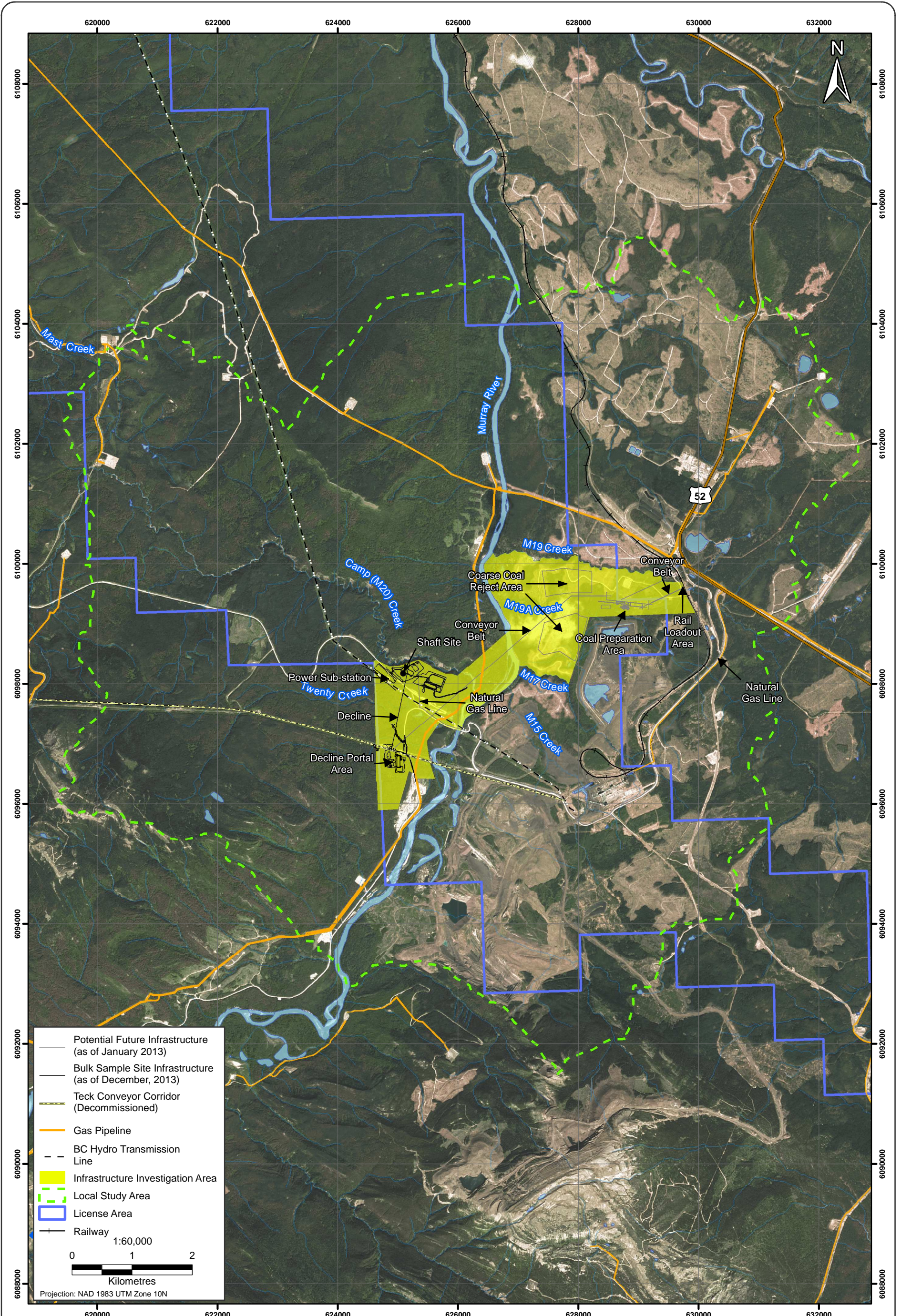
Project Study Boundaries

Figure 1-2



The Murray River station will continue to collect data in order to build a historical meteorological database for the Project, and to continue to support other disciplines in the future.

The following chapters outline the available background information that supports the study (Chapter 2); a description of the methods and rationale used to identify sites and collect Project specific data (Chapter 3); the results of data collection (Chapter 4); and a summary that synthesizes the key findings of the baseline program (Chapter 5).



2. Background Information

2. Background Information

2.1 APPLICABLE STANDARDS

According to the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC MOE 2011), “the better the baseline data (e.g., long record, appropriate siting, instrumentation and QA/QC, relevant parameters measured), the more certainty there will be in understanding the relationship between a project and air quality, meteorology and climate.” To ensure that results collected were of high quality, the meteorological station was installed in accordance with guidelines developed by the MSC (MSC 2004). These guidelines closely follow standards set by the World Meteorological Organization (WMO; 1983) and were established to promote standardization and describe practices, procedures, and specifications for proper siting of instruments, precision and accuracy of measurements, and archive formats. As suggested by the BC MOE 2011, the data collected are also verified following steps outlined by the US EPA (US EPA 2006).

2.2 LITERATURE REVIEW

The MSC reports climate normals from select weather stations throughout Canada. Data from the closest stations with climate normals were compared to the Murray River meteorological station data and were used to define the long-term averages of climate in the area.

3. Methodology

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3.1 AUTOMATED METEOROLOGICAL STATION

The Murray River meteorological station was installed on March 8, 2011 (Plates 3.1-1 and 3.1-2) in a laydown area beside the Mast Road near kilometre four. Data collection at this station commenced on March 9, 2011. The location of the Project meteorological station is provided in Figure 3.1-1.



Plate 3.1-1. Facing south east, the Murray River meteorological station, March 8, 2011.



Plate 3.1-2. Facing south, the Murray River meteorological station, October 19, 2012.

The station was installed in accordance with guidelines developed by the MSC (MSC 2004). These guidelines closely follow standards set by the WMO (1983) and were established to promote standardization and describe practices, procedures, and specifications for proper siting of instruments, precision and accuracy of measurements, and archive formats.

The Murray River station consists of a standard 10 metre meteorological tower with instrumentation to measure the following parameters:

- air temperature;
- precipitation;
- snow depth;
- wind speed and direction;
- solar radiation;
- barometric pressure; and
- relative humidity.

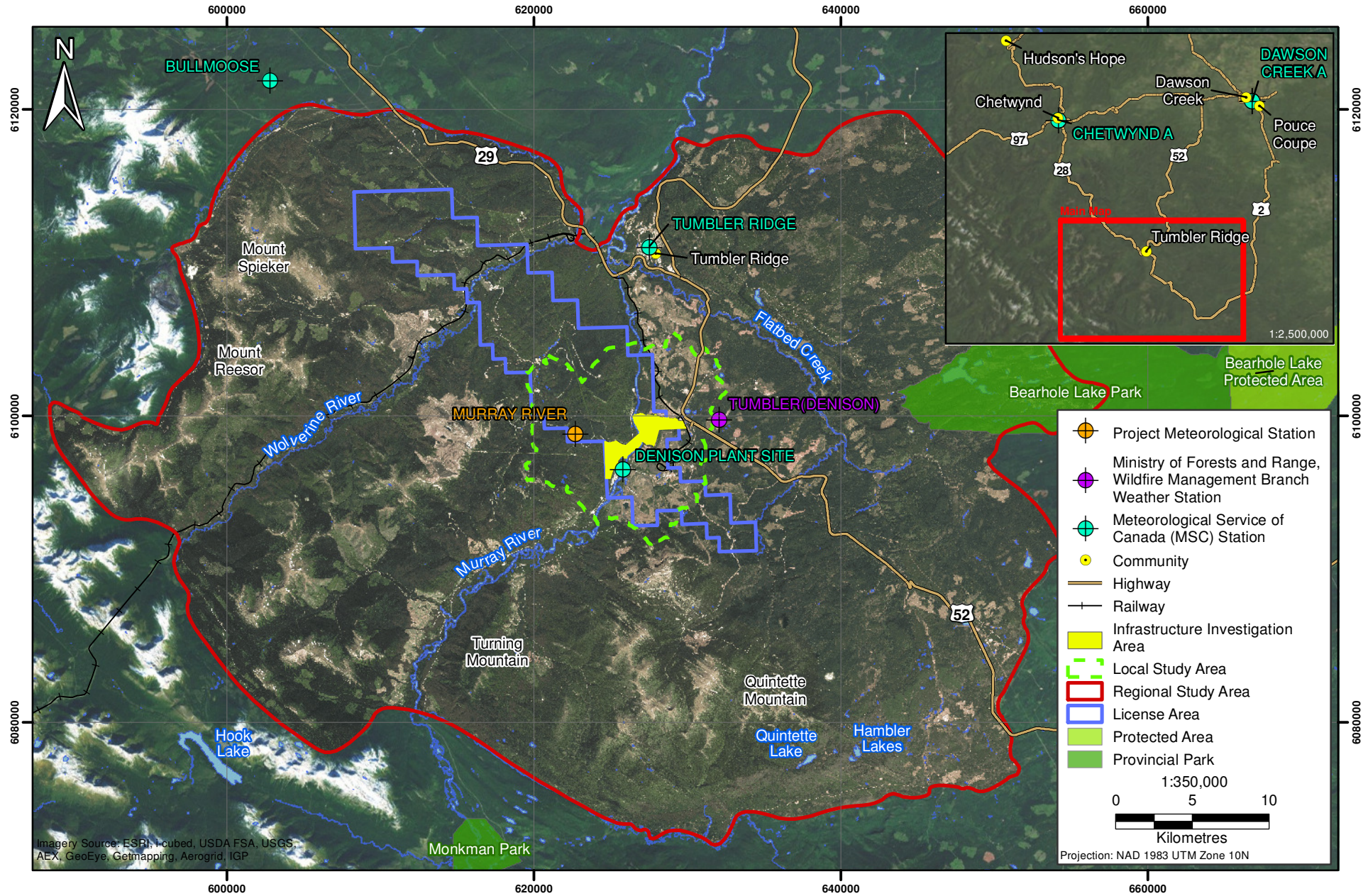


Figure 3.1-1



MURRAY RIVER COAL PROJECT

Locations of the Murray River and Regional Meteorological Stations

Figure 3.1-1



The station is powered by a 12 volt DC battery and a 30 watt solar panel. Station data is recorded to a Campbell Scientific CR1000-XT data logger every 5 seconds and saved on a compact flash module at hourly intervals. The data are regularly downloaded from the datalogger using a laptop computer in the field or by replacing the storage module attached to the datalogger with a second unit to allow downloading of the module offsite. Meteorological baseline data included in this report are from March 9, 2011 to December 31, 2013.

The sensors are mounted on a 10 m high aluminum tower which is drilled into a concrete pad. Three guy wires were installed to further stabilize the tower and prevent swaying under heavy winds. The wind anemometer is situated near the top of the tower, below the lightning rod. The remaining instrumentation is located lower on the tower, between 3 and 4.4 m off the ground. The tipping bucket rain gauge is mounted on a 1.5 m pole, approximately 4.6 m from the base of the main tower. A CS705 winter precipitation adapter is installed in the fall to collect precipitation that falls as snow, and is removed in the spring. Table 3.1-1 list the sensors operating on the Murray River station and the parameters that they monitor.

Table 3.1-1. Sensors and Variables Measured at the Murray River Meteorological Station

Variable	Sensor	Serial Number	Manufacturer
Air Temperature & Relative Humidity	HMP45C212 Temperature & Relative Humidity Probe	n/a	Vaisala
Precipitation	TE525WS Tipping Bucket Rain Gauge	42178-909	Texas Instruments
Snow Depth	SR50A Sonic Ranger 50 kHz Ultrasonic Snow Depth Sensor	n/a	Campbell Scientific Inc.
Wind Speed & Direction	05305-10A Air Quality Wind Speed/Direction Sensor	WM100796	R. M. Young Company
Solar Radiation	SP Lite2 Silicon Pyranometer	102292	Kipp & Zonen
Barometric Pressure	61302V Barometer	BPA1628	R. M. Young Company
n/a	CR1000-XT Datalogger	n/a	Campbell Scientific Inc.
n/a	CFM100-XT Compact Flash Module	n/a	Campbell Scientific Inc.

n/a = not available or not applicable

3.2 REGIONAL DATA

Several meteorology stations, operated by MSC, were located in the Murray River regional area; however, most stations are currently inactive. Data from the active stations have also been included in this report to show the regional climate and to compare to the Murray River station data (EC 2014).

Table 3.2-1 lists the regional meteorological stations operated by MSC. The locations of these stations are shown in Figure 3.1-1. The regional stations with a long period of record provide a good comparison for the data collected by the Murray River meteorological station. Available climate normals from the region, which summarize the average climatic conditions, are compared to data collected from the Project meteorological station. Climate normals are based on meteorological stations with at least 15 years of data between 1981 and 2010. Climate normal data for the regional stations used in this analysis (Bullmoose and Chetwynd A) are provided in Appendix 1.

Table 3.2-1. Automated Weather Stations in the Region

Station Name	Location			Time Period	Meteorological Parameters	Status
	Climate ID	(Lat., Long., Elevation)	Distance from Murray River Station			
Murray River	n/a	55.02° N 121.08° W 1,055 masl	n/a	3/9/2011 to 12/31/2013	Air Temperature Precipitation Snow Depth Wind Speed and Direction Solar Radiation Barometric Pressure Relative Humidity	Active
Denison Plant Site	1182427	55° N 121.03° W 854 masl	3.8 km southeast	7/1/1982 to 5/31/1997	Air Temperature Precipitation Snow Depth	Inactive
Tumbler Ridge	1188297	55.13° N ^a 121.01° W ^a 824 masl	13.2 km north northeast	3/1/1985 to 3/31/2003 Climate Normals ^b	Air Temperature Precipitation Snow Depth	Inactive
Bullmoose	1181120	55.13° N 121.48° W 1,102 masl	25.8 km northwest	1981 - 2010 Climate Normals	Air Temperature Precipitation Snow Depth	Inactive
Chetwynd A	1181508	55.69° N 121.63° W 610 masl	81.9 km north west	1981 - 2010 Climate Normals and 2011, 2012 and 2013	Air Temperature Precipitation Snow Depth Wind Speed and Direction	Active
Dawson Creek A	1182289	55.74° N 120.1° W 656 masl	98 km north east	2011, 2012 and 2013	Air Temperature Precipitation Wind Speed and Direction	Active
Tumbler (Denison)	n/a	55.03° N 120.93° W 942 masl	9.5 km east	1982-2013	Air Temperature Relative humidity Wind Speed and Direction Precipitation	Active

^a The MSC's reported position of Tumbler Ridge station is incorrect based on knowledge from previous studies. The listed position is an estimate of the correct location based on the location of the town of Tumbler Ridge and its topography.

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normal.

The five MSC stations were selected because of their proximity to the Project. Each regional station measured air temperature, precipitation and snow depth. Note that Tumbler Ridge meteorological station commenced operation in 1985 and ceased in 2003. EC did not publish climate normal for Tumbler Ridge meteorological station; however, data collected from 1985 to 2002 were calculated in the same fashion to represent long term climate at this location. The closest MSC station with wind data was Chetwynd A; however, it is located the furthest from the Murray River station, at a distance of approximately 82 km.

Tumbler (Denison) station, managed by the BC Ministry of Forest, Lands, and Natural Resources Operations - Wild Fire Management Branch, is the closest station to the Project station that is still active (E. Meyer pers. com. 2013). The data is given the same QAQC process by Rescan personnel as the Murray River Meteorological station data.

Due to the mountainous terrain of the region, meteorological conditions can vary significantly spatially. It is important to use meteorological data that is as close to the Project as possible, located in comparable terrain and at a similar elevation, in order to get the best representation of the Project's climate. Three of the MSC stations were located within, or close to the border of the RSA.

4. Results

4. Results

The baseline data collected from March 9, 2011 to December 31, 2013 for air temperature, precipitation, snow depth, wind speed and direction, solar radiation, barometric pressure and relative humidity are presented in this section and summarized in Tables 4-1, 4-2 and 4-3. Appendix 2 presents the daily mean, maximum and minimum air temperature, as well as total daily precipitation for the Murray River meteorological station for the period of record.

4.1 AIR TEMPERATURE

Figure 4.1-1 summarizes the daily mean, maximum and minimum air temperatures at the Murray River meteorological station from March 9, 2011 to December 31, 2013. The monitored air temperatures at Murray River follow a similar pattern to those at the regional stations during 2011, 2012 and 2013.

Tables 4.1-1 through 4.1-9, and Figures 4.1-2, 4.1-3 and 4.1-4 present the mean, maximum and minimum monthly air temperatures at the Murray River and regional meteorological stations for the periods of March 9 to December 31, 2011; January 1 to December 31, 2012 and January 1 to December 31, 2013. The mean monthly air temperatures for the Murray River station ranged from a low of -10.6°C in December 2013 to a high of 14.5°C for August 2013. The mean monthly maximum air temperatures for the Murray River station ranged from a low of -4.7°C in December 2013 to a high of 20.8°C in August 2013. The mean monthly minimum air temperatures for the Murray River station ranged from a low of -15.9°C in December 2013 to a high of 8.8°C in August 2013.

Murray River temperatures were generally similar to or slightly lower than climate normals recorded at regional stations. This is probably due to the Murray River meteorology station being at a higher altitude (i.e. 200 to 400 m higher) than the regional stations which are located in valley bottom settings. Tumbler (Denison) station, due to the close proximity and similar elevation, is the most comparable station. Mean monthly temperatures for all years the Project station has been operational are very similar to the averages at the Tumbler (Denison) station, and for this reason the station is a great source of local historical temperature data.

Table 4.1-10 presents the extreme temperature values recorded at the Murray River and Regional meteorological stations. Including all years of data at the Murray River meteorological station, the extreme mean daily maximum air temperature of 30.7°C was recorded on July 1, 2013, and the extreme mean daily minimum air temperature recorded was -36.3°C on January 17, 2012.

4.2 PRECIPITATION

Precipitation varies greatly in the province of BC due to the orographic influence of the mountains, which act as a natural barrier to clouds carrying precipitation. Precipitation in the region typically falls as rain from May to September and as snow for the remaining months of the year.

Daily total precipitation from March 9, 2011 to December 31, 2013 is presented in Figure 4.2-1. Tables 4.2-1, 4.2-2 and 4.2-3 summarize the average monthly precipitation for the Murray River meteorological station in 2011, 2012 and 2013 respectively. They also summarize the monthly precipitation recorded at the regional meteorological stations. Annual precipitation measured at the Murray River meteorological station (elevation 1055 m) ranged from 387.4 mm in 2011, 484.6 mm in 2012 and 583.2 mm in 2013.

Table 4-1. Murray River Meteorological Station, Monthly Summary for 2011

Date (mm-yy)	Average Temperature (°C)	Mean Daily Minimum Temperature (°C)	Mean Daily Maximum Temperature (°C)	Average Relative Humidity (%)	Total Precipitation (mm)	Average Solar Radiation (W/m ²)	Average Wind Speed (m/s)	Maximum Wind Gust (m/s)	Time of Maximum Hourly Wind Speed (mm/dd/yyyy hh:mm)	Snow Depth (cm)	Barometric Pressure (kPa)
Mar-11 ^a	-4.4	-8.9	0.6	80.7	27.9	98	1.5	14.5	3/30/11 5:16 PM	15.7	100.5
Apr-11	0.9	-3.8	5.3	63.4	0.0	196	2.4	19.7	4/8/11 6:25 AM	5.9	100.7
May-11	7.7	2.0	13.1	66.9	66.6	199	1.9	13.1	5/4/11 7:01 AM	0.3	101.1
Jun-11	10.7	5.5	15.6	67.9	97.5	204	2.0	14.6	6/30/11 6:48 AM	0.0	100.9
Jul-11	12.1	8.5	16.2	70.0	121.2	199	2.4	15.5	7/15/11 12:52 PM	0.0	101.0
Aug-11	13.1	7.3	18.3	57.7	6.6	223	2.6	16.1	8/24/11 10:21 AM	0.0	101.1
Sep-11	10.7	5.2	16.0	62.0	4.1	146	2.5	16.7	9/27/11 7:23 AM	0.0	101.1
Oct-11	3.3	0.3	6.6	72.1	0.3	68	2.4	15.6	10/9/11 10:01 AM	1.6	100.9
Nov-11	-4.9	-8.6	-1.4	75.8	23.4	31	2.5	18.2	11/2/11 12:26 AM	15.5	100.3
Dec-11	-2.2	-5.9	1.2	70.9	39.9	19	3.0	20.8	12/1/11 1:53 PM	24.1	100.9
Average	5.6	0.2	9.2	68.7	38.7	138	2.3	16.5	n/a	6.3	100.9
Max	13.1	8.5	18.3	80.7	121.2	223	3.0	20.8	n/a	24.1	101.1
Min	-4.9	-8.9	-1.4	57.7	0.0	19	1.5	13.1	n/a	0.0	100.3
Total	n/a	n/a	n/a	n/a	387.4	n/a	n/a	n/a	n/a	n/a	n/a

^a Murray River station was not operational until March 9, 2011

Table 4-2. Murray River Meteorological Station, Monthly Summary for 2012

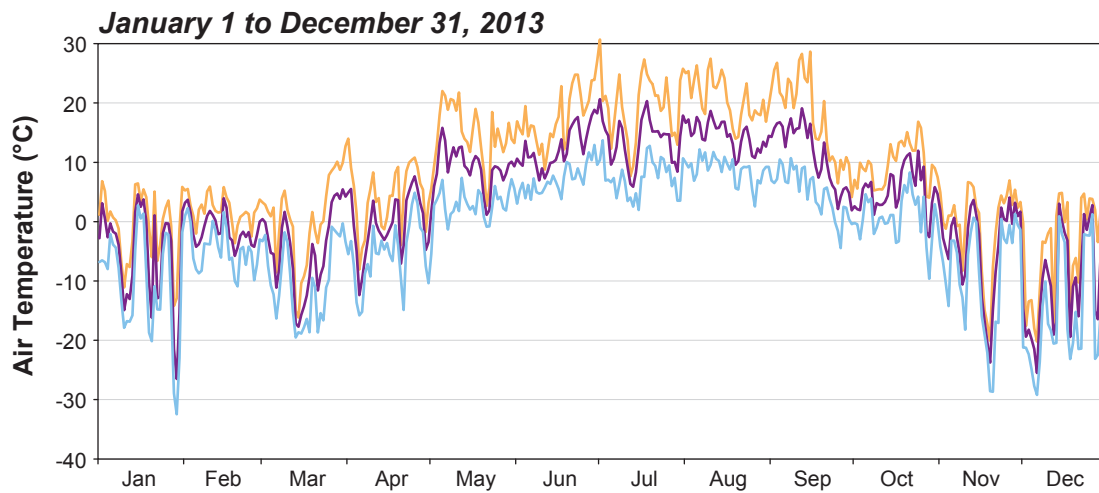
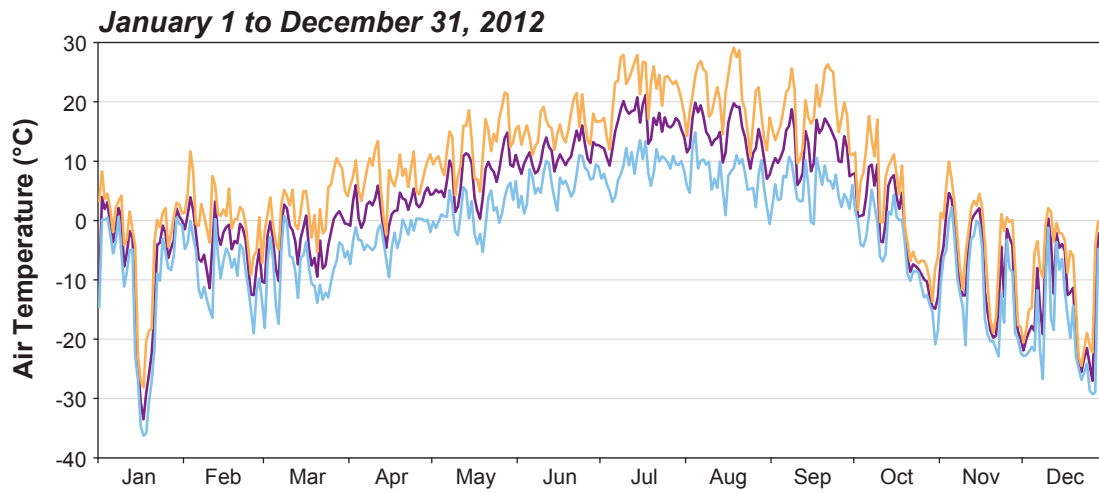
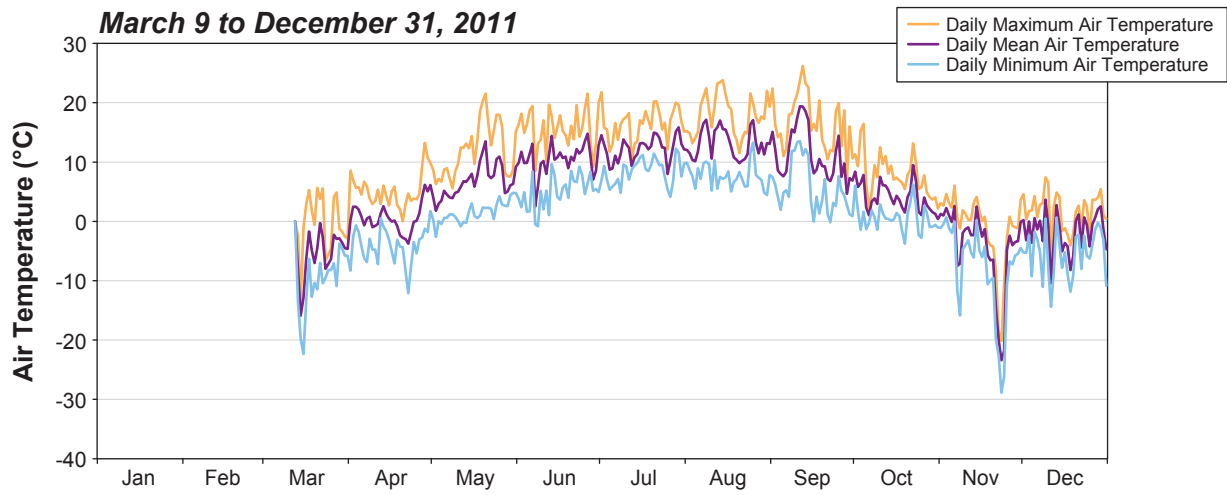
Date (mm-yy)	Average Temperature (°C)	Mean Daily Minimum Temperature (°C)	Mean Daily Maximum Temperature (°C)	Average Relative Humidity (%)	Total Precipitation (mm)	Average Solar Radiation (W/m ²)	Average Wind Speed (m/s)	Maximum Wind Gust (m/s)	Time of Maximum Hourly Wind Speed (mm/dd/yyyy hh:mm)	Snow Depth (cm)	Barometric Pressure (kPa)
Jan-12	-7.7	-11.2	-3.8	73.4	m	24	2.9	16.9	1/27/12 10:51	30.0	100.5
Feb-12	-4.2	-8.7	0.6	69.3	m	73	1.8	16.2	2/21/12 9:25	35.1	101.0
Mar-12	-3.2	-8.3	2.4	67.3	32.8	119	2.3	16.8	3/9/12 15:19	34.2	100.0
Apr-12	2.3	-2.8	7.4	64.3	10.2	172	1.9	14.7	4/27/12 12:01	20.1	100.9
May-12	7.5	1.4	12.7	50.6	19.6	252	2.6	17.0	5/11/12 7:00	0.1	101.1
Jun-12	11.2	6.5	15.7	64.9	90.9	203	2.1	15.6	6/26/12 8:38	0.0	100.8
Jul-12	16.1	9.0	22.4	58.5	67.6	254	2.0	12.9	7/10/12 14:43	0.0	101.3
Aug-12	14.2	7.3	20.7	61.0	32.5	204	2.2	15.3	8/8/12 17:51	0.0	101.3
Sep-12	12.3	5.5	18.4	51.3	3.6	164	2.5	15.2	9/2/12 10:18	0.0	101.4
Oct-12	-1.7	-5.4	2.2	81.3	119.4	55	1.6	17.2	10/14/12 23:21	6.3	101.1
Nov-12	-7.5	-11.0	-3.5	78.8	64.8	23	1.4	17.4	11/5/12 1:29	23.9	100.9
Dec-12	-12.9	-17.3	-8.9	77.3	43.4	13	1.6	17.0	12/13/12 3:59	48.9	100.4
Average	2.2	-2.9	7.2	66.5	48.5	130	2.1	16.0	n/a	16.6	100.9
Max	16.1	9.0	22.4	81.3	119.4	254	2.9	17.4	n/a	48.9	101.4
Min	-12.9	-17.3	-8.9	50.6	3.6	13	1.4	12.9	n/a	0.0	100.0
Total	n/a	n/a	n/a	n/a	484.6	n/a	n/a	n/a	n/a	n/a	n/a

Table 4-3. Murray River Meteorological Station, Monthly Summary for 2013

Date (mm-yy)	Average Temperature (°C)	Mean Daily Minimum Temperature (°C)	Mean Daily Maximum Temperature (°C)	Average Relative Humidity (%)	Total Precipitation (mm)	Average Solar Radiation (W/m ²)	Average Wind Speed ^a (m/s)	Maximum Wind Gust ^a (m/s)	Time of Maximum Hourly Wind Speed ^a (mm/dd/yyyy hh:mm)	Snow Depth (cm)	Barometric Pressure (kPa)
Jan-13	-5.6	-10.5	-0.8	70.6	8.6	26	2.0	17.0	1/17/2013 9:26	42.2	101.0
Feb-13	-1.2	-4.6	2.0	71.9	22.6	58	2.3	16.0	2/11/2013 9:17	41.6	100.7
Mar-13	-4.7	-10.1	0.6	66.2	9.7	113	1.6	12.8	3/9/2013 22:47	64.5	101.1
Apr-13	-0.4	-5.5	4.2	64.9	45.7	162	n/a	n/a	n/a	45.3	101.1
May-13	9.0	2.9	14.6	61.0	64.0	217	n/a	n/a	n/a	0.6	101.3
Jun-13	12.4	7.1	17.7	66.7	71.1	208	n/a	n/a	n/a	0.0	101.2
Jul-13	13.7	7.5	19.6	67.7	88.1	214	n/a	n/a	n/a	0.0	101.4
Aug-13	14.5	8.8	20.8	70.6	76.5	184	n/a	n/a	n/a	0.0	101.2
Sep-13	11.4	4.9	17.7	66.3	33.0	146	n/a	n/a	n/a	0.0	100.7
Oct-13	5.3	0.8	9.7	69.9	53.3	69	1.5	13.3	10/9/13 11:02	0.0	101.3
Nov-13	-4.1	-8.8	-0.5	76.2	39.4	28	1.9	18.0	11/14/13 18:06	6.2	101.0
Dec-13	-10.6	-15.9	-4.7	81.0	71.1	13	1.8	18.5	12/17/13 7:33	23.5	101.1
Average	3.3	-2.0	8.4	69.4	48.6	120	1.9	15.9	n/a	0.2	101.1
Max	14.5	8.8	20.8	81.0	88.1	217	2.3	18.5	n/a	0.6	101.4
Min	-10.6	-15.9	-4.7	61.0	8.6	13	1.5	12.8	n/a	0.0	100.7
Total	n/a	n/a	n/a	n/a	583.2	n/a	n/a	n/a	n/a	n/a	n/a

n/a = not available or not applicable

^a*The anemometer (wind monitor) was damaged on March 12 till October 10, 2013 when it was replaced.*



Note: The Murray River station was not operation until March 9, 2011.

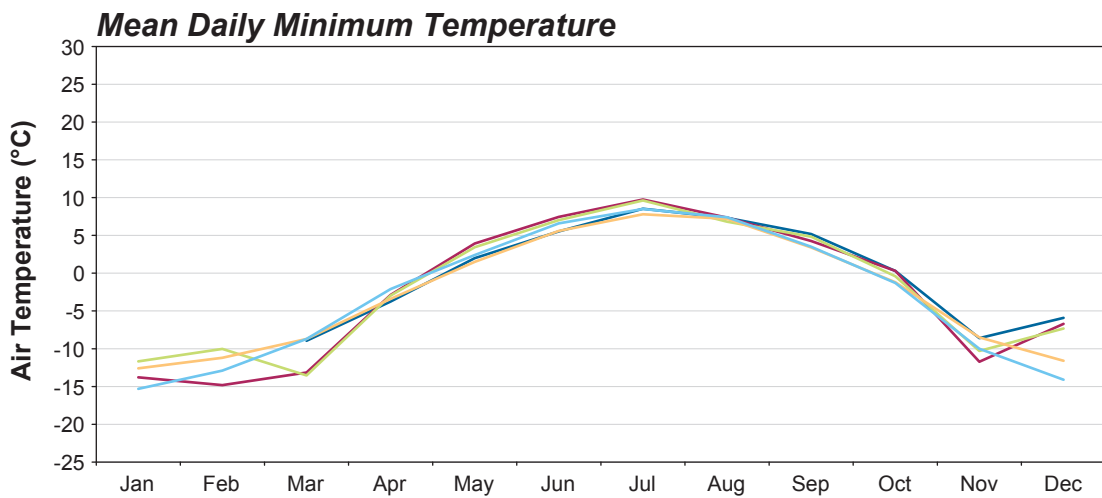
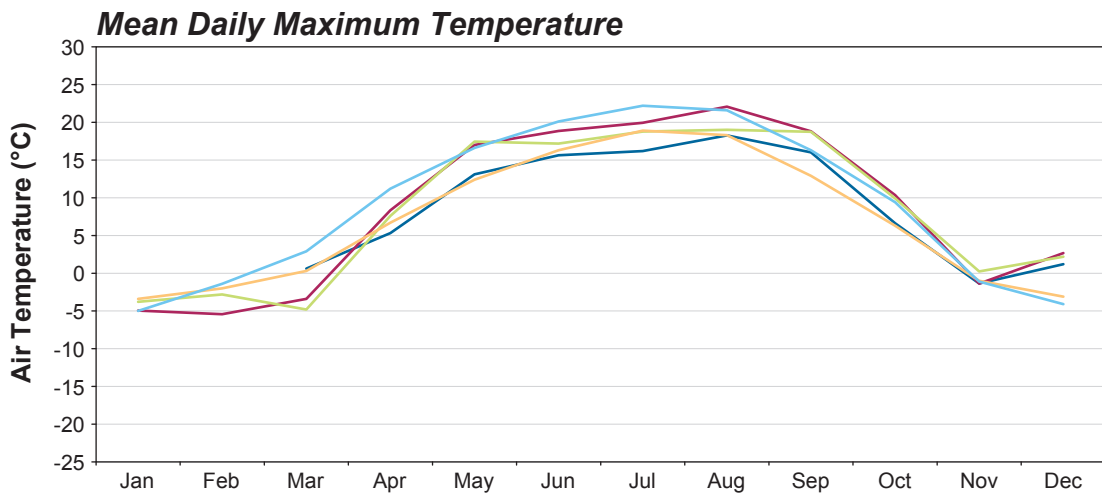
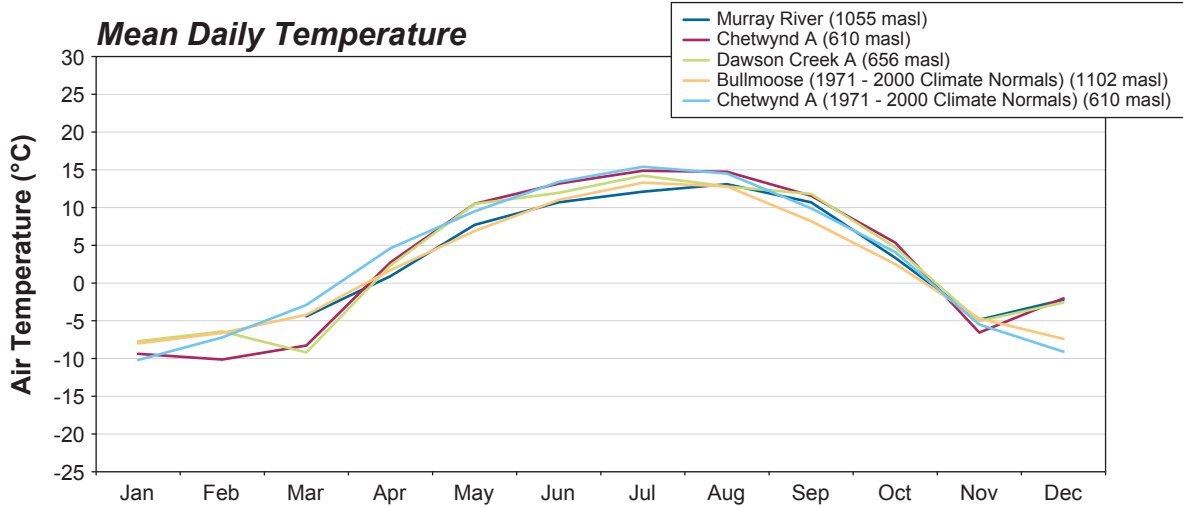


Figure 4.1-2

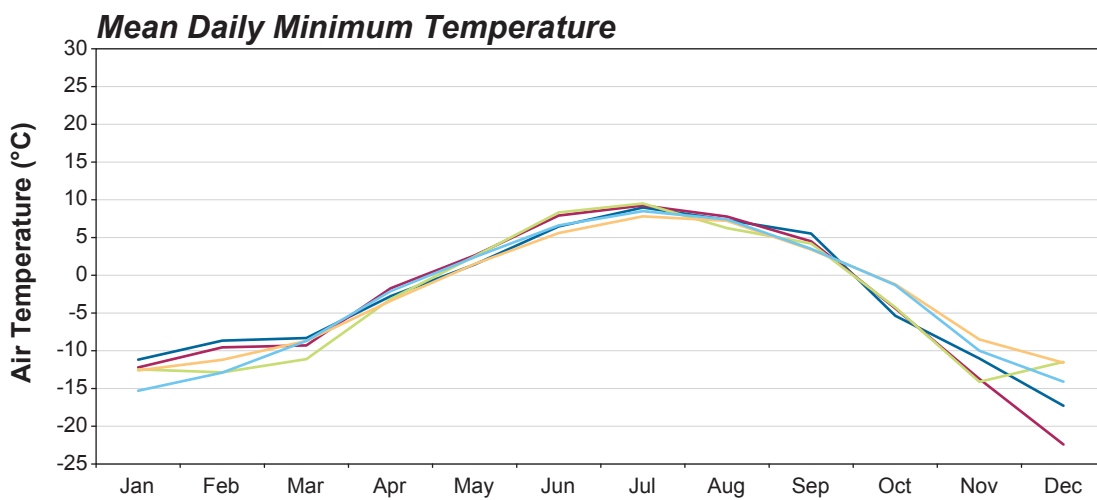
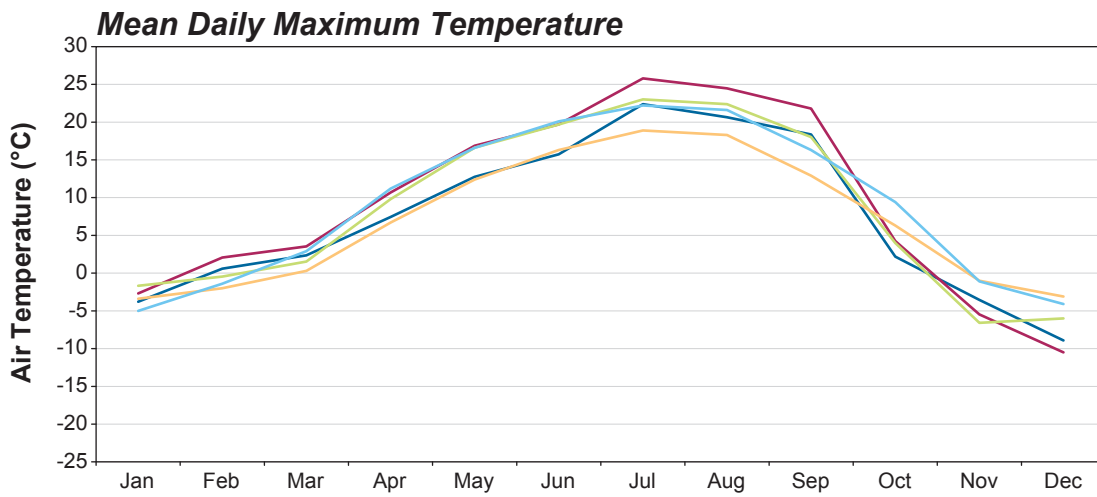
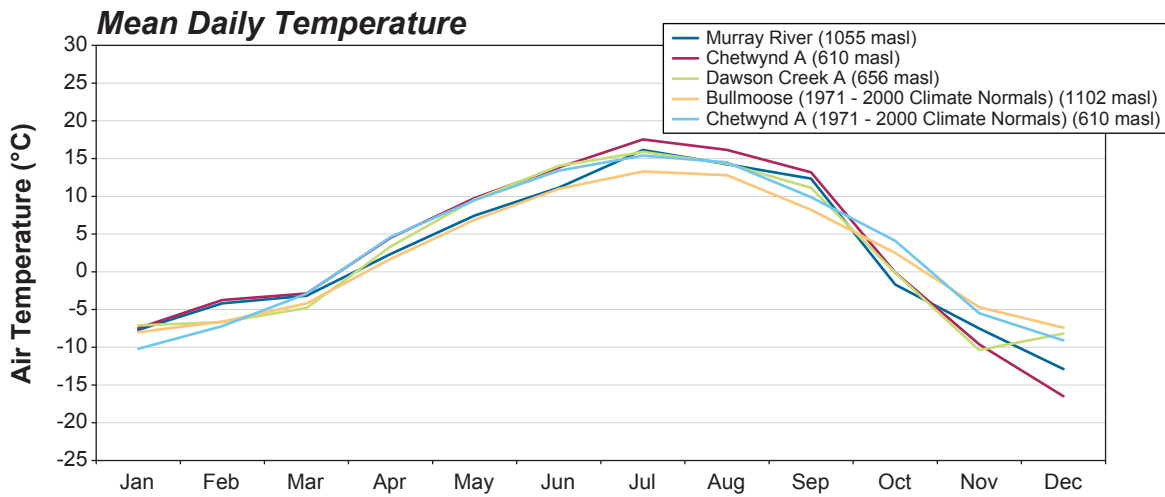


Figure 4.1-3

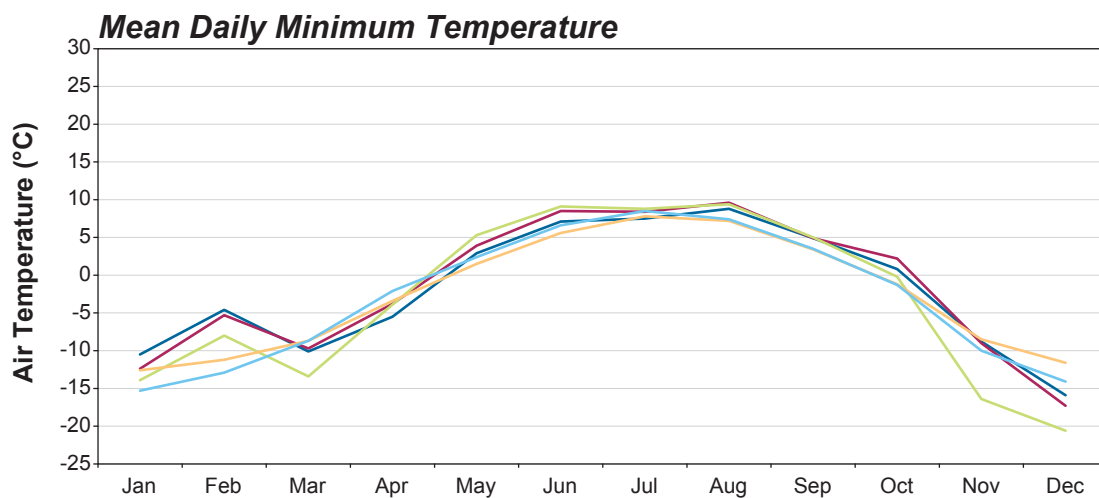
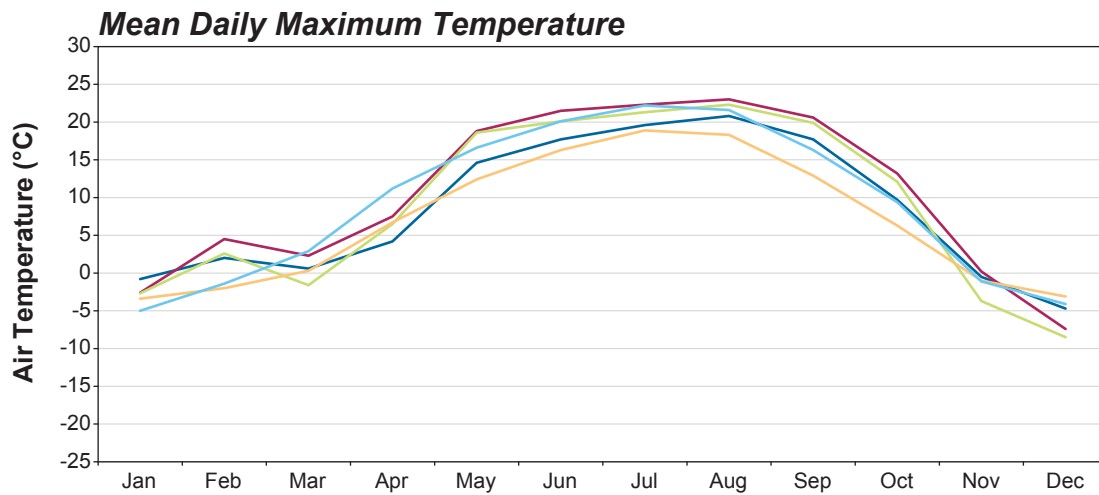
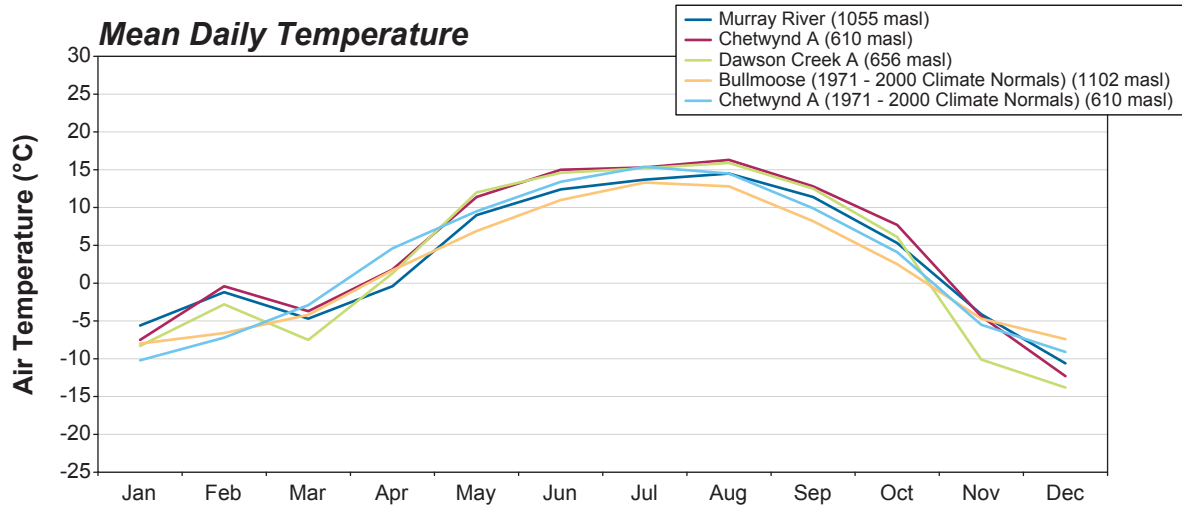


Figure 4.1-4

Table 4.1-1. 2011 Murray River and Regional Mean Monthly Air Temperatures (°C)

Month	Murray River (1,055 masl)	Tumbler (Denison) (942 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
					Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^b) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-11	n/a	-9.9	-9.4	-10.4	-8.0	-9.6	-8.0	-10.2
Feb-11	n/a	-10.7	-10.1	-8.5	-6.1	-6.9	-6.6	-7.2
Mar-11	-4.4 ^a	-8.5	-8.3	-10.2	-2.2	-2.5	-4.2	-2.9
Apr-11	0.9	1.1	2.7	2.3	3.9	3.9	1.7	4.6
May-11	7.7	8.1	10.5	10.5	8.9	9.0	6.9	9.5
Jun-11	10.7	11.1	13.2	12.8	12.8	13.1	11.0	13.4
Jul-11	12.1	12.7	14.9	14.7	15.0	15.2	13.3	15.4
Aug-11	13.1	12.9	14.7	14.2	14.2	14.6	12.8	14.5
Sep-11	10.7	9.9	11.6	11.8	10.2	10.3	8.2	9.9
Oct-11	3.3	3.5	5.3	4.9	4.0	4.3	2.5	4.1
Nov-11	-4.9	-5.1	-6.6	-5.8	-5.0	-4.0	-4.7	-5.5
Dec-11	-2.2	-2.2	-2.0	-2.9	-7.0	-7.0	-7.4	-9.1
Average	n/a	2.0	3.0	2.8	3.4	3.4	2.1	3.0
Max	13.1	12.9	14.9	14.7	15.0	15.2	13.3	15.4
Min	n/a	-10.7	-10.1	-10.4	-8.0	-9.6	-8.0	-10.2

^a Murray River station was not operational until March 9, 2011

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.2-1 for station operating periods

Table 4.1-2. 2012 Murray River and Regional Mean Monthly Air Temperatures (°C)

Month	Murray River (1,055 masl)	Tumbler (Denison) (942 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
					Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^b) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-12	-7.7	-8.2	-7.5	-7.9	-8.0	-9.6	-8.0	-10.2
Feb-12	-4.2	-4.9	-3.7	-6.7	-6.1	-6.9	-6.6	-7.2
Mar-12	-3.2	-3.3	-2.9	-4.8	-2.2	-2.5	-4.2	-2.9
Apr-12	2.3	2.6	4.5	3.4	3.9	3.9	1.7	4.6
May-12	7.5	7.7	9.8	9.6	8.9	9.0	6.9	9.5
Jun-12	11.2	11.9	13.8	14.0	12.8	13.1	11.0	13.4
Jul-12	16.1	16.2	17.5	17.6	15.0	15.2	13.3	15.4
Aug-12	14.2	14.1	16.1	15.3	14.2	14.6	12.8	14.5
Sep-12	12.3	11.7	13.2	12.8	10.2	10.3	8.2	9.9
Oct-12	-1.7	-1.6	-0.1	-0.1	4.0	4.3	2.5	4.1
Nov-12	-7.5	-8.2	-9.6	-10.4	-5.0	-4.0	-4.7	-5.5
Dec-12	-12.9	-14.6	-16.5	-16.7	-7.0	-7.0	-7.4	-9.1
Average	2.2	2.0	2.9	2.2	3.4	3.4	2.1	3.0
Max	16.1	16.2	17.5	17.6	15.0	15.2	13.3	15.4
Min	-12.9	-14.6	-16.5	-16.7	-8.0	-9.6	-8.0	-10.2

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal

See Table 3.2-1 for station operating periods

Table 4.1-3. 2013 Murray River and Regional Mean Monthly Air Temperatures (°C)

Month	Murray River (1,055 masl)	Tumbler (Denison) (942 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
					Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^a) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-13	-5.6	-6.4	-7.5	-8.3	-8.0	-9.6	-8.0	-10.2
Feb-13	-1.2	-1.2	-0.4	-2.8	-6.1	-6.9	-6.6	-7.2
Mar-13	-4.7	-4.7	-3.7	-7.5	-2.2	-2.5	-4.2	-2.9
Apr-13	-0.4	0.1	1.8	1.3	3.9	3.9	1.7	4.6
May-13	9.0	9.2	11.4	12.0	8.9	9.0	6.9	9.5
Jun-13	12.4	13.1	15.0	14.6	12.8	13.1	11.0	13.4
Jul-13	13.7	14.3	15.3	15.2	15.0	15.2	13.3	15.4
Aug-13	14.5	14.8	16.3	15.9	14.2	14.6	12.8	14.5
Sep-13	11.4	10.9	12.8	12.5	10.2	10.3	8.2	9.9
Oct-13	5.3	5.8	7.7	6.1	4.0	4.3	2.5	4.1
Nov-13	-4.1	-4.4	-4.4	-10.1	-5.0	-4.0	-4.7	-5.5
Dec-13	-10.6	-11.4	-12.3	-13.8	-7.0	-7.0	-7.4	-9.1
Average	3.3	3.3	4.3	2.9	3.4	3.4	2.1	3.0
Max	14.5	14.8	16.3	15.9	15.0	15.2	13.3	15.4
Min	-10.6	-11.4	-12.3	-13.8	-8.0	-9.6	-8.0	-10.2

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal
See Table 3.2-1 for station operating periods

Table 4.1.4. 2011 Murray River and Regional Mean Monthly Maximum Air Temperatures (°C)

Month	Murray River ^a (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
				Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^b) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-11	n/a	-5.0	-5.1	-4.0	-4.5	-3.4	-5.0
Feb-11	n/a	-5.4	-3.7	-1.9	-0.9	-2.0	-1.4
Mar-11	0.6	-3.6	-5.3	2.4	3.4	0.3	2.9
Apr-11	5.3	8.3	7.6	9.4	10.6	6.7	11.2
May-11	13.1	17.0	17.4	15.0	16.2	12.4	16.6
Jun-11	15.6	18.9	18.4	18.4	20.0	16.3	20.1
Jul-11	16.2	19.9	19.4	20.9	22.4	18.9	22.2
Aug-11	18.3	22.1	21.0	20.2	22.0	18.3	21.6
Sep-11	16.0	18.8	18.7	15.2	17.1	12.9	16.3
Oct-11	6.6	10.4	10.3	7.9	9.7	6.3	9.4
Nov-11	-1.4	-1.4	0.3	-1.4	0.6	-1.0	-1.1
Dec-11	1.2	2.7	2.4	-3.0	-2.2	-3.1	-4.1
Average	n/a	8.6	8.4	8.3	9.5	6.9	9.1
Max	18.3	22.1	21.0	20.9	22.4	18.9	22.2
Min	n/a	-5.4	-5.3	-4.0	-4.5	-3.4	-5.0

^a Murray River station was not operational until March 9, 2011

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.2-1 for station operating periods

Table 4.1-5. 2012 Murray River and Regional Mean Monthly Maximum Air Temperatures (°C)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
				Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^a) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-12	-3.8	-2.7	-1.9	-4.0	-4.5	-3.4	-5.0
Feb-12	0.6	2.1	-0.5	-1.9	-0.9	-2.0	-1.4
Mar-12	2.4	3.5	1.5	2.4	3.4	0.3	2.9
Apr-12	7.4	10.7	9.8	9.4	10.6	6.7	11.2
May-12	12.7	16.9	16.6	15.0	16.2	12.4	16.6
Jun-12	15.7	19.7	19.7	18.4	20.0	16.3	20.1
Jul-12	22.4	25.8	25.5	20.9	22.4	18.9	22.2
Aug-12	20.7	24.5	23.9	20.2	22.0	18.3	21.6
Sep-12	18.4	21.8	20.8	15.2	17.1	12.9	16.3
Oct-12	2.2	4.2	4.3	7.9	9.7	6.3	9.4
Nov-12	-3.5	-5.5	-6.6	-1.4	0.6	-1.0	-1.1
Dec-12	-8.9	-10.5	-11.8	-3.0	-2.2	-3.1	-4.1
Average	7.2	9.2	8.5	8.3	9.5	6.9	9.1
Max	22.4	25.8	25.5	20.9	22.4	18.9	22.2
Min	-8.9	-10.5	-11.8	-4.0	-4.5	-3.4	-5.0

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal
See Table 3.2-1 for station operating periods

Table 4.1-6. 2013 Murray River and Regional Mean Monthly Maximum Air Temperatures (°C)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
				Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^a) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-13	-0.8	-2.6	-2.7	-4.0	-4.5	-3.4	-5.0
Feb-13	2.0	4.5	2.6	-1.9	-0.9	-2.0	-1.4
Mar-13	0.6	2.3	-1.6	2.4	3.4	0.3	2.9
Apr-13	4.2	7.5	6.5	9.4	10.6	6.7	11.2
May-13	14.6	18.8	18.6	15.0	16.2	12.4	16.6
Jun-13	17.7	21.5	20.1	18.4	20.0	16.3	20.1
Jul-13	19.6	22.3	21.3	20.9	22.4	18.9	22.2
Aug-13	20.8	23.0	22.3	20.2	22.0	18.3	21.6
Sep-13	17.7	20.6	19.9	15.2	17.1	12.9	16.3
Oct-13	9.7	13.2	12.1	7.9	9.7	6.3	9.4
Nov-13	-0.5	0.2	-3.7	-1.4	0.6	-1.0	-1.1
Dec-13	-4.7	-7.4	-8.5	-3.0	-2.2	-3.1	-4.1
Average	8.4	10.3	8.9	8.3	9.5	6.9	9.1
Max	20.8	23.0	22.3	20.9	22.4	18.9	22.2
Min	-4.7	-7.4	-8.5	-4.0	-4.5	-3.4	-5.0

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.2-1 for station operating periods

Table 4.1-7. 2011 Murray River and Regional Mean Monthly Minimum Air Temperatures (°C)

Month	Murray River ^a (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
				Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^b) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-11	n/a	-13.8	-15.1	-12.0	-14.8	-12.6	-15.3
Feb-11	n/a	-14.8	-13.4	-10.4	-12.8	-11.2	-12.9
Mar-11	-8.9	-14.0	-15.0	-6.9	-8.5	-8.7	-8.7
Apr-11	-3.8	-2.9	-3.0	-1.6	-2.7	-3.4	-2.1
May-11	2.0	3.9	3.4	2.8	1.9	1.5	2.4
Jun-11	5.5	7.5	7.0	7.1	6.2	5.6	6.6
Jul-11	8.5	9.8	10.0	9.1	7.9	7.8	8.5
Aug-11	7.3	7.3	7.3	8.1	7.2	7.2	7.4
Sep-11	5.2	4.3	4.8	4.9	3.5	3.4	3.5
Oct-11	0.3	0.3	-0.4	-0.1	-1.2	-1.2	-1.3
Nov-11	-8.6	-11.7	-11.9	-8.5	-8.5	-8.5	-10.0
Dec-11	-5.9	-6.7	-8.1	-10.9	-11.7	-11.6	-14.1
Average	n/a	-2.6	-2.9	-1.5	-2.8	-2.7	-3.0
Max	8.5	9.8	10.0	9.1	7.9	7.8	8.5
Min	n/a	-14.8	-15.1	-12.0	-14.8	-12.6	-15.3

^a Murray River station was not operational until March 9, 2011

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.2-1 for station operating periods

Table 4.1-8. 2012 Murray River and Regional Mean Monthly Minimum Air Temperatures (°C)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant	Tumbler Ridge	Bullmoose	Chetwynd A
				Site (1982 - 1997 Climate Normals) (854 masl)	(1985 - 2002 Climate Normals ^a) (824 masl)	(1981 - 2010 Climate Normals) (1,102 masl)	(1981 - 2010 Climate Normals) (610 masl)
Jan-12	-11.2	-12.2	-13.8	-12.0	-14.8	-12.6	-15.3
Feb-12	-8.7	-9.5	-12.9	-10.4	-12.8	-11.2	-12.9
Mar-12	-8.3	-9.3	-11.1	-6.9	-8.5	-8.7	-8.7
Apr-12	-2.8	-1.7	-3.1	-1.6	-2.7	-3.4	-2.1
May-12	1.4	2.6	2.5	2.8	1.9	1.5	2.4
Jun-12	6.5	7.9	8.3	7.1	6.2	5.6	6.6
Jul-12	9.0	9.2	9.8	9.1	7.9	7.8	8.5
Aug-12	7.3	7.8	6.7	8.1	7.2	7.2	7.4
Sep-12	5.5	4.5	4.9	4.9	3.5	3.4	3.5
Oct-12	-5.4	-4.4	-4.5	-0.1	-1.2	-1.2	-1.3
Nov-12	-11.0	-13.7	-14.1	-8.5	-8.5	-8.5	-10.0
Dec-12	-17.3	-22.4	-22.3	-10.9	-11.7	-11.6	-14.1
Average	-2.9	-3.4	-4.1	-1.5	-2.8	-2.7	-3.0
Max	9.0	9.2	9.8	9.1	7.9	7.8	8.5
Min	-17.3	-22.4	-22.3	-12.0	-14.8	-12.6	-15.3

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal

See Table 3.2-1 for station operating periods

Table 4.1-9. 2013 Murray River and Regional Mean Monthly Minimum Air Temperatures (°C)

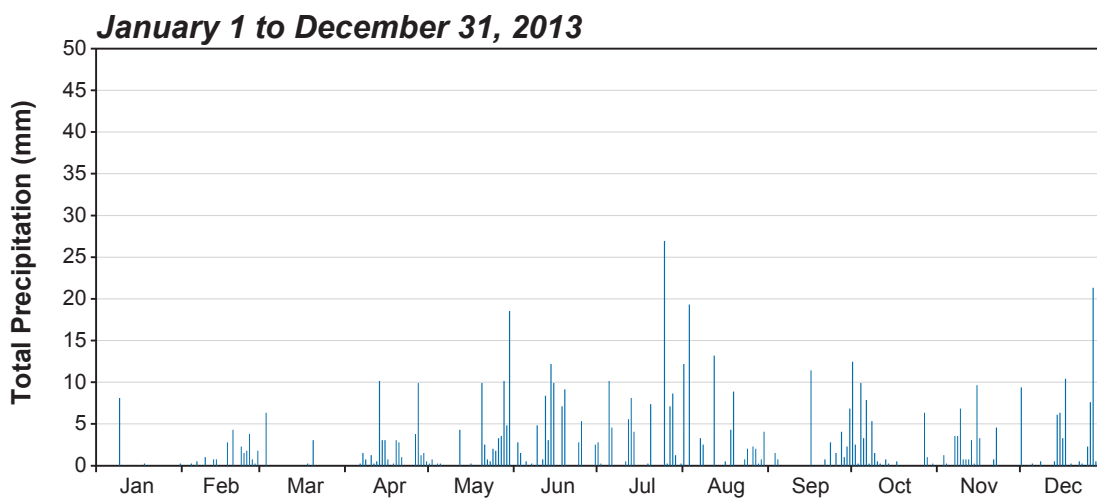
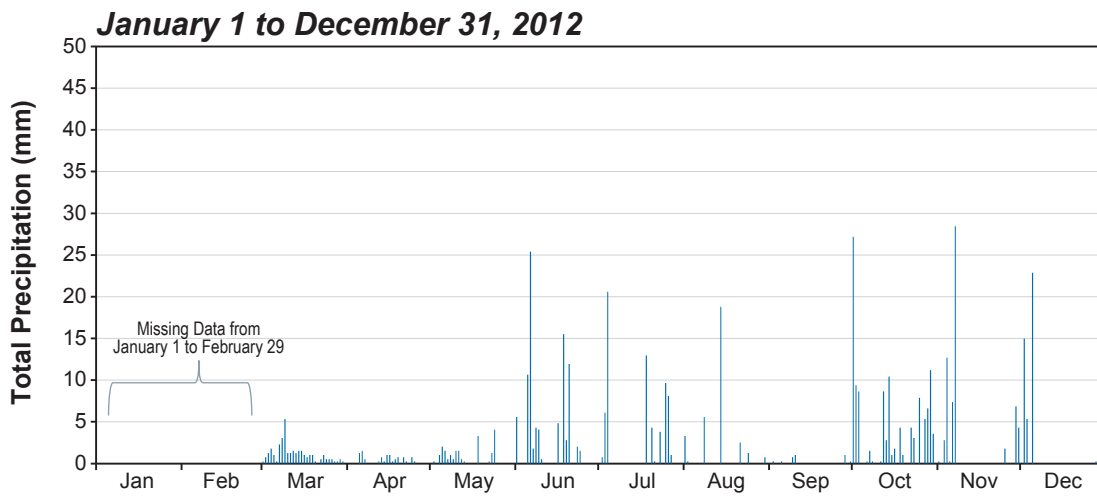
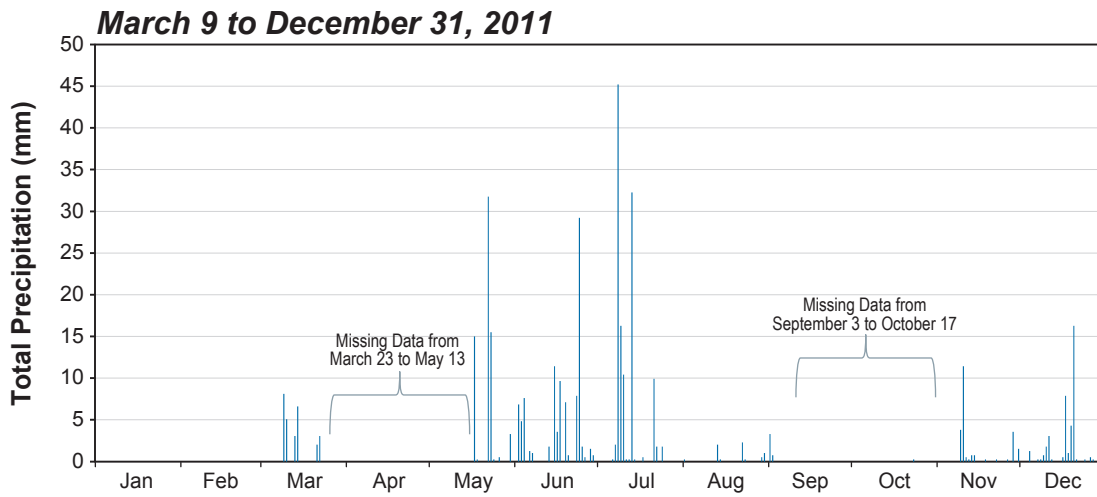
Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^a) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-13	-10.5	-12.4	-13.9	-12.0	-14.8	-12.6	-15.3
Feb-13	-4.6	-5.3	-8.0	-10.4	-12.8	-11.2	-12.9
Mar-13	-10.1	-9.7	-13.4	-6.9	-8.5	-8.7	-8.7
Apr-13	-5.5	-3.8	-3.9	-1.6	-2.7	-3.4	-2.1
May-13	2.9	3.9	5.3	2.8	1.9	1.5	2.4
Jun-13	7.1	8.5	9.1	7.1	6.2	5.6	6.6
Jul-13	7.5	8.4	8.8	9.1	7.9	7.8	8.5
Aug-13	8.8	9.6	9.4	8.1	7.2	7.2	7.4
Sep-13	4.9	4.9	5.0	4.9	3.5	3.4	3.5
Oct-13	0.8	2.2	-0.2	-0.1	-1.2	-1.2	-1.3
Nov-13	-8.8	-9.0	-16.4	-8.5	-8.5	-8.5	-10.0
Dec-13	-15.9	-17.3	-20.6	-10.9	-11.7	-11.6	-14.1
Average	-2.0	-1.7	-3.2	-1.5	-2.8	-2.7	-3.0
Max	8.8	9.6	9.4	9.1	7.9	7.8	8.5
Min	-15.9	-17.3	-20.6	-12.0	-14.8	-12.6	-15.3

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal
See Table 3.2-1 for station operating periods

Table 4.1-10. Murray River and Regional Extreme Temperature Values (°C) for 2013

	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1971 - 2000 Climate Normals) (1,102 masl)	Chetwynd A (1971 - 2000 Climate Normals) (610 masl)
Extreme Maximum (°C)	30.7	31.8	31.6	33	35.5	32.5	33.8
Date	1-Jul-13	1-Jul-13	12-Sept-13	13-Aug-92	13-Aug-92	1-Sep-87	15-Aug-91
Extreme Minimum (°C)	-32.5	-33.6	-34.4	-46	-46	-39.5	-52
Date	29-Jan-13	6-Dec-13	20-Nov-13	26-Nov-85	17-Jan-96	31-Jan-90	25-Jan-97

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal
See Table 3.2-1 for station operating periods



Note: The Murray River station was not operation until March 9, 2011.



MURRAY RIVER COAL PROJECT

Murray River Daily Precipitation

Figure 4.2-1



Table 4.2-1. 2011 Murray River and Regional Total Monthly Precipitation (mm)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-11	n/a	53.0	53.0	42.0	36.7	69.1	21.1
Feb-11	n/a	30.9	5.7	26.3	24.9	49.8	16.2
Mar-11	27.9 ^{a,b}	30.8	14.1	34.8	35.8	49.6	21.9
Apr-11	n/a ^c	54.8	18.0	30.3	21.3	37.1	20.4
May-11	66.5 ^b	97.2	28.9	30.8	30.3	45.0	37.2
Jun-11	97.5	188.9	142.6	83.0	73.0	94.2	75.7
Jul-11	121.2	136.0	126.8	87.9	77.1	91.2	76.9
Aug-11	6.6	6.4	26.5	51.7	56.3	72.3	51.4
Sep-11	4.1 ^c	22.8	7.4	54.5	37.7	65.8	41.2
Oct-11	0.3	11.0	5.0	49.4	25.8	82.8	29.1
Nov-11	23.4	30.2	9.6	54.1	41.0	81.5	30.6
Dec-11	39.9	18.5	10.9	33.1	25.6	54.4	19.1
Annual Total	387.4	680.5	448.5	577.9	485.5	792.7	440.6

^aMurray River station was not operational until March 9, 2011

^bMurray River precipitation gauge malfunctioned, between 1 and 15 days of data are missing

^cMurray River precipitation gauge malfunctioned, between 15 and 31 days of data are missing

^dData from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.2-1 for station operating periods

Table 4.2-2. 2012 Murray River and Regional Total Monthly Precipitation (mm)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-12	n/a ^a	23.4	9.5	42.0	36.7	69.1	21.1
Feb-12	n/a ^a	8.2	1.5	26.3	24.9	49.8	16.2
Mar-12	32.8	22.6	7.5	34.8	35.8	49.6	21.9
Apr-12	10.2	42.5	26.3	30.3	21.3	37.1	20.4
May-12	19.6	18.9	22.2	30.8	30.3	45.0	37.2
Jun-12	90.9	89.8	76.0	83.0	73.0	94.2	75.7
Jul-12	67.6	38.7	16.5	87.9	77.1	91.2	76.9
Aug-12	32.5	32.2	26.1	51.7	56.3	72.3	51.4
Sep-12	3.6	17.2	0.5	54.5	37.7	65.8	41.2
Oct-12	119.4	59.8	63.2	49.4	25.8	82.8	29.1
Nov-12	64.8	37.3	10.5	54.1	41.0	81.5	30.6
Dec-12	43.4	37.7	8.3	33.1	25.6	54.4	19.1
Annual Total	484.6	428.3	268.1	577.9	485.5	792.7	440.6

^a The CS705 winter precipitation adapter malfunctioned and data from this period is not realistic and removed.

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.1-1 for station operating periods

Table 4.2-3. 2013 Murray River and Regional Total Monthly Precipitation (mm)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-13	8.6	3.6	6.2	42.0	36.7	69.1	21.1
Feb-13	22.6	5.8	4.3	26.3	24.9	49.8	16.2
Mar-13	9.7	30.8	11.2	34.8	35.8	49.6	21.9
Apr-13	45.7	13.5	9.8	30.3	21.3	37.1	20.4
May-13	64.0	82.7	69.0	30.8	30.3	45.0	37.2
Jun-13	71.1	88.9	81.4	83.0	73.0	94.2	75.7
Jul-13	88.1	84.2	97.8	87.9	77.1	91.2	76.9
Aug-13	76.5	34.9	30.0	51.7	56.3	72.3	51.4
Sep-13	33.0	29.3	23.3	54.5	37.7	65.8	41.2
Oct-13	53.3	23.0	29.4	49.4	25.8	82.8	29.1
Nov-13	39.4	39.7	16.2	54.1	41.0	81.5	30.6
Dec-13	71.1	48.3	20.9	33.1	25.6	54.4	19.1
Annual Total	583.2	484.7	399.5	577.9	485.5	792.7	440.6

It should be noted that 2011 and 2012 do not have a complete set of data due to the timing of the installation of the station and to sensor malfunction, which makes direct comparison of annual precipitation with other regional stations difficult. A full year of data was collected in 2013 which facilitates a comparison to the regional stations. Total precipitation amounts, in 2013, at the Murray River station were higher than the total amounts recorded at the regional EC meteorological stations, Chetwynd A and Dawson Creek A which were 484.7 and 399.5 mm respectively. Total precipitation amounts at Murray River in 2013 were higher than all but one of the regional stations with climate normal data.

Comparing the annual total precipitation at Chetwynd A from climate normal (440.6 mm) and from 2011 (680.5 mm), precipitation from 2011 represented an approximately 35% increase from climate normal, indicating 2011 is a wet year for this region. In 2012, the annual total precipitation collected at Chetwynd A was 428.3 mm indicating that 2012 is an average year in the region in comparison to climate normal data. Total precipitation at the Project in 2013 was 583.2 mm. Extreme, single-day precipitation values are listed in Table 4.2-4 for each station.

The climate normal from the MSC climate stations provide an expected range of precipitation values for each month. June and July typically receive significantly more precipitation compared to other months, due to convective weather systems that are most active during this time of year. Data from 2013 shows a similar trend with the highest precipitation amounts seen during May through August. A significant amount of precipitation fell in December 2013. These are reflected, to some extent, by the precipitation amounts seen at the Chetwynd A and Dawson Creek A MSC sites. The amount of precipitation that falls over an area can vary significantly over a short distances and small variations in elevation. Denison Plant Site and Tumbler Ridge climate stations are the closest MSC stations to the Project. Although they are at different elevations, they provide the best available historical precipitation averages representative of the Project's LSA.

Table 4.2-4. Murray River and Regional Extreme Single Day Precipitation Values for 2013

	Murray River (1,055 masl)	Chetwynd A (610 masl)	Dawson Creek A (656 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Extreme Rainfall (mm)	27.0	18	36.7	59.8	51	76	64.4
Date	25-Jul-13	29-May-13	30-May-13	13-Jul-82	17-Jul-01	31-Jul-87	31-Jul-87
Extreme Snowfall (cm)	n/a	18.7	n/a	35	35	47	34.3
Date	n/a	21-Nov-13	n/a	28-Nov-90	7-Nov-99	19-Nov-94	27-Oct-86

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal

n/a = data not available

See Table 3.1-1 for station operating periods

Incomplete precipitation datasets were collected at Murray River station. The precipitation sensor malfunctioned and no data was available between March 23 and May 13, 2011, September 3 and October 17, 2011, and January 1 and February 29, 2012. There was no data missing in 2013.

4.3 SNOW DEPTH

Tables 4.3-1, 4.3-2 and 4.3-3 summarize the mean monthly snow depth for the Murray River station and the five MSC climate stations for 2011, 2012 and 2013 respectively. Figure 4.3-1 presents the mean daily snow depth at the Murray River station between March 9, 2011 and December 31, 2013. Extreme snow depth values for each station are listed in Table 4.3-4.

Table 4.3-1. 2011 Murray River and Regional Mean Daily Snow Depths (cm)

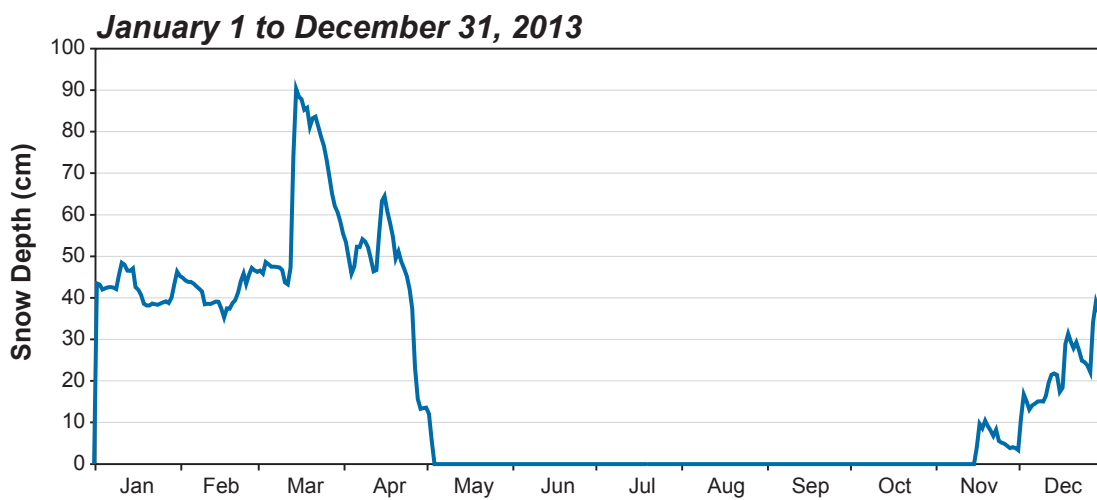
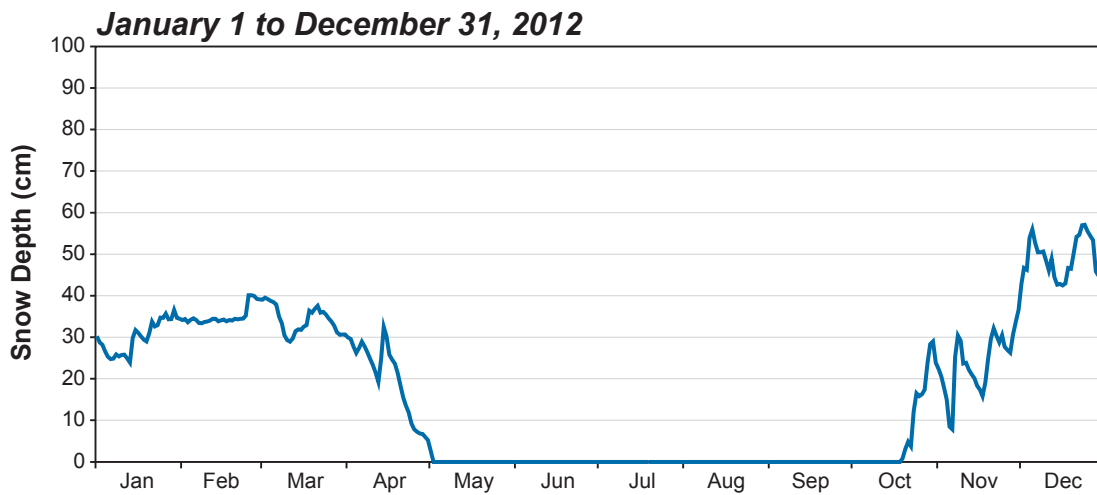
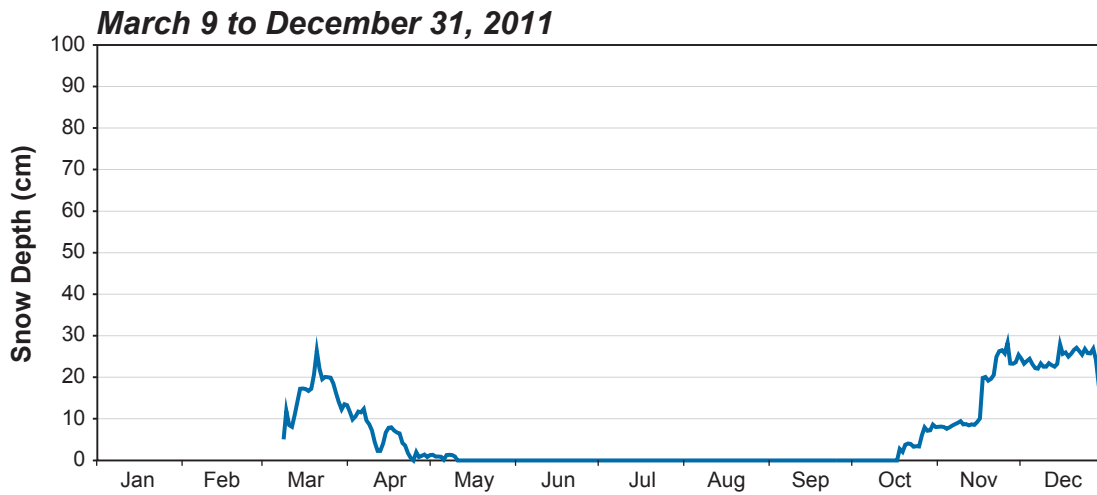
Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-11	n/a	41.1	16.2	13.2	34.7	16.7
Feb-11	n/a	24.0	12.7	23.9	45.7	17.9
Mar-11	15.7 ^a	34.7	10.4	19.2	19.6	12.1
Apr-11	5.9	5.1	2.3	1.1	12.6	1.0
May-11	0.3	0.0	0.0	0.0	0.2	0.1
Jun-11	0.0	0.0	0.0	0.0	0.0	0.0
Jul-11	0.0	0.0	0.0	0.0	0.0	0.0
Aug-11	0.0	0.0	0.0	0.0	0.0	0.0
Sep-11	0.0	0.0	0.0	0.0	0.1	0.1
Oct-11	1.6	0.0	1.5	0.4	1.6	1.2
Nov-11	15.5	5.1	7.9	5.4	15.1	8.4
Dec-11	24.2	3.4	19.1	6.5	31.6	13.1

^a Murray River station was not operational until March 9, 2011

^b Data from 1985 to 2002 were summarized for long term averages to represent climate normals

n/a = data not available

See Table 3.1-1 for station operating periods



Note: The Murray River station was not operation until March 9, 2011.



MURRAY RIVER COAL PROJECT

Murray River Mean Daily Snow Depth

Figure 4.3-1



Table 4.3-2. 2012 Murray River and Regional Mean Daily Snow Depths (cm)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-12	30.0	4.2	16.2	13.2	34.7	16.7
Feb-12	35.1	2.4	12.7	23.9	45.7	17.9
Mar-12	34.2	9.7	10.4	19.2	19.6	12.1
Apr-12	20.1	0.8	2.3	1.1	12.6	1.0
May-12	0.1	0.2	0.0	0.0	0.2	0.1
Jun-12	0.0	0.0	0.0	0.0	0.0	0.0
Jul-12	0.0	0.0	0.0	0.0	0.0	0.0
Aug-12	0.0	0.0	0.0	0.0	0.0	0.0
Sep-12	0.0	0.0	0.0	0.0	0.1	0.1
Oct-12	6.3	5.6	1.5	0.4	1.6	1.2
Nov-12	23.9	10.7	7.9	5.4	15.1	8.4
Dec-12	48.9	38.5	19.1	6.5	31.6	13.1

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal

n/a = data not available

See Table 3.1-1 for station operating periods

Table 4.3-3. 2013 Murray River and Regional Mean Daily Snow Depths (cm)

Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	Denison Plant Site (1982 - 1997 Climate Normals) (854 masl)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1981 - 2010 Climate Normals) (1,102 masl)	Chetwynd A (1981 - 2010 Climate Normals) (610 masl)
Jan-13	42.2	21.0	16.2	13.2	34.7	16.7
Feb-13	41.6	8.3	12.7	23.9	45.7	17.9
Mar-13	64.5	10.6	10.4	19.2	19.6	12.1
Apr-13	45.3	0.8	2.3	1.1	12.6	1.0
May-13	0.6	0.0	0.0	0.0	0.2	0.1
Jun-13	0.0	0.0	0.0	0.0	0.0	0.0
Jul-13	0.0	0.0	0.0	0.0	0.0	0.0
Aug-13	0.0	0.0	0.0	0.0	0.0	0.0
Sep-13	0.0	0.0	0.0	0.0	0.1	0.1
Oct-13	0.0	0.0	1.5	0.4	1.6	1.2
Nov-13	6.2	11.4	7.9	5.4	15.1	8.4
Dec-13	23.5	21.5	19.1	6.5	31.6	13.1

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal

n/a = data not available

See Table 3.1-1 for station operating periods

Table 4.3-4. Murray River and Regional Extreme Daily Snow Depths (cm)

			Denison Plant Site (1982 - 1997 Climate Normals)	Tumbler Ridge (1985 - 2002 Climate Normals ^b) (824 masl)	Bullmoose (1971 - 2000 Climate Normals) (1,102 masl)	Chetwynd A (1971 - 2000 Climate Normals) (610 masl)
Month	Murray River (1,055 masl)	Chetwynd A (610 masl)	(854 masl)	(824 masl)	(1,102 masl)	(610 masl)
Extreme Snow Depth (cm)	90	39	90	48	120	67
Date	14-Mar-13	31-Dec-13	30-Nov-90	13-Feb-88	27-Feb-94	22-Feb-94

^a Data from 1985 to 2002 were summarized for long term averages to represent climate normal
See Table 3.1-1 for station operating periods

As with precipitation, the snow depth at a given location varies significantly depending on the proximity to mountains, and elevation. Denison Plant Site and Tumbler Ridge stations provide the best long-term average monthly snow depth estimates for the LSA. On average, most climate stations began to accumulate snow in mid to late October and it remains until late April.

For the period of March 9 to December 31, 2011, the highest daily snow depth recorded at the Murray River station was 28.3 cm on November 26, 2011. In 2012 the highest daily snow depth recorded at the Murray River station was 57.1 cm recorded on December 24, 2012. In 2013 the highest daily snow depth recorded at the Project station was 90.3 cm recorded on March 14, 2013. A significant snowfall event occurred from March 12 through March 14, where over 45 cm of snow fell in a 48 hour period (Figure 4.3-1).

Snow surveys were conducted at Monkman Creek and Pine Pass. Monkman Creek (4A20) is approximately 35 km south-southwest from the Project area at an elevation of 1,566 masl. The average snow depth, on April 1, from surveys conducted between 1971 and 2000 for April 1 is 162 cm. Pine Pass (4A02) snow survey location is approximately 100 km west-northwest of the Project area at an elevation of 1,439 masl. The average April 1 snow depth from surveys conducted between 1971 and 2000 is 308 cm (BC MOE 2014).

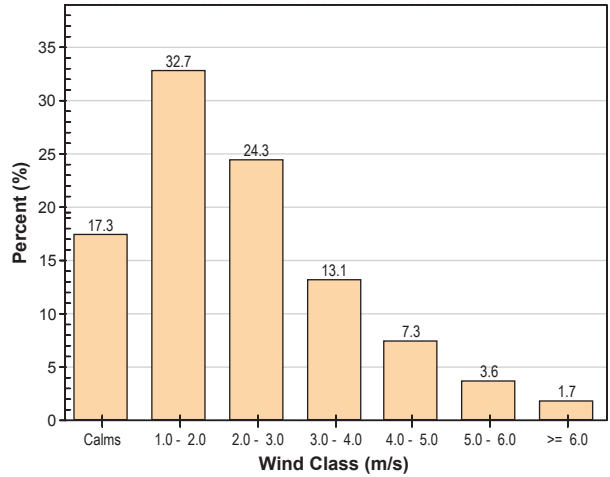
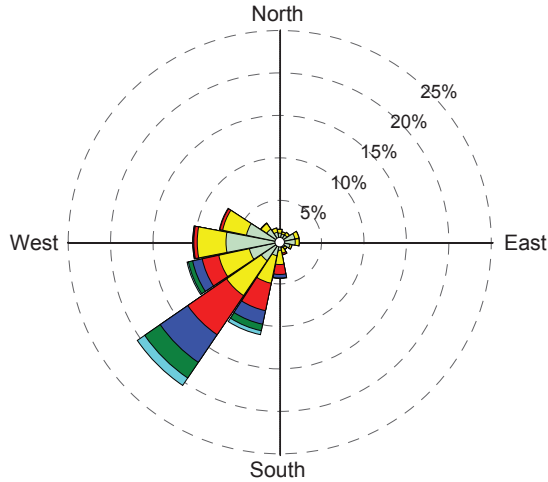
4.4 WIND SPEED AND DIRECTION

A windrose is a joint frequency distribution of wind directions and wind speed. Windroses in the winter (November to May) and summer (June to October), as well as an annual windrose, are presented in Figure 4.4-1. The winter and summer windroses at Murray River station show that there is almost no seasonal variation in wind pattern.

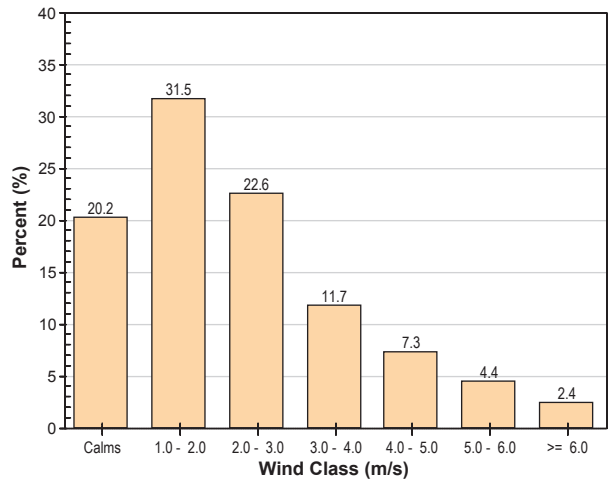
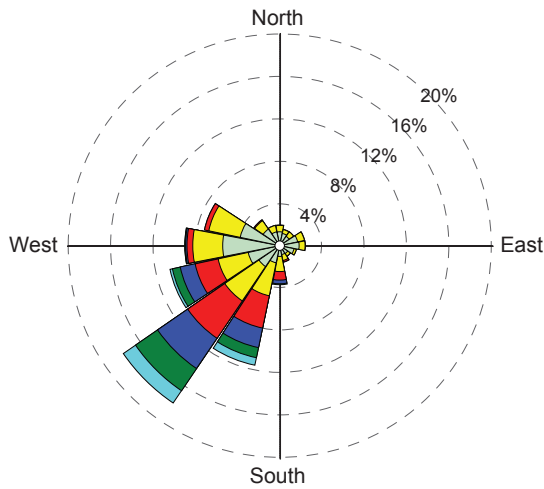
In 2013 the impellor on the front of the wind monitor was damaged and caused erroneous wind direction and speed data from March 12, 2013 until the impellor was replaced on October 10, 2013. Data presented below is from March 8, 2011 to March 8, 2013.

Wind speeds observed at Murray River station are generally low, with the most frequent wind speeds between 1 and 2 m/s (33% of the time) and calm (wind speed less than 1 m/s) 17% of the time. Winds over 6 m/s occur less than 2% of the time. Winds most commonly blow from the southwest quadrant (23% of the time).

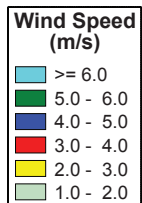
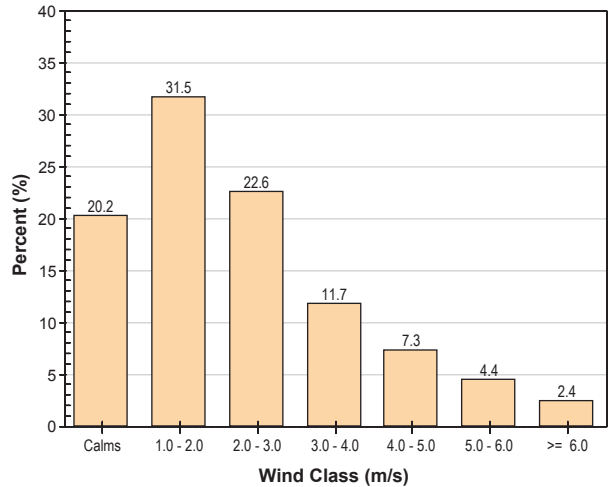
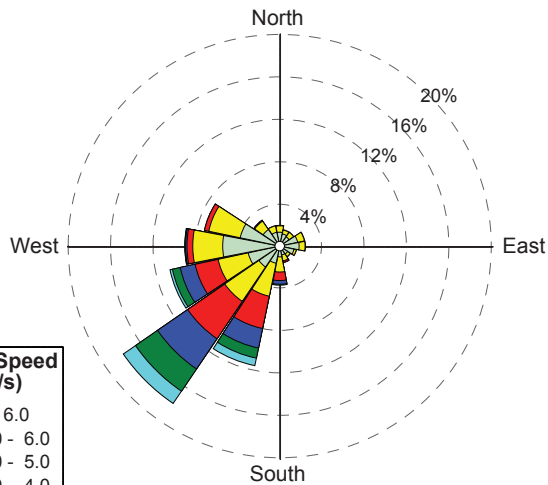
Annual



Winter



Summer



Wind observed at the Tumbler (Denison) station showed the most frequent wind speeds to be between 1 and 2 m/s (29% of the time) and calm periods 19% of the time (Figure 4.4-2). The wind distribution from Tumbler (Denison) showed more wind channelling than from the Project station. This is most likely due to the wind channelling through the valley along the Murray River southwest of the Tumbler (Denison) station.

The Tumbler Ridge Wind Power Project is located approximately 7 km north-northwest of the Murray River Project, and 8 km southwest of the Town of Tumbler Ridge. The wind turbines are installed on the high points of the mountain ridge. The interest in wind power in the area indicates the wind direction is predominantly from the same direction, and speeds are relatively high in the area. In an assessment of the energy potential in BC, it is stated that the Peace Region has strong wind with annual average of 7.5 to 10.5 m/s at 80 m hub height (GH 2008).

The stations managed by the BC MOE, Chetwynd A and Dawson Creek A, are approximately 100 km from the Project area, and only record wind speed and direction during the day.

4.5 SOLAR RADIATION

Solar radiation is the total frequency spectrum of electromagnetic energy from the sun. Solar energy accounts for 99% of the Earth's energy. Electromagnetic radiation originating from Earth and its atmosphere is defined as terrestrial radiation, while the solar radiation incident on top of the terrestrial atmosphere is called extraterrestrial solar radiation. A portion of the extraterrestrial solar radiation from the sun (mostly short-wave radiation with spectral range of 0.29 to 3 microns) penetrates through the atmosphere to the Earth's surface, while part of it is scattered, absorbed or reflected in the atmosphere by gas, aerosol particles, cloud droplets and cloud crystals.

Mean daily solar radiation received at Murray River station for each month in 2011 through 2013 are summarized in Tables 4-1, 4-2 and 4-3 respectively. Figure 4.5-1 displays the mean daily solar radiation between March 9, 2011 and December 31, 2013. None of the MSC climate stations reported solar radiation.

The highest recorded daily average solar radiation since the installation of the Project meteorological station, 353 W/m², was recorded on June 21, 2011. On average, the lowest and highest mean daily solar radiation occurs during the winter and summer, respectively. This is because the sun is lowest on the horizon during the winter and highest during the summer. The large differences in day-to-day values of mean daily solar radiation are due to differences in cloud cover throughout each day. All hourly average solar radiation values recorded during night time hours were 0 W/m².

4.6 BAROMETRIC PRESSURE

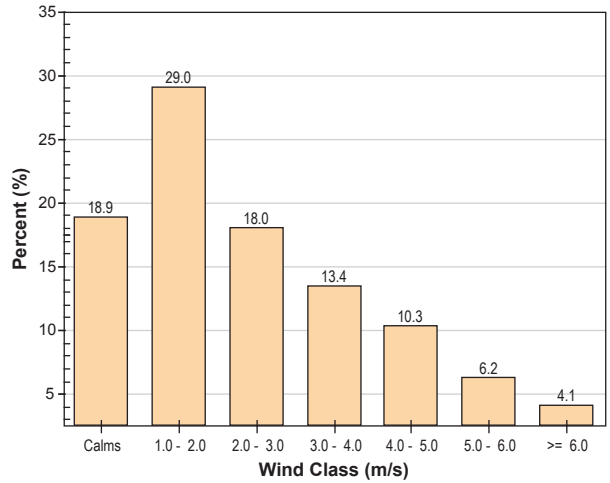
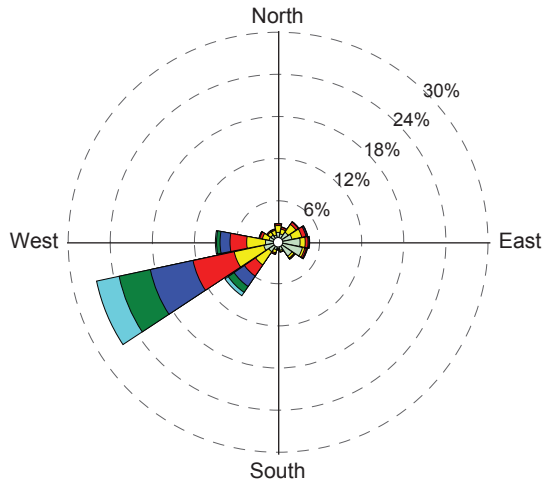
The mean daily barometric pressure for each month is summarized in Tables 4-1, 4-2 and 4-3. Figure 4.6-1 displays the mean daily barometric pressure between March 9, 2011 and December 31, 2013. None of the MSC climate stations report barometric pressure.

Daily barometric pressure at Murray River station remained between 98.6 and 102.7 kPa for the period of record. Winter months are expected to have lower pressures than summer months, on average, as low pressure weather systems are more active during the winter in BC.

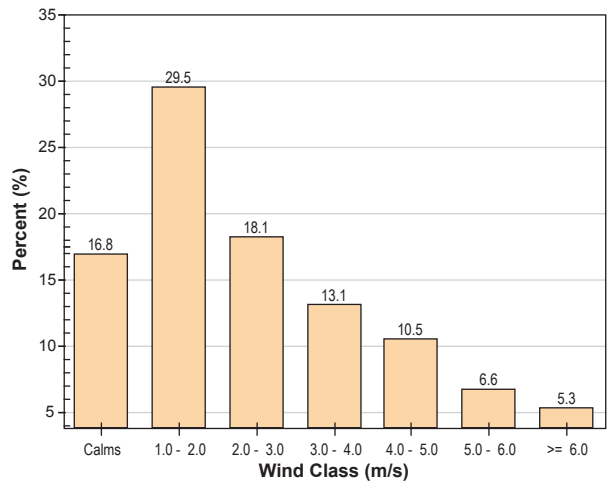
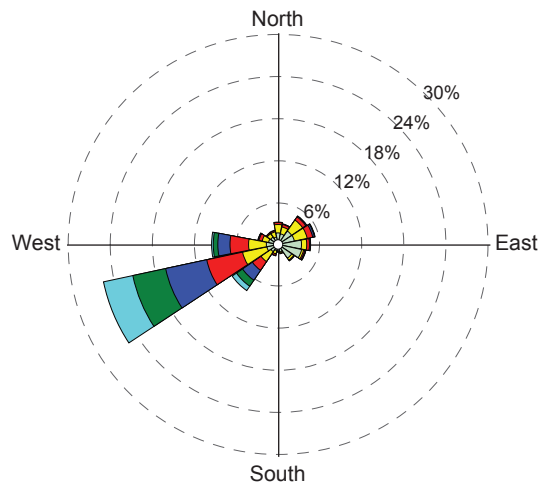
4.7 RELATIVE HUMIDITY

Mean daily relative humidity for each month is summarized in Tables 4-1, 4-2 and 4-3. Daily relative humidity ranged from 24 to 99%, and monthly average relative humidity ranged from 51 to 81% (Figures 4.7-1). Relative humidity is generally higher in the winter and lower in the summer at Murray River.

Annual



Winter



Summer

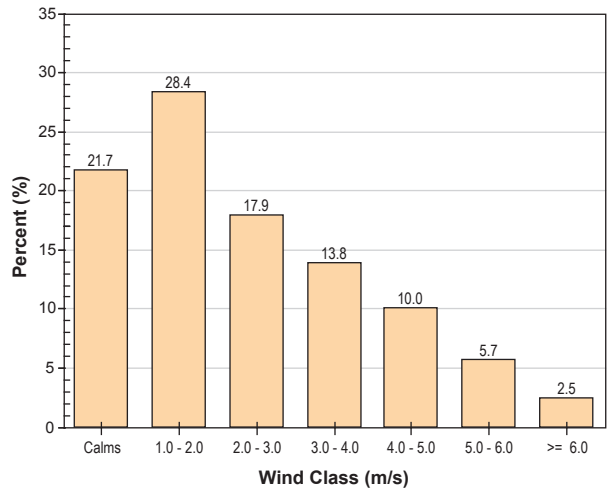
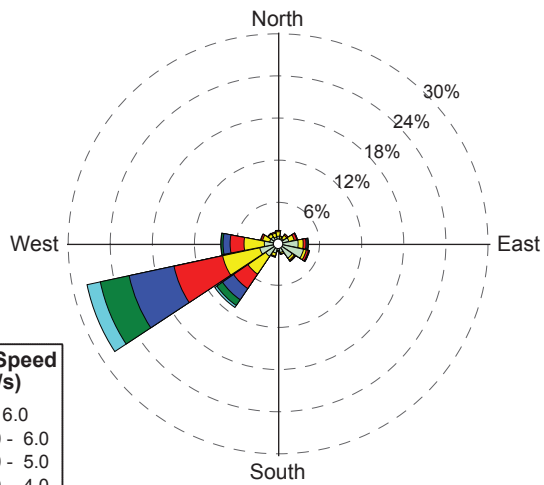
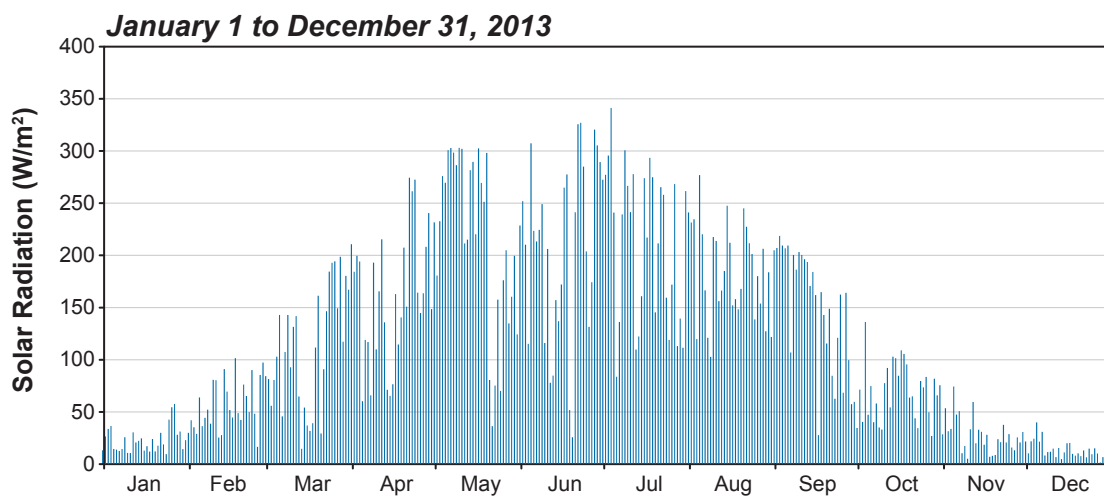
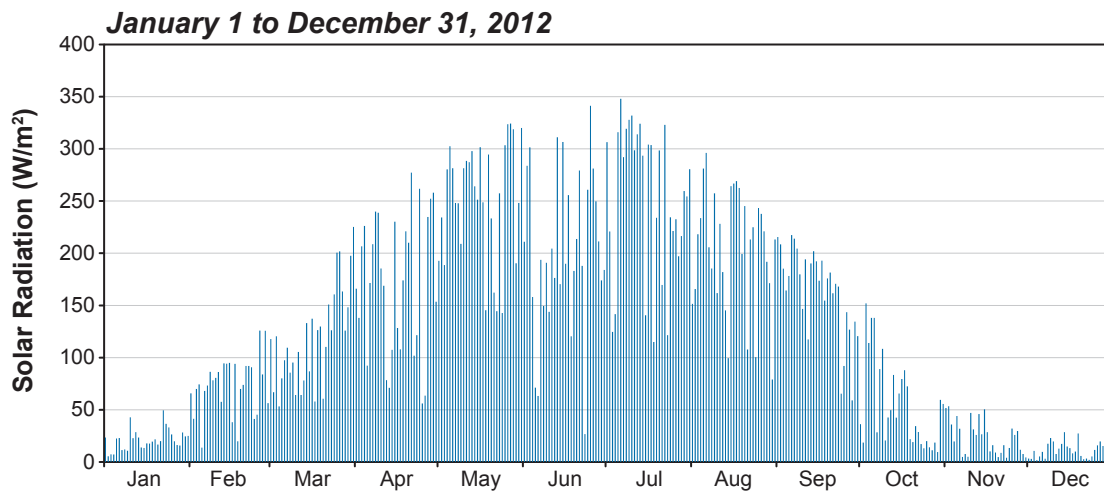
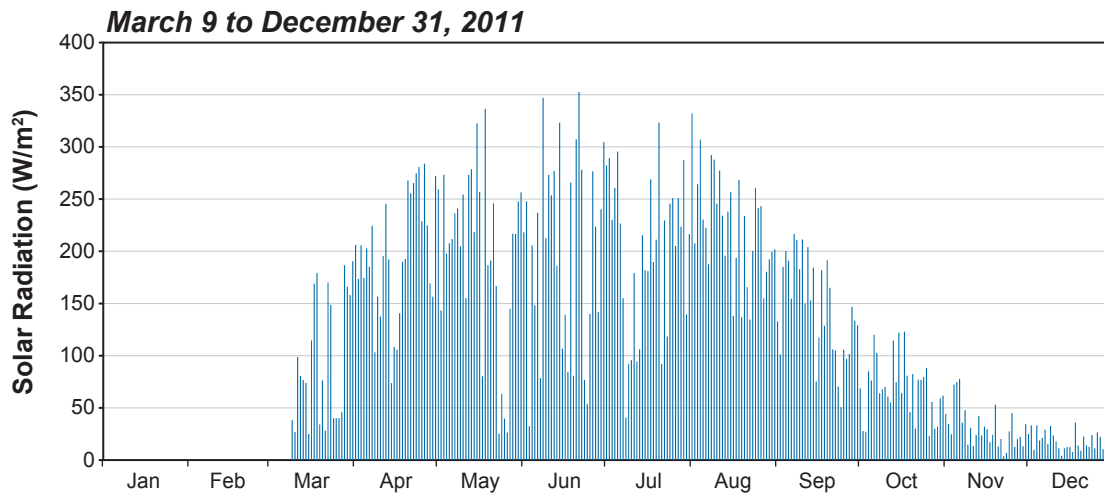


Figure 4.4-2



Note: The Murray River station was not operation until March 9, 2011.

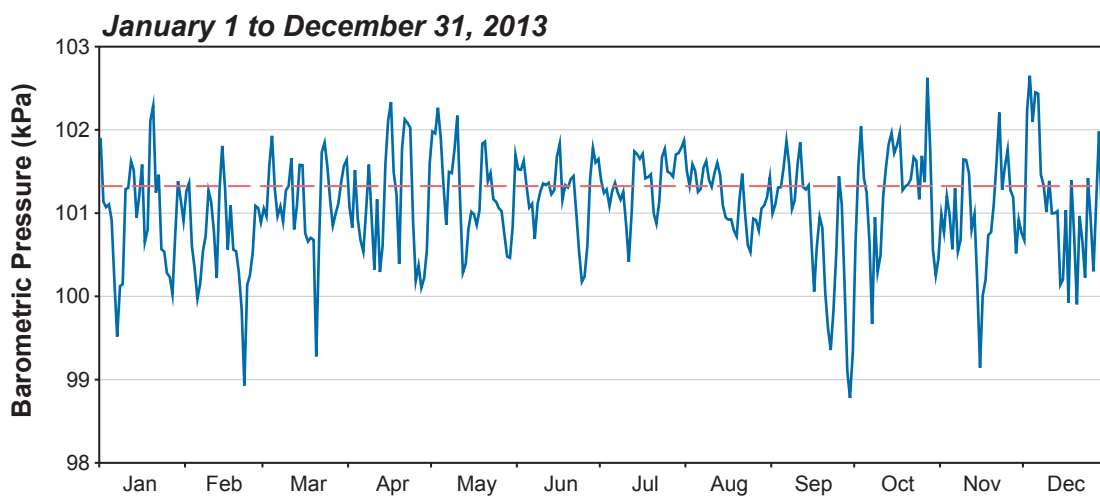
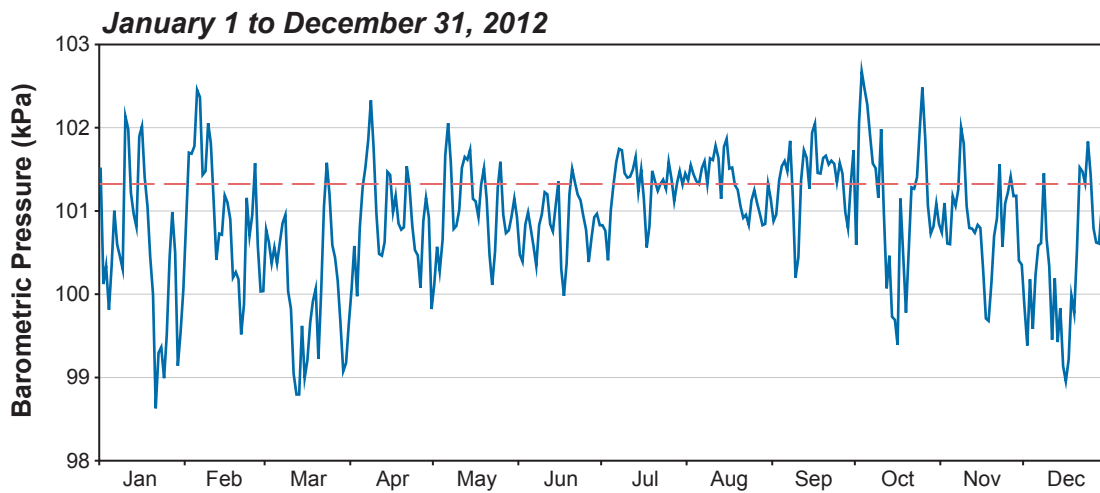
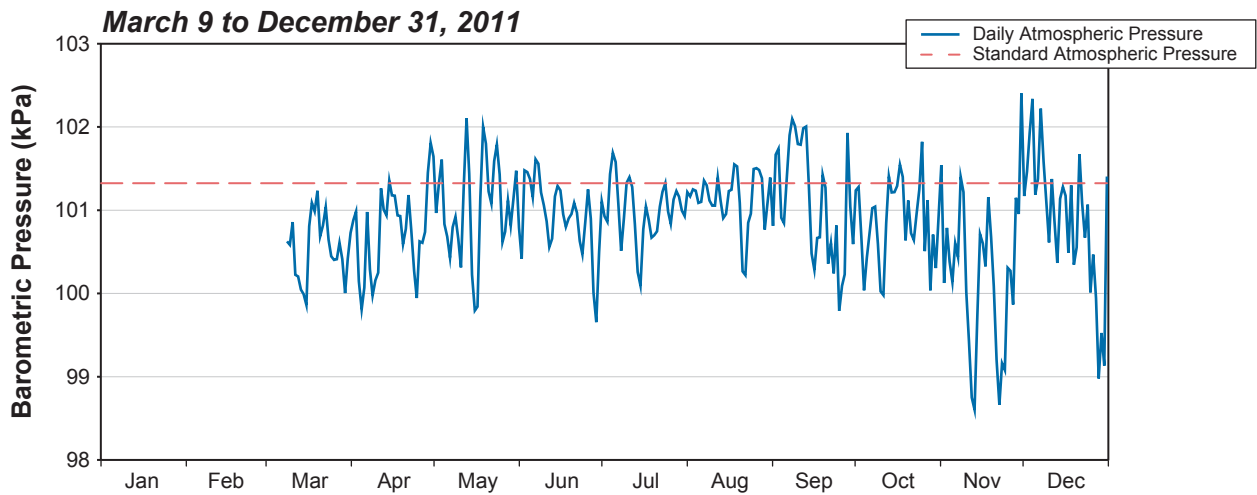


MURRAY RIVER COAL PROJECT

Murray River Mean Daily Solar Radiation

Figure 4.5-1





Note: The Murray River station was not operation until March 9, 2011.

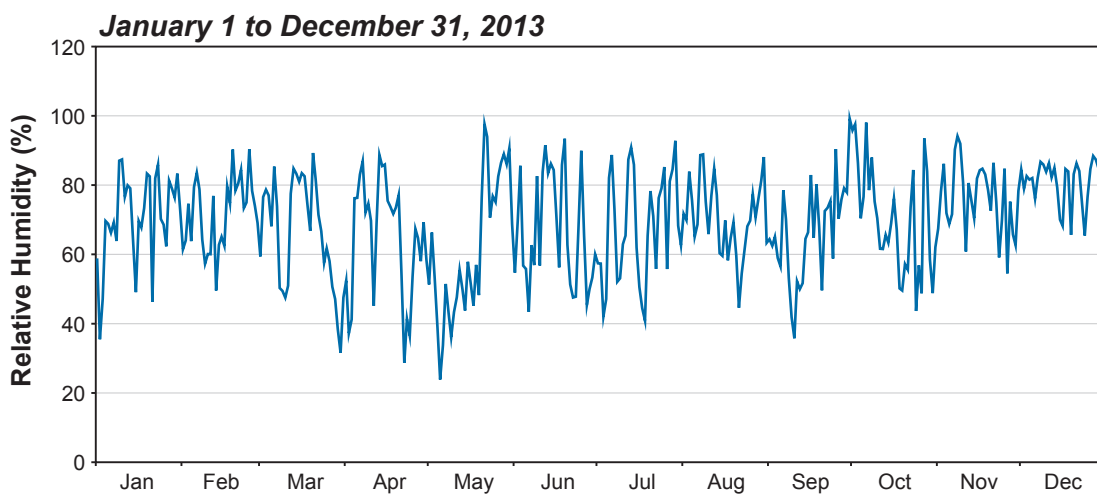
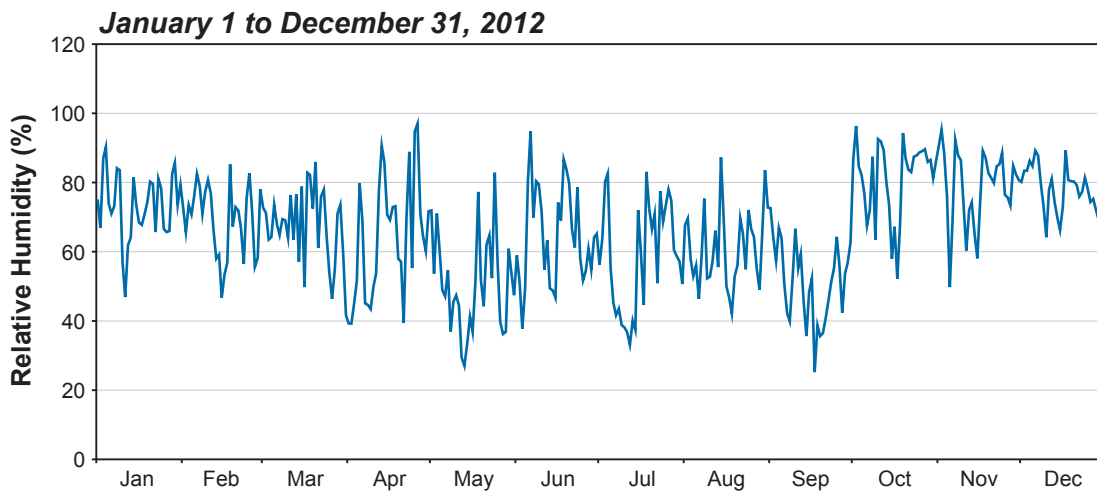
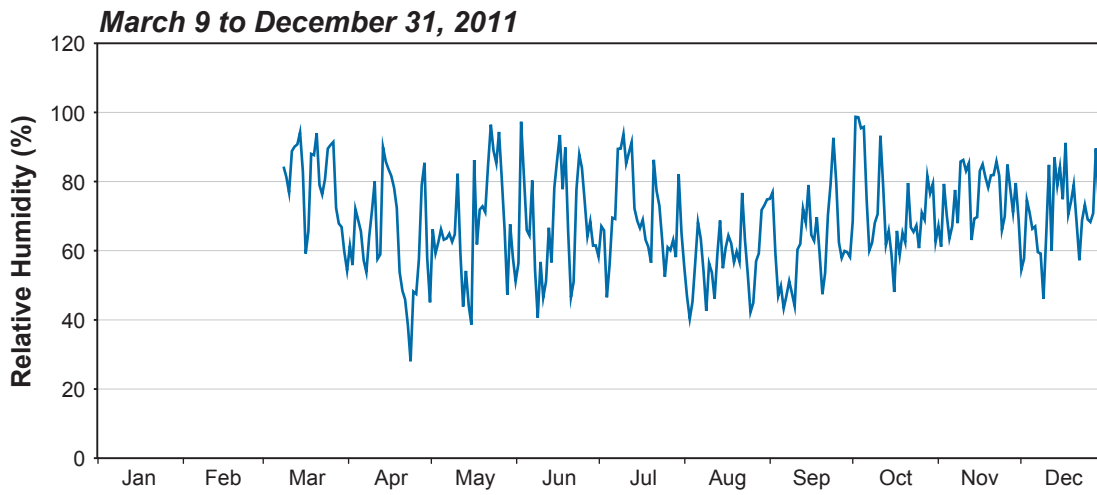


MURRAY RIVER COAL PROJECT

Murray River Mean Daily Barometric Pressure

Figure 4.6-1





Note: The Murray River station was not operation until March 9, 2011.



MURRAY RIVER COAL PROJECT

Murray River Mean Daily Relative Humidity

Figure 4.7-1



5. Summary

5. Summary

The climate of the Murray River Project has been defined using five MSC weather stations as well as the Project specific Murray River station. The region is frequently influenced by moist air from the Pacific as well as drier continental air, as it is very close to the leeward side of the Rocky Mountains' Hart Ranges. The topography of the region plays a large role in the Project's climate as precipitation, air temperature, snow depth, and wind speed and direction are highly variable within the area itself.

The mean daily maximum summer temperatures are above 15°C and the mean daily minimum winter air temperature falls well below -10°C. Based on the approximately 34 month reporting period (March 9, 2011 to December 31, 2013), the extreme maximum air temperature recorded at the Project's Murray River meteorological station (1,055 m) was 30.7°C (July 1, 2013) and the extreme minimum air temperature was -36.3°C (January 17, 2012).

The orographic influence of mountains within the Regional Study Area, as well as the inflow of moist air from the Pacific meeting with drier a continental air mass, means that precipitation is highly variable over the Project Area. Total precipitation amounts, in 2013, at the Murray River station were higher than the total amounts recorded at the regional EC meteorological stations, Chetwynd A and Dawson Creek A which were 484.7 and 399.5 mm respectively. Total precipitation amounts at Murray River in 2013 were higher than all but one of the regional stations with climate normal data.

Snow depth data from regional stations typically ranged from 5 to 43 cm between November and March. Snow depth is highly dependent on elevation. In 2011, 2012 and 2013 the deepest snow was in November (28 cm), December (57 cm) and March (90 cm), respectively. Historically, the deepest snow was observed in February. The greatest snow depth observed at Murray River meteorological station was 90 cm on March 14, 2013.

Strong winds occur during all seasons at high elevations in the Project area, with flow predominantly from the south. Winds at low elevations are funnelled through the valleys with a light to moderate flow, again, predominantly from the south. Based on a 24 month (March 9, 2011 to March 9, 2013) dataset from the Murray River meteorological station, 1 to 2 m/s winds were the most frequent occurring 33% of the time. The frequency of calm winds was 17%, and winds over 6 m/s occurred approximately 2% of the time. The maximum gust speed recorded was 19.7 m/s (70.9 km/h) on April 8, 2011.

The highest recorded daily average solar radiation of 353 W/m², was recorded on June 21, 2011. On average, the lowest and highest mean daily solar radiation occurs during the winter and summer, respectively. This is because the sun is lowest on the horizon during the winter and highest during the summer. The large differences in day-to-day values of mean daily solar radiation are due to differences in cloud cover. All hourly average solar radiation values recorded during night time hours were 0 W/m².

Daily barometric pressure corrected to sea level at the Murray River station remained between 98.6 and 102.7 kPa for the record period. Daily relative humidity ranged from 25 to 99%, and monthly average relative humidity ranged from 50.6 to 81.3%.

References

References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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<http://a100.gov.bc.ca/pub/mss/stationlist.do>

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Personal Communication

Eric Meyer. 2013. Personal Communication May 3, 2013

Appendix 1

Regional Meteorology Station Data

Appendix 1. Regional Meteorology Station Data

Station Name	CHETWYND A		
Province	BC	Latitude (dd mm)	55 41 N
Country	CAN	Longitude (ddd mm)	121 37 W
Time Zone	MTZ	Latitude (decimal degrees)	55.69
Climate Id	1181508	Longitude (decimal degrees)	-121.63
WMO Id		Elevation (m)	609.6
TC Id	YCQ	Station Status	Active

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<i>Temperature</i>														
Daily Average (°C)	-10.7	-7.6	-2.4	4.7	9.6	13.2	15.3	14.5	10	3.9	-5.9	-9.4	3	D
Standard Deviation	4.9	4.2	3.8	1.1	1.7	1	0.9	1.1	1.9	1.8	3.9	5.4	3	D
Daily Maximum (°C)	-5.4	-1.7	3.4	11.4	16.7	20	22.2	21.6	16.5	9.2	-1.3	-4.4	9	D
Daily Minimum (°C)	-15.9	-13.5	-8.2	-2	2.5	6.5	8.4	7.4	3.5	-1.3	-10.4	-14.3	-3.1	D
Extreme Maximum (°C)	15.2	14.8	21.4	26.1	33.4	31	32.7	33.8	30.2	26.3	13.4	12.7		
Date (yyyy/dd)	1993/31	1986/27	1994/30	1984/15	1983/29	1990/22	1987/23	1991/15	1988/02	1987/01	1987/10	1997/13		
Extreme Minimum (°C)	-52	-42.1	-33	-18.5	-8.5	-2.7	-1.8	-6.6	-8.5	-28.2	-42	-46.3		
Date (yyyy/dd)	1997/25	1986/19	1995/05	1986/11	1996/08	1991/02	1999/16	1992/23	1984/23	1984/31	1985/26	1992/29		
<i>Precipitation</i>														
Rainfall (mm)	0.9	0.6	1.3	10.3	33	76.1	79.3	53.9	42.1	16.1	3.5	1.3	318.4	D
Snowfall (cm)	27.7	22	25.4	9.1	4.4	0	0	0	2.4	19.2	33.9	25.6	169.6	D
Precipitation (mm)	21.6	16	19.5	18.7	37.2	76.1	79.3	53.9	44.4	30.7	29.6	20.5	447.5	D
Average Snow Depth (cm)	18	19	12	1	0	0	0	0	0	1	8	13	6	D
Median Snow Depth (cm)	18	19	11	0	0	0	0	0	0	0	8	12	6	D
Snow Depth at Month-end (cm)	17	14	4	0	0	0	0	0	0	2	11	15	5	D
Extreme Daily Rainfall (mm)	5.2	1.8	3.2	15.6	18.6	52.8	64.4	36.3	32.6	22.4	11	3.6		
Date (yyyy/dd)	1995/31	1986/27	1993/22	1988/18	1990/25	1983/24	1987/31	1994/05	1985/12	1997/01	1995/17	1990/03		
Extreme Daily Snowfall (cm)	14	15	21	21.8	19.6	0	0	0	7	34.3	25	22		
Date (yyyy/dd)	1990/25	1999/02	1987/04	1993/04	1986/13	1983/01	1983/01	1983/01	1996/30	1986/27	1996/09	1997/20		
Extreme Daily Precipitation (mm)	10.2	11.6	14.2	20.9	19.6	52.8	64.4	36.3	32.6	27	18	18.4		
Date (yyyy/dd)	1988/27	1999/02	1987/03	1986/16	1986/13	1983/24	1987/31	1994/05	1985/12	1986/27	1991/16	1997/20		
Extreme Snow Depth (cm)	58	67	58	18	20	0	0	0	6	22	47	53		
Date (yyyy/dd)	1997/28	1994/22	1994/01	1983/01	1986/14	1983/01	1983/01	1983/01	1992/25	1984/18	1995/30	1991/11		
<i>Days with Maximum Temperature</i>														
<= 0 °C	18.9	13.5	8.8	0.89	0	0	0	0	0	2.5	13.8	18.3	76.8	D
> 0 °C	12.1	14.8	22.2	29.1	31	30	31	31	30	28.5	16.2	12.7	288.5	D
> 10 °C	0.22	1.1	4.8	19.1	28	29.6	30.9	30.5	25.5	15	0.84	0.32	185.9	D
> 20 °C	0	0	0.06	1.2	8.3	15.6	21.8	19.9	8.4	1.2	0	0	76.5	D
> 30 °C	0	0	0	0	0.11	0.22	1.1	0.78	0.06	0	0	0	2.2	D
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	D

Appendix 1. Regional Meteorology Station Data

Station Name	CHETWYND A		
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Country	CAN	Longitude (ddd mm)	121 37 W
Time Zone	MTZ	Latitude (decimal degrees)	55.69
Climate Id	1181508	Longitude (decimal degrees)	-121.63
WMO Id		Elevation (m)	609.6
TC Id	YCQ	Station Status	Active

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<i>Days with Minimum Temperature</i>														
> 0 °C	1.1	1.7	2.7	8.2	22.3	29.2	30.9	30.3	24.1	11.9	1.9	2.1	166.4	D
<= 2 °C	30.6	27.4	30.1	26.2	15.2	2.8	0.61	2.1	10.8	23.4	29.1	30	228.2	D
<= 0 °C	29.9	26.6	28.3	21.8	8.7	0.83	0.06	0.72	5.9	19.1	28.1	28.9	198.8	D
< -2 °C	28.4	25.3	24.6	14.4	3.1	0.06	0	0.17	2.7	12.8	25.7	27.3	164.5	D
< -10 °C	20.5	16.6	9.2	1.3	0	0	0	0	0	1.5	13.7	19.3	82.1	D
< -20 °C	10.4	7	3.2	0	0	0	0	0	0	0.33	4.1	9.1	34.2	D
< -30 °C	3.2	1.8	0.39	0	0	0	0	0	0	0	0.74	2.6	8.7	D
<i>Days with Rainfall</i>														
>= 0.2 mm	0.89	0.78	1.2	5.3	10.6	12.7	13.7	12.4	11.9	7.2	1.7	1.1	79.5	D
>= 5 mm	0.06	0	0	0.33	2.1	4.4	4.8	3.3	2.8	0.74	0.21	0	18.8	D
>= 10 mm	0	0	0	0.17	1	2.3	2.4	1.9	1.2	0.26	0.05	0	9.3	D
>= 25 mm	0	0	0	0	0	0.61	0.56	0.17	0.11	0	0	0	1.5	D
<i>Days With Snowfall</i>														
>= 0.2 cm	9.2	8.1	8.7	3.7	1.3	0	0	0	0.83	5.3	10.1	8.7	55.8	D
>= 5 cm	2.2	1.4	1.7	0.44	0.22	0	0	0	0.11	1.3	2.1	1.7	11.2	D
>= 10 cm	0.56	0.28	0.5	0.06	0.11	0	0	0	0	0.42	0.63	0.32	2.9	D
>= 25 cm	0	0	0	0	0	0	0	0	0	0.05	0.05	0	0.1	D
<i>Days with Precipitation</i>														
>= 0.2 mm	9.6	8.4	9.4	7.8	11.1	12.7	13.7	12.4	12.2	11.1	11	9.4	128.8	D
>= 5 mm	1.3	0.94	1.1	0.78	2.4	4.4	4.8	3.3	2.9	1.8	1.6	0.95	26.3	D
>= 10 mm	0.17	0.11	0.22	0.33	1.2	2.3	2.4	1.9	1.3	0.53	0.47	0.21	11.2	D
>= 25 mm	0	0	0	0	0	0.61	0.56	0.17	0.11	0.05	0	0	1.5	D
<i>Wind</i>														
Speed (km/h)	8.5	7.9	8.6	9.2	9	8.2	7.8	7.2	7.7	8.6	7.4	8.6	8.2	D
Most Frequent Direction	SW	SW	SW	SW	SW	SW	SW	W	SW	SW	SW	SW	SW	D
Maximum Hourly Speed (km/h)	59	59	52	56	57	52	56	46	78	74	61	56		
Date (yyyy/dd)	1991/18	1990/22	1985/12	1987/16	1992/04	1985/15	1984/01	1986/13	1991/23	1993/27	1993/14	1990/06		
Direction of Maximum Hourly	SW	SW	SW	SW	SW	SW	S	S	W	SW	SW	S	W	

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WMO Id		Elevation (m)	609.6
TC Id	YCQ	Station Status	Active

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<i>Degree Days</i>														
Above 24 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	D
Above 18 °C	0	0	0	0	0.3	0.9	5.8	6.8	0.1	0	0	0	13.9	D
Above 15 °C	0	0	0	0	4.8	13.1	36.6	34.1	4.7	0.4	0	0	93.6	D
Above 10 °C	0.1	0	0	2.6	42.8	102.6	165.4	144.6	49.2	8.3	0	0	515.6	D
Above 5 °C	0.9	1.9	5	38	148.9	247.1	320	295.7	157.2	46.9	1.8	1.2	1264.4	D
Above 0 °C	10.8	18.5	50.2	150.7	298.3	397	475	450.5	300.6	146.8	19.2	15.1	2332.6	D
Below 0 °C	341.2	233.9	123.5	10.1	0.4	0	0	0	0.1	24.6	195	305.2	1233.9	D
Below 5 °C	486.4	358.7	233.2	47.4	6	0.1	0	0.2	6.7	79.8	327.6	446.3	1992.1	D
Below 10 °C	640.6	498.2	383.2	162	54.9	5.6	0.4	4	48.8	196.2	475.8	600.1	3069.7	D
Below 15 °C	795.5	639.6	538.2	309.4	171.9	66.1	26.6	48.6	154.2	343.2	625.8	755.1	4474.2	D
Below 18 °C	888.5	724.4	631.2	399.4	260.4	143.8	88.9	114.3	239.7	435.9	715.8	848.1	5490.2	D
<i>Bright Sunshine</i>														
Extreme Daily	7.1	9.6	11.5	14.2	15.7	16.6	16	15.2	13.3	10.2	8.1	6.4		D
Date (yyyy/dd)	1986/31	1988/27	1987/31	1990/29	1984/25	1983/28	1984/01	1986/01	1988/04	1994/04	1987/01	1986/10		
<i>Humidex</i>														
Extreme Humidex	14.6	13.5	20.4	25.5	34.3	31.2	35.4	35.4	33.3	26	12.5	12.4		
Date (yyyy/dd)	1993/31	1992/26	1994/30	1984/15	1983/29	1989/12	2002/13	1997/05	1988/04	1987/01	1986/02	1997/13		
<i>Wind Chill</i>														
Extreme Wind Chill	-58	-48.8	-34.1	-27.2	-14.9	-2.2	0	-6.1	-10	-34.4	-50	-53.8		
Date (yyyy/dd)	1997/25	1986/19	1989/01	2002/02	2002/05	1999/01	1999/16	1992/23	1992/15	1984/31	1985/26	1995/07		
<i>Humidity</i>														
Average Relative Humidity - 1	70.3	64.7	54.8	40.7	40.5	47.1	49.5	49.3	50.8	56	71.1	72.3	55.6	D

Appendix 2

2011 to 2013 Murray River Daily Air Temperature and Precipitation Data

Appendix 2. 2011 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
9-Mar-11	-8.2	-2.5	-13.6	8.1
10-Mar-11	-15.9	-13.4	-19.8	5.1
11-Mar-11	-12.8	-1.0	-22.4	0.0
12-Mar-11	-6.4	2.9	-13.3	0.0
13-Mar-11	-1.7	5.3	-6.3	3.0
14-Mar-11	-4.8	1.8	-12.7	6.6
15-Mar-11	-7.0	-0.6	-10.3	0.0
16-Mar-11	-4.5	5.7	-11.4	0.0
17-Mar-11	-0.3	3.8	-7.0	0.0
18-Mar-11	-2.7	5.6	-10.5	0.0
19-Mar-11	-8.0	-6.5	-9.5	0.0
20-Mar-11	-7.2	-5.7	-8.2	0.0
21-Mar-11	-6.4	-4.5	-8.2	2.0
22-Mar-11	-2.3	4.1	-7.0	3.0
23-Mar-11	-2.9	4.9	-10.9	n/a
24-Mar-11	-2.9	-1.3	-3.8	n/a
25-Mar-11	-3.6	-1.7	-4.5	n/a
26-Mar-11	-4.5	-2.5	-5.8	n/a
27-Mar-11	-4.6	-2.9	-5.8	n/a
28-Mar-11	0.2	8.6	-8.3	n/a
29-Mar-11	2.5	6.9	-2.6	n/a
30-Mar-11	2.5	5.7	-0.7	n/a
31-Mar-11	2.0	5.8	-1.7	n/a
1-Apr-11	0.8	4.5	-4.1	n/a
2-Apr-11	-0.6	6.7	-6.2	n/a
3-Apr-11	0.5	5.9	-6.9	n/a
4-Apr-11	0.8	3.8	-2.9	n/a
5-Apr-11	-1.0	2.9	-4.8	n/a
6-Apr-11	-0.7	3.4	-4.8	n/a
7-Apr-11	-0.4	5.4	-7.2	n/a
8-Apr-11	1.4	2.9	0.5	n/a
9-Apr-11	2.6	6.1	-0.9	n/a
10-Apr-11	1.3	4.3	-1.7	n/a
11-Apr-11	0.5	2.7	-3.1	n/a
12-Apr-11	0.0	5.1	-5.1	n/a
13-Apr-11	0.1	5.9	-7.1	n/a
14-Apr-11	-0.8	2.7	-3.1	n/a
15-Apr-11	-2.3	2.0	-4.2	n/a
16-Apr-11	-2.8	0.0	-4.3	n/a
17-Apr-11	-3.0	2.9	-8.4	n/a
18-Apr-11	-3.8	4.7	-12.1	n/a
19-Apr-11	-1.9	3.4	-7.4	n/a
20-Apr-11	-0.1	3.8	-3.5	n/a
21-Apr-11	0.1	3.7	-5.4	n/a
22-Apr-11	1.3	4.6	-3.0	n/a
23-Apr-11	4.1	9.4	-2.7	n/a
24-Apr-11	6.2	13.2	-1.2	n/a
25-Apr-11	5.1	10.7	-1.8	n/a
26-Apr-11	6.1	9.9	1.8	n/a
27-Apr-11	4.1	8.7	0.3	n/a
28-Apr-11	1.8	6.3	-2.6	n/a
29-Apr-11	3.0	7.2	0.0	n/a
30-Apr-11	3.5	6.7	-0.4	n/a

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2011 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-May-11	5.2	8.8	0.6	n/a
2-May-11	4.5	8.9	0.6	n/a
3-May-11	4.0	7.3	1.2	n/a
4-May-11	3.9	5.6	1.2	n/a
5-May-11	4.8	8.4	0.8	n/a
6-May-11	5.0	9.7	0.1	n/a
7-May-11	5.8	12.4	-0.8	n/a
8-May-11	6.8	12.4	-0.1	n/a
9-May-11	6.7	13.1	-0.2	n/a
10-May-11	7.3	12.3	1.8	n/a
11-May-11	8.0	14.4	3.0	n/a
12-May-11	5.8	9.7	0.9	n/a
13-May-11	7.7	13.6	0.6	0.0
14-May-11	10.2	18.6	0.9	0.0
15-May-11	11.8	20.3	2.3	0.0
16-May-11	13.5	21.6	2.2	0.0
17-May-11	7.8	16.5	2.3	15.0
18-May-11	7.3	12.8	2.1	0.3
19-May-11	7.7	15.3	0.4	0.0
20-May-11	10.5	18.0	2.9	0.0
21-May-11	10.9	18.0	4.3	0.0
22-May-11	9.5	16.0	2.8	31.8
23-May-11	4.8	8.1	2.7	15.5
24-May-11	5.0	7.6	2.6	0.3
25-May-11	6.1	7.6	4.4	0.0
26-May-11	6.3	8.7	4.8	0.5
27-May-11	9.2	15.2	4.8	0.0
28-May-11	9.9	16.4	3.8	0.0
29-May-11	11.7	18.2	2.4	0.0
30-May-11	9.8	14.9	4.9	3.3
31-May-11	9.9	16.4	1.6	0.0
1-Jun-11	11.4	18.7	1.7	0.0
2-Jun-11	13.1	19.5	8.4	6.9
3-Jun-11	2.5	8.5	-0.5	4.8
4-Jun-11	5.9	13.1	-0.8	7.6
5-Jun-11	9.7	13.8	5.2	0.0
6-Jun-11	10.2	17.0	2.0	1.3
7-Jun-11	8.0	10.2	5.2	1.0
8-Jun-11	11.2	19.7	1.0	0.0
9-Jun-11	14.4	17.8	9.6	0.0
10-Jun-11	10.4	14.1	7.8	0.0
11-Jun-11	10.7	15.8	4.1	0.0
12-Jun-11	11.6	17.9	3.7	0.0
13-Jun-11	10.7	15.2	5.7	1.8
14-Jun-11	10.9	14.6	6.2	0.0
15-Jun-11	8.9	12.8	4.0	11.4
16-Jun-11	10.9	16.1	8.5	3.6
17-Jun-11	10.2	13.8	6.8	9.7
18-Jun-11	12.2	19.6	6.6	0.0
19-Jun-11	11.4	14.3	9.2	7.1
20-Jun-11	12.0	15.7	7.8	0.8
21-Jun-11	13.5	19.0	4.6	0.0
22-Jun-11	14.8	21.6	6.4	0.0
23-Jun-11	11.1	13.7	8.4	7.9
24-Jun-11	7.1	9.2	5.2	29.2
25-Jun-11	8.5	13.1	5.4	1.8
26-Jun-11	12.8	19.9	5.0	0.5
27-Jun-11	14.5	21.8	6.9	0.0
28-Jun-11	13.0	15.7	9.3	1.5
29-Jun-11	11.4	15.5	7.0	0.8
30-Jun-11	8.7	11.7	5.3	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2011 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Jul-11	8.9	13.0	5.9	0.0
2-Jul-11	11.1	16.6	6.3	0.0
3-Jul-11	9.8	13.7	7.1	0.0
4-Jul-11	11.4	16.4	4.8	0.0
5-Jul-11	13.8	17.2	9.6	0.0
6-Jul-11	13.0	17.6	9.3	0.3
7-Jul-11	12.4	18.3	7.0	2.0
8-Jul-11	9.3	10.3	8.7	45.2
9-Jul-11	10.8	13.0	9.4	16.3
10-Jul-11	11.3	13.5	9.8	10.4
11-Jul-11	13.2	17.1	10.8	0.3
12-Jul-11	13.2	16.5	11.2	0.3
13-Jul-11	12.9	18.6	8.9	32.3
14-Jul-11	12.1	17.1	8.5	0.3
15-Jul-11	12.7	15.6	9.5	0.0
16-Jul-11	15.0	20.2	11.4	0.0
17-Jul-11	14.8	20.2	10.5	0.5
18-Jul-11	14.1	18.3	9.5	0.0
19-Jul-11	12.5	15.5	9.5	0.0
20-Jul-11	12.4	16.6	7.5	0.0
21-Jul-11	8.0	12.2	5.3	9.9
22-Jul-11	10.2	17.1	4.1	1.8
23-Jul-11	12.7	18.5	6.8	0.0
24-Jul-11	15.2	20.0	12.3	1.8
25-Jul-11	15.9	19.6	11.6	0.0
26-Jul-11	13.1	16.8	7.6	0.0
27-Jul-11	12.1	15.1	9.8	0.0
28-Jul-11	12.1	15.2	9.9	0.0
29-Jul-11	11.4	14.9	8.6	0.0
30-Jul-11	10.3	13.2	7.6	0.0
31-Jul-11	10.1	14.1	5.5	0.0
1-Aug-11	11.8	15.1	9.0	0.3
2-Aug-11	14.8	19.6	7.2	0.0
3-Aug-11	16.5	21.0	9.8	0.0
4-Aug-11	17.1	22.4	10.1	0.0
5-Aug-11	14.4	18.9	9.7	0.0
6-Aug-11	10.6	15.9	5.2	0.0
7-Aug-11	15.3	19.4	10.3	0.0
8-Aug-11	15.8	23.2	5.5	0.0
9-Aug-11	17.0	23.5	7.5	0.0
10-Aug-11	15.5	23.8	7.2	0.0
11-Aug-11	15.5	21.4	7.4	0.0
12-Aug-11	14.2	19.5	8.4	0.0
13-Aug-11	12.6	19.0	5.0	2.0
14-Aug-11	10.8	14.9	6.6	0.3
15-Aug-11	10.4	13.8	7.1	0.0
16-Aug-11	9.8	11.5	8.3	0.0
17-Aug-11	10.2	13.9	7.1	0.0
18-Aug-11	10.5	15.1	5.9	0.0
19-Aug-11	11.3	14.8	6.0	0.0
20-Aug-11	16.4	21.6	11.6	0.0
21-Aug-11	17.1	19.9	13.3	0.0
22-Aug-11	13.2	17.5	7.8	2.3
23-Aug-11	11.5	16.6	7.4	0.3
24-Aug-11	13.3	17.7	7.0	0.0
25-Aug-11	11.3	17.3	4.8	0.0
26-Aug-11	13.2	22.0	4.4	0.0
27-Aug-11	13.1	19.3	7.8	0.0
28-Aug-11	15.1	22.4	7.5	0.0
29-Aug-11	12.2	16.3	6.2	0.5
30-Aug-11	8.6	14.2	4.1	1.0
31-Aug-11	8.0	14.8	1.9	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2011 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Sep-11	7.6	11.0	4.9	3.3
2-Sep-11	8.4	12.2	5.2	0.8
3-Sep-11	12.4	18.0	4.1	n/a
4-Sep-11	15.5	18.1	11.9	n/a
5-Sep-11	15.0	20.1	11.9	n/a
6-Sep-11	17.6	21.5	13.4	n/a
7-Sep-11	19.4	23.8	13.5	n/a
8-Sep-11	19.3	26.2	11.1	n/a
9-Sep-11	18.5	23.2	12.2	n/a
10-Sep-11	17.1	22.6	11.2	n/a
11-Sep-11	10.4	15.3	3.3	n/a
12-Sep-11	8.1	16.5	0.0	n/a
13-Sep-11	8.7	15.3	4.2	n/a
14-Sep-11	10.5	20.4	1.3	n/a
15-Sep-11	9.3	13.7	3.5	n/a
16-Sep-11	9.3	12.5	7.1	n/a
17-Sep-11	7.2	10.5	1.2	n/a
18-Sep-11	6.8	12.0	-0.2	n/a
19-Sep-11	8.1	11.8	3.1	n/a
20-Sep-11	11.8	18.5	2.6	n/a
21-Sep-11	14.4	20.0	7.6	n/a
22-Sep-11	7.5	12.7	5.2	n/a
23-Sep-11	9.8	18.7	4.4	n/a
24-Sep-11	4.7	7.0	2.7	n/a
25-Sep-11	7.3	16.0	1.2	n/a
26-Sep-11	6.9	10.6	0.9	n/a
27-Sep-11	8.4	11.3	6.0	n/a
28-Sep-11	5.8	9.3	1.7	n/a
29-Sep-11	6.4	15.3	-1.4	n/a
30-Sep-11	7.8	16.4	1.6	n/a
1-Oct-11	2.3	6.2	-1.3	n/a
2-Oct-11	1.0	2.2	-0.2	n/a
3-Oct-11	3.4	4.9	1.8	n/a
4-Oct-11	3.9	9.5	0.7	n/a
5-Oct-11	2.9	7.5	-1.4	n/a
6-Oct-11	7.5	12.5	2.8	n/a
7-Oct-11	6.1	9.7	1.4	n/a
8-Oct-11	6.0	11.0	0.5	n/a
9-Oct-11	5.3	8.1	0.4	n/a
10-Oct-11	4.0	9.4	0.1	n/a
11-Oct-11	2.9	7.1	0.3	n/a
12-Oct-11	4.3	7.4	1.4	n/a
13-Oct-11	3.6	6.9	0.9	n/a
14-Oct-11	2.4	6.5	-1.6	n/a
15-Oct-11	1.5	5.5	-3.8	n/a
16-Oct-11	4.1	7.8	1.3	n/a
17-Oct-11	4.1	8.7	3.2	0.0
18-Oct-11	4.1	13.1	6.2	0.0
19-Oct-11	4.1	9.9	2.6	0.0
20-Oct-11	4.1	5.4	-2.3	0.0
21-Oct-11	4.1	5.8	-2.8	0.0
22-Oct-11	4.1	7.7	2.6	0.0
23-Oct-11	4.1	4.9	1.4	0.3
24-Oct-11	4.1	4.1	-0.9	0.0
25-Oct-11	4.1	3.7	-0.9	0.0
26-Oct-11	4.1	4.0	-0.6	0.0
27-Oct-11	4.1	2.2	-1.0	0.0
28-Oct-11	4.1	3.1	-1.1	0.0
29-Oct-11	4.1	2.6	-0.5	0.0
30-Oct-11	4.1	4.6	0.7	0.0
31-Oct-11	4.1	3.1	-1.1	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2011 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Nov-11	4.1	2.3	-1.9	0.0
2-Nov-11	4.1	6.0	0.0	0.0
3-Nov-11	4.1	0.5	-11.7	0.0
4-Nov-11	4.1	-1.2	-15.9	0.0
5-Nov-11	4.1	1.9	-4.7	0.0
6-Nov-11	4.1	1.2	-4.0	0.0
7-Nov-11	4.1	0.3	-3.2	0.0
8-Nov-11	4.1	0.3	-5.3	0.0
9-Nov-11	4.1	3.2	-6.1	3.8
10-Nov-11	4.1	4.1	0.2	11.4
11-Nov-11	4.1	1.8	-4.9	0.5
12-Nov-11	4.1	0.0	-6.0	0.3
13-Nov-11	4.1	0.8	-4.2	0.8
14-Nov-11	4.1	-3.2	-10.6	0.8
15-Nov-11	4.1	-4.1	-9.9	0.0
16-Nov-11	4.1	-4.2	-9.5	0.0
17-Nov-11	4.1	-8.3	-19.8	0.0
18-Nov-11	4.1	-18.6	-22.7	0.3
19-Nov-11	4.1	-20.1	-28.9	0.0
20-Nov-11	4.1	-10.7	-26.2	0.0
21-Nov-11	4.1	-2.8	-10.7	0.0
22-Nov-11	4.1	0.8	-6.7	0.3
23-Nov-11	4.1	-0.7	-7.2	0.0
24-Nov-11	4.1	-1.0	-5.8	0.0
25-Nov-11	4.1	-1.2	-5.4	0.0
26-Nov-11	4.1	3.6	-4.5	0.3
27-Nov-11	4.1	4.6	-5.3	0.0
28-Nov-11	4.1	0.3	-5.3	3.6
29-Nov-11	4.1	1.7	-2.3	0.0
30-Nov-11	4.1	1.8	-9.3	1.5
1-Dec-11	4.1	4.3	-1.8	0.0
2-Dec-11	4.1	0.7	-3.0	0.0
3-Dec-11	4.1	2.8	-5.2	0.0
4-Dec-11	4.1	3.1	-11.0	1.3
5-Dec-11	4.1	7.4	0.5	0.0
6-Dec-11	4.1	6.5	-8.0	0.0
7-Dec-11	4.1	-6.9	-14.4	0.3
8-Dec-11	4.1	2.6	-8.4	0.3
9-Dec-11	4.1	4.8	0.6	0.8
10-Dec-11	4.1	4.2	-3.8	1.8
11-Dec-11	4.1	-1.6	-7.8	3.0
12-Dec-11	4.1	-1.2	-5.2	0.3
13-Dec-11	4.1	-2.2	-8.9	0.0
14-Dec-11	4.1	-4.0	-11.8	0.0
15-Dec-11	4.1	-2.2	-9.3	0.0
16-Dec-11	4.1	1.7	-2.6	0.5
17-Dec-11	4.1	2.7	-2.3	7.9
18-Dec-11	4.1	-1.3	-8.0	1.0
19-Dec-11	4.1	3.6	-2.4	4.3
20-Dec-11	4.1	2.5	-5.8	16.3
21-Dec-11	4.1	-2.2	-6.3	0.3
22-Dec-11	4.1	3.7	-4.0	0.0
23-Dec-11	4.1	3.6	-1.3	0.0
24-Dec-11	4.1	4.0	-0.2	0.3
25-Dec-11	4.1	5.4	-1.1	0.0
26-Dec-11	4.1	1.0	-3.2	0.5
27-Dec-11	4.1	0.4	-10.9	0.3
28-Dec-11	4.1	2.5	-8.6	0.0
29-Dec-11	4.1	1.8	-8.6	1.0
30-Dec-11	4.1	-4.5	-8.5	0.0
31-Dec-11	4.1	-6.2	-12.4	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily Precipitation (mm)
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Jan-12	-10.5	3.3	-14.7	n/a
2-Jan-12	4.0	8.3	0.1	n/a
3-Jan-12	1.9	3.6	0.1	n/a
4-Jan-12	3.1	4.5	0.5	n/a
5-Jan-12	-0.9	2.0	-2.4	n/a
6-Jan-12	-3.6	-1.9	-5.5	n/a
7-Jan-12	-0.8	2.2	-3.6	n/a
8-Jan-12	2.1	3.3	0.6	n/a
9-Jan-12	0.5	4.2	-5.3	n/a
10-Jan-12	-7.7	-4.1	-11.1	n/a
11-Jan-12	-5.4	-3.1	-8.6	n/a
12-Jan-12	-1.8	1.5	-5.0	n/a
13-Jan-12	-3.0	-1.5	-4.9	n/a
14-Jan-12	-12.3	-4.3	-22.8	n/a
15-Jan-12	-24.4	-22.8	-26.9	n/a
16-Jan-12	-30.7	-26.9	-34.7	n/a
17-Jan-12	-33.5	-28.1	-36.3	n/a
18-Jan-12	-29.0	-20.3	-35.8	n/a
19-Jan-12	-26.0	-18.6	-30.8	n/a
20-Jan-12	-22.5	-18.2	-27.2	n/a
21-Jan-12	-15.8	-3.5	-21.7	n/a
22-Jan-12	-4.1	0.1	-8.9	n/a
23-Jan-12	-3.7	-1.1	-10.2	n/a
24-Jan-12	-0.9	1.3	-3.0	n/a
25-Jan-12	-2.1	2.1	-5.4	n/a
26-Jan-12	-6.3	-4.4	-8.0	n/a
27-Jan-12	-4.7	-2.3	-8.4	n/a
28-Jan-12	-3.3	0.7	-5.9	n/a
29-Jan-12	2.1	3.0	0.5	n/a
30-Jan-12	0.7	2.7	-0.6	n/a
31-Jan-12	0.0	1.2	-0.8	n/a
1-Feb-12	-1.5	1.4	-4.8	n/a
2-Feb-12	0.9	4.5	-3.8	n/a
3-Feb-12	3.9	11.7	0.0	n/a
4-Feb-12	1.8	8.3	-2.8	n/a
5-Feb-12	-2.1	-0.6	-5.0	n/a
6-Feb-12	-6.4	-0.9	-11.5	n/a
7-Feb-12	-6.9	2.8	-13.1	n/a
8-Feb-12	-5.8	0.8	-11.2	n/a
9-Feb-12	-8.4	-1.4	-13.3	n/a
10-Feb-12	-11.4	-3.7	-15.1	n/a
11-Feb-12	-4.2	7.5	-16.4	n/a
12-Feb-12	3.2	6.0	0.3	n/a
13-Feb-12	-2.6	1.2	-5.7	n/a
14-Feb-12	-4.1	0.8	-9.7	n/a
15-Feb-12	-2.0	1.9	-6.8	n/a
16-Feb-12	-1.1	0.8	-4.7	n/a
17-Feb-12	-0.7	5.4	-5.6	n/a
18-Feb-12	-4.9	-1.4	-8.0	n/a
19-Feb-12	-3.4	0.2	-6.5	n/a
20-Feb-12	-3.8	0.2	-9.3	n/a
21-Feb-12	-0.6	2.3	-4.0	n/a
22-Feb-12	-1.3	1.6	-4.7	n/a
23-Feb-12	-3.2	-0.5	-8.5	n/a
24-Feb-12	-8.0	-4.7	-11.4	n/a
25-Feb-12	-12.5	-9.1	-15.0	n/a
26-Feb-12	-12.6	-6.0	-19.0	n/a
27-Feb-12	-8.0	-5.1	-12.0	n/a
28-Feb-12	-4.9	0.6	-9.8	n/a
29-Feb-12	-10.3	-7.1	-13.6	n/a

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Mar-12	-10.5	-1.6	-18.1	0.3
2-Mar-12	-2.5	1.1	-7.1	0.8
3-Mar-12	-0.2	3.9	-2.7	1.3
4-Mar-12	-3.3	-0.9	-6.7	1.8
5-Mar-12	-8.1	-3.8	-14.3	1.0
6-Mar-12	-10.2	-4.9	-17.4	0.3
7-Mar-12	-0.6	2.9	-5.1	2.3
8-Mar-12	2.7	5.2	0.8	3.0
9-Mar-12	2.0	4.1	-0.4	5.3
10-Mar-12	-0.9	2.5	-6.0	1.3
11-Mar-12	-1.6	5.2	-6.2	1.3
12-Mar-12	-3.5	-0.7	-8.5	1.5
13-Mar-12	-7.4	-1.5	-13.1	1.3
14-Mar-12	-3.0	1.4	-6.2	1.5
15-Mar-12	-1.2	4.9	-5.9	1.5
16-Mar-12	0.8	4.9	-3.5	1.0
17-Mar-12	-4.6	1.2	-8.0	0.8
18-Mar-12	-7.6	-2.9	-10.7	1.0
19-Mar-12	-6.3	0.9	-11.0	1.0
20-Mar-12	-9.5	-5.3	-13.9	0.3
21-Mar-12	-3.4	1.9	-10.8	0.0
22-Mar-12	-8.1	-2.2	-13.4	0.5
23-Mar-12	-7.5	-1.6	-12.1	1.0
24-Mar-12	-4.2	5.6	-13.0	0.5
25-Mar-12	-1.9	6.1	-10.3	0.5
26-Mar-12	0.2	8.6	-8.2	0.5
27-Mar-12	1.0	10.5	-6.8	0.3
28-Mar-12	1.6	9.6	-3.7	0.3
29-Mar-12	0.6	8.7	-4.2	0.5
30-Mar-12	-0.5	5.1	-6.3	0.3
31-Mar-12	-0.6	4.1	-5.2	0.0
1-Apr-12	-0.9	5.8	-7.3	0.0
2-Apr-12	3.2	7.4	-3.5	0.0
3-Apr-12	6.0	10.1	-1.1	0.0
4-Apr-12	0.5	5.1	-3.3	0.0
5-Apr-12	-1.2	3.3	-3.3	1.3
6-Apr-12	-0.1	5.9	-4.9	1.5
7-Apr-12	2.7	8.5	-4.1	0.5
8-Apr-12	3.2	10.5	-4.5	0.0
9-Apr-12	2.6	9.2	-5.0	0.0
10-Apr-12	3.7	12.1	-4.3	0.0
11-Apr-12	5.9	13.4	-1.6	0.0
12-Apr-12	2.3	5.6	-0.7	0.3
13-Apr-12	-1.5	0.7	-3.5	0.8
14-Apr-12	-4.6	-2.4	-6.6	0.3
15-Apr-12	-0.9	8.5	-9.6	1.0
16-Apr-12	1.1	6.7	-4.5	1.0
17-Apr-12	1.6	5.8	-2.0	0.3
18-Apr-12	1.7	7.9	-4.7	0.5
19-Apr-12	4.7	11.1	-3.0	0.8
20-Apr-12	3.7	7.6	0.2	0.0
21-Apr-12	3.5	8.8	-1.0	0.8
22-Apr-12	1.8	5.7	-2.4	0.3
23-Apr-12	3.4	8.8	0.1	0.0
24-Apr-12	5.4	11.7	-1.7	0.8
25-Apr-12	2.7	4.9	0.3	0.3
26-Apr-12	2.2	4.4	0.3	0.0
27-Apr-12	3.0	6.4	0.3	0.0
28-Apr-12	4.7	8.5	-0.1	0.0
29-Apr-12	5.6	10.1	0.1	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
30-Apr-12	4.4	11.1	-1.9	0.0
1-May-12	4.5	9.4	-0.2	0.0
2-May-12	5.2	10.4	-1.3	0.3
3-May-12	4.7	10.8	-0.1	0.0
4-May-12	5.0	8.9	1.0	1.0
5-May-12	3.9	7.6	0.7	2.0
6-May-12	6.7	11.7	0.7	1.5
7-May-12	10.1	15.0	5.1	0.5
8-May-12	8.8	14.0	2.5	1.0
9-May-12	1.4	4.3	-1.8	0.5
10-May-12	2.3	7.3	-2.5	1.5
11-May-12	5.4	9.6	1.0	1.5
12-May-12	10.9	15.9	5.6	0.5
13-May-12	11.3	16.0	5.0	0.3
14-May-12	10.9	18.6	0.4	0.0
15-May-12	9.6	13.6	3.3	0.0
16-May-12	3.9	7.1	-2.2	0.0
17-May-12	1.7	6.9	-4.0	0.0
18-May-12	0.3	4.9	-2.3	3.3
19-May-12	3.9	10.8	-5.3	0.0
20-May-12	8.7	17.1	-1.0	0.0
21-May-12	9.9	15.3	3.8	0.0
22-May-12	8.8	11.7	5.1	0.3
23-May-12	8.2	14.6	1.7	1.3
24-May-12	6.5	13.3	2.2	4.1
25-May-12	8.6	17.3	-0.4	0.0
26-May-12	11.5	19.1	1.2	0.0
27-May-12	14.0	21.6	3.9	0.0
28-May-12	14.8	21.3	5.6	0.0
29-May-12	9.4	12.4	6.4	0.0
30-May-12	9.1	13.2	3.5	0.0
31-May-12	11.1	15.5	6.6	0.0
1-Jun-12	9.3	15.9	2.2	5.6
2-Jun-12	7.8	12.8	4.2	0.0
3-Jun-12	9.6	14.7	1.2	0.0
4-Jun-12	10.7	16.0	2.8	0.0
5-Jun-12	11.5	14.0	8.6	10.7
6-Jun-12	9.3	11.0	7.4	25.4
7-Jun-12	8.0	12.5	4.5	1.8
8-Jun-12	8.4	13.2	5.5	4.3
9-Jun-12	9.9	18.3	4.7	4.1
10-Jun-12	12.6	19.2	7.9	0.5
11-Jun-12	14.0	16.9	10.1	0.0
12-Jun-12	12.4	15.9	9.6	0.0
13-Jun-12	11.8	15.6	6.2	0.0
14-Jun-12	8.3	11.9	3.7	0.0
15-Jun-12	9.9	14.5	1.7	0.0
16-Jun-12	11.1	16.2	7.2	4.8
17-Jun-12	10.3	14.1	6.2	0.0
18-Jun-12	9.3	13.2	6.7	15.5
19-Jun-12	10.2	15.1	5.5	2.8
20-Jun-12	10.8	18.1	4.0	11.9
21-Jun-12	13.0	20.5	4.8	0.0
22-Jun-12	15.1	21.5	7.7	0.0
23-Jun-12	13.5	15.8	11.0	2.0
24-Jun-12	16.0	21.3	10.9	1.5
25-Jun-12	13.0	16.6	8.9	0.0
26-Jun-12	10.4	13.6	8.4	0.0
27-Jun-12	9.7	12.8	6.9	0.0
28-Jun-12	13.2	18.0	7.1	0.0
29-Jun-12	12.7	16.6	9.5	0.0
30-Jun-12	12.7	16.7	9.1	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Jul-12	12.4	16.7	7.1	0.0
2-Jul-12	12.1	17.3	7.9	0.8
3-Jul-12	10.6	14.0	6.1	6.1
4-Jul-12	9.3	12.0	5.0	20.6
5-Jul-12	12.0	18.2	3.1	0.0
6-Jul-12	15.0	23.3	4.0	0.0
7-Jul-12	16.8	23.5	6.7	0.0
8-Jul-12	18.7	27.5	7.8	0.0
9-Jul-12	20.1	27.9	9.3	0.0
10-Jul-12	18.7	23.0	12.2	0.0
11-Jul-12	18.0	23.9	9.3	0.0
12-Jul-12	18.4	25.2	11.5	0.0
13-Jul-12	18.6	26.7	7.9	0.0
14-Jul-12	20.8	27.9	11.0	0.0
15-Jul-12	16.5	21.3	13.5	0.0
16-Jul-12	19.6	26.8	10.4	0.0
17-Jul-12	21.2	26.6	13.4	0.0
18-Jul-12	12.9	17.1	7.9	13.0
19-Jul-12	13.7	23.3	5.9	0.0
20-Jul-12	17.3	26.0	8.2	4.3
21-Jul-12	16.1	22.2	12.0	0.3
22-Jul-12	18.1	24.5	10.0	0.0
23-Jul-12	15.0	19.3	10.8	3.8
24-Jul-12	17.4	24.1	10.5	0.0
25-Jul-12	15.9	24.4	9.8	9.7
26-Jul-12	15.7	23.7	8.7	8.1
27-Jul-12	16.1	23.0	10.9	1.0
28-Jul-12	17.3	23.6	9.4	0.0
29-Jul-12	16.8	22.3	9.4	0.0
30-Jul-12	15.3	20.4	10.0	0.0
31-Jul-12	14.1	17.9	8.3	0.0
1-Aug-12	11.5	14.3	5.8	3.3
2-Aug-12	12.3	18.3	4.7	0.3
3-Aug-12	17.2	21.1	12.5	0.0
4-Aug-12	19.8	24.3	14.9	0.0
5-Aug-12	18.2	26.3	8.8	0.0
6-Aug-12	19.4	26.9	10.0	0.0
7-Aug-12	17.6	25.5	10.3	0.0
8-Aug-12	14.9	25.1	9.4	5.6
9-Aug-12	14.2	17.5	9.9	0.0
10-Aug-12	12.7	18.1	5.2	0.0
11-Aug-12	13.6	20.4	7.0	0.0
12-Aug-12	13.9	22.5	5.5	0.0
13-Aug-12	14.9	20.3	9.9	0.0
14-Aug-12	9.8	14.6	5.1	18.8
15-Aug-12	11.4	21.4	0.9	0.0
16-Aug-12	16.4	24.5	7.6	0.0
17-Aug-12	18.4	27.6	8.3	0.0
18-Aug-12	19.8	29.2	8.9	0.0
19-Aug-12	19.1	27.5	11.0	0.0
20-Aug-12	19.2	28.7	9.5	0.0
21-Aug-12	15.7	20.3	10.4	2.5
22-Aug-12	14.1	18.8	8.2	0.0
23-Aug-12	11.0	14.9	5.1	0.0
24-Aug-12	8.7	10.8	5.4	1.3
25-Aug-12	11.3	16.4	5.5	0.0
26-Aug-12	12.2	21.8	2.3	0.0
27-Aug-12	15.4	22.5	7.7	0.0
28-Aug-12	13.4	17.8	10.2	0.0
29-Aug-12	10.4	13.9	5.3	0.0
30-Aug-12	7.1	11.8	2.3	0.8
31-Aug-12	7.7	17.4	-0.6	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Sep-12	9.3	15.3	2.5	0.0
2-Sep-12	10.5	13.5	6.1	0.3
3-Sep-12	9.7	14.8	3.5	0.0
4-Sep-12	10.7	16.1	3.6	0.0
5-Sep-12	12.0	18.8	7.5	0.3
6-Sep-12	15.3	21.6	7.3	0.0
7-Sep-12	15.9	22.4	10.7	0.0
8-Sep-12	18.8	25.6	9.6	0.0
9-Sep-12	15.5	22.1	6.4	0.8
10-Sep-12	6.0	9.6	3.6	1.0
11-Sep-12	6.7	10.3	3.2	0.0
12-Sep-12	8.0	12.2	3.3	0.0
13-Sep-12	15.1	20.3	10.2	0.0
14-Sep-12	13.3	17.5	6.0	0.0
15-Sep-12	8.3	16.3	-0.2	0.0
16-Sep-12	9.6	17.1	-0.6	0.0
17-Sep-12	17.0	22.9	10.6	0.0
18-Sep-12	14.7	19.2	8.4	0.0
19-Sep-12	15.5	21.6	6.0	0.0
20-Sep-12	17.2	25.4	9.3	0.0
21-Sep-12	16.4	26.3	6.7	0.0
22-Sep-12	15.5	25.4	6.6	0.0
23-Sep-12	14.4	25.1	5.4	0.0
24-Sep-12	13.3	19.5	7.7	0.0
25-Sep-12	10.0	14.9	4.0	0.0
26-Sep-12	9.8	17.1	2.3	0.0
27-Sep-12	14.2	19.9	4.4	0.0
28-Sep-12	12.3	17.9	3.6	1.0
29-Sep-12	7.4	11.3	1.9	0.0
30-Sep-12	7.8	11.0	6.0	0.3
1-Oct-12	8.0	11.5	1.7	27.2
2-Oct-12	0.6	1.7	-0.1	9.4
3-Oct-12	0.8	6.6	-4.1	8.6
4-Oct-12	0.9	8.1	-4.3	0.0
5-Oct-12	4.1	12.2	-2.7	0.0
6-Oct-12	9.1	17.6	0.9	0.3
7-Oct-12	9.4	13.7	5.2	1.5
8-Oct-12	5.9	10.8	2.6	0.3
9-Oct-12	9.5	17.1	-0.2	0.0
10-Oct-12	-3.5	-0.2	-6.0	0.0
11-Oct-12	-3.7	-0.3	-6.9	0.3
12-Oct-12	-0.4	7.3	-5.6	8.6
13-Oct-12	5.8	9.1	1.5	2.8
14-Oct-12	7.1	10.1	1.0	10.4
15-Oct-12	7.6	11.2	4.3	1.0
16-Oct-12	3.9	7.6	0.6	1.8
17-Oct-12	2.0	4.4	0.0	0.0
18-Oct-12	4.7	9.3	0.2	4.3
19-Oct-12	-1.4	-1.0	-3.7	1.0
20-Oct-12	-6.4	-3.7	-9.0	0.0
21-Oct-12	-8.7	-6.8	-10.2	0.0
22-Oct-12	-7.4	-5.3	-8.6	4.3
23-Oct-12	-7.7	-6.7	-8.5	3.0
24-Oct-12	-8.2	-7.2	-8.9	0.0
25-Oct-12	-9.0	-6.7	-11.1	7.9
26-Oct-12	-9.9	-6.8	-12.9	0.0
27-Oct-12	-10.3	-7.9	-12.6	5.3
28-Oct-12	-12.8	-10.1	-14.1	6.6
29-Oct-12	-14.6	-13.7	-15.4	11.2
30-Oct-12	-14.9	-8.0	-20.9	3.6
31-Oct-12	-12.9	-6.0	-18.4	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2012 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily Precipitation (mm)
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Nov-12	-6.6	1.3	-10.6	0.3
2-Nov-12	-4.4	0.4	-6.2	0.0
3-Nov-12	1.1	5.9	-5.0	2.8
4-Nov-12	4.6	9.9	0.0	12.7
5-Nov-12	3.6	6.9	2.2	0.3
6-Nov-12	-0.2	3.0	-2.8	7.4
7-Nov-12	-5.6	-2.2	-9.6	28.5
8-Nov-12	-10.6	-8.1	-12.3	0.0
9-Nov-12	-12.6	-11.7	-14.5	0.0
10-Nov-12	-12.6	-5.9	-21.0	0.0
11-Nov-12	-5.1	-2.2	-8.3	0.0
12-Nov-12	-0.1	2.0	-3.1	0.0
13-Nov-12	0.9	3.3	-2.6	0.0
14-Nov-12	1.5	2.5	0.0	0.0
15-Nov-12	2.1	4.5	-0.6	0.0
16-Nov-12	-1.5	2.3	-4.7	0.0
17-Nov-12	-11.9	-3.6	-16.6	0.0
18-Nov-12	-15.5	-11.0	-19.2	0.0
19-Nov-12	-18.5	-16.8	-20.4	0.0
20-Nov-12	-19.7	-18.9	-20.4	0.0
21-Nov-12	-19.4	-16.3	-21.7	0.0
22-Nov-12	-14.7	-8.1	-22.9	0.0
23-Nov-12	-4.4	1.1	-12.2	0.0
24-Nov-12	-12.8	-1.7	-17.2	0.0
25-Nov-12	-1.4	0.6	-3.2	1.8
26-Nov-12	-2.9	-0.3	-8.1	0.0
27-Nov-12	-4.2	0.1	-8.6	0.0
28-Nov-12	-15.4	-7.8	-19.0	0.0
29-Nov-12	-18.7	-17.6	-19.9	6.9
30-Nov-12	-20.0	-17.9	-22.3	4.3
1-Dec-12	-21.9	-20.5	-22.9	0.0
2-Dec-12	-20.0	-18.4	-22.7	15.0
3-Dec-12	-18.8	-15.0	-22.1	5.3
4-Dec-12	-17.8	-14.7	-21.3	0.0
5-Dec-12	-18.6	-5.4	-21.9	22.9
6-Dec-12	-8.0	-3.4	-11.8	0.0
7-Dec-12	-14.8	-8.2	-22.0	0.0
8-Dec-12	-19.2	-9.6	-26.7	0.0
9-Dec-12	-4.8	-0.6	-10.5	0.0
10-Dec-12	0.3	2.1	-1.2	0.0
11-Dec-12	-3.6	1.5	-16.5	0.0
12-Dec-12	-12.3	-3.6	-18.5	0.0
13-Dec-12	-2.1	-0.4	-3.6	0.0
14-Dec-12	-4.6	-2.1	-8.3	0.0
15-Dec-12	-4.0	-2.2	-6.5	0.0
16-Dec-12	-5.1	-3.3	-12.0	0.0
17-Dec-12	-12.6	-8.8	-16.1	0.0
18-Dec-12	-12.1	-5.1	-19.8	0.0
19-Dec-12	-11.3	-6.0	-14.4	0.0
20-Dec-12	-19.0	-14.3	-22.9	0.0
21-Dec-12	-23.9	-22.9	-24.9	0.0
22-Dec-12	-25.5	-24.5	-26.8	0.0
23-Dec-12	-23.2	-21.7	-25.6	0.0
24-Dec-12	-21.5	-19.0	-24.1	0.0
25-Dec-12	-24.4	-21.0	-28.7	0.0
26-Dec-12	-27.0	-22.3	-29.3	0.0
27-Dec-12	-14.5	-4.3	-28.9	0.0
28-Dec-12	-2.2	-0.2	-4.8	0.3
29-Dec-12	-4.0	-0.6	-7.7	0.0
30-Dec-12	-1.9	0.4	-6.0	0.0
31-Dec-12	-1.1	-2.2	-7.8	0.0

Note: n/a = sensor malfunction, data unavailable

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
1-Jan-13	-2.8	-2.5	-6.8	0.0
2-Jan-13	3.1	1.5	-6.5	0.0
3-Jan-13	0.5	2.2	-6.9	0.0
4-Jan-13	-2.7	3.7	-8.0	0.0
5-Jan-13	-0.3	3.2	-2.1	0.0
6-Jan-13	-1.7	2.9	-3.9	0.0
7-Jan-13	-2.0	1.7	-4.4	0.0
8-Jan-13	-3.9	0.9	-7.8	0.0
9-Jan-13	-8.8	2.4	-13.3	8.1
10-Jan-13	-14.9	-8.6	-17.9	0.0
11-Jan-13	-12.2	-1.9	-16.8	0.0
12-Jan-13	-13.0	3.9	-16.9	0.0
13-Jan-13	-9.1	5.2	-15.8	0.0
14-Jan-13	1.6	2.0	-4.8	0.0
15-Jan-13	4.6	0.4	2.7	0.0
16-Jan-13	2.5	-0.8	0.5	0.0
17-Jan-13	3.7	-15.0	1.4	0.0
18-Jan-13	0.1	-16.2	-8.6	0.3
19-Jan-13	-10.3	-10.4	-18.7	0.0
20-Jan-13	-16.2	-9.2	-20.2	0.0
21-Jan-13	1.1	-7.3	-10.9	0.0
22-Jan-13	-12.9	-1.9	-14.8	0.0
23-Jan-13	-12.6	1.6	-14.8	0.0
24-Jan-13	-2.0	-1.5	-5.4	0.0
25-Jan-13	-0.2	-3.6	-1.9	0.0
26-Jan-13	-0.3	-0.5	-2.2	0.0
27-Jan-13	-3.3	0.1	-14.4	0.0
28-Jan-13	-21.5	4.3	-28.9	M
29-Jan-13	-26.5	7.8	-32.5	M
30-Jan-13	-15.4	8.6	-23.0	0.0
31-Jan-13	1.8	9.2	-1.8	0.3
1-Feb-13	3.2	10.1	1.0	0.0
2-Feb-13	3.7	8.7	2.3	0.0
3-Feb-13	1.5	9.9	-0.1	0.0
4-Feb-13	-2.2	12.7	-6.2	0.3
5-Feb-13	-4.2	14.0	-8.0	0.0
6-Feb-13	-3.8	9.1	-8.7	0.5
7-Feb-13	-2.6	6.1	-8.3	0.0
8-Feb-13	-0.7	1.3	-3.7	0.0
9-Feb-13	1.0	-8.1	-3.8	1.0
10-Feb-13	1.8	-4.5	-3.8	0.0
11-Feb-13	1.1	-3.2	0.1	0.0
12-Feb-13	0.2	3.2	-1.5	0.8
13-Feb-13	-2.1	5.5	-4.3	0.8
14-Feb-13	-1.9	8.3	-6.0	0.0
15-Feb-13	3.9	3.3	1.6	0.0
16-Feb-13	2.3	4.0	-1.0	0.0
17-Feb-13	-2.7	-0.8	-6.4	2.8
18-Feb-13	-3.2	-1.3	-6.1	0.0
19-Feb-13	-5.8	0.7	-10.0	4.3
20-Feb-13	-4.4	4.3	-10.9	0.0
21-Feb-13	-2.4	4.3	-4.6	0.0
22-Feb-13	-1.7	8.2	-4.3	2.3
23-Feb-13	-2.6	9.2	-7.3	1.5
24-Feb-13	-1.8	-3.9	-4.2	1.8
25-Feb-13	-3.9	4.5	-5.1	3.8
26-Feb-13	-4.2	8.5	-9.9	0.8
27-Feb-13	-2.3	9.9	-7.2	0.3
28-Feb-13	0.0	10.4	-3.0	1.8
1-Mar-13	0.4	10.8	-3.3	0.0
2-Mar-13	-0.1	9.2	-2.2	0.0
3-Mar-13	-2.7	6.4	-7.5	6.4
4-Mar-13	-5.3	5.4	-10.8	0.0

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
5-Mar-13	-5.5	-1.7	-12.3	0.0
6-Mar-13	-11.1	3.1	-16.3	0.0
7-Mar-13	-8.1	5.6	-12.5	0.0
8-Mar-13	-1.1	9.3	-7.2	0.0
9-Mar-13	1.7	12.9	-1.8	0.0
10-Mar-13	-0.8	18.0	-3.4	0.0
11-Mar-13	-3.7	22.0	-8.9	0.0
12-Mar-13	-7.9	21.2	-15.2	0.0
13-Mar-13	-17.2	18.9	-19.5	M
14-Mar-13	-17.7	20.7	-18.6	M
15-Mar-13	-15.7	20.5	-18.9	M
16-Mar-13	-14.3	18.7	-17.8	M
17-Mar-13	-12.4	21.8	-16.4	M
18-Mar-13	-9.3	15.2	-18.6	0.3
19-Mar-13	-3.8	14.0	-9.5	0.0
20-Mar-13	-5.7	13.4	-11.1	3.0
21-Mar-13	-11.6	11.8	-18.7	0.0
22-Mar-13	-8.9	15.5	-15.4	0.0
23-Mar-13	-7.5	19.0	-16.6	0.0
24-Mar-13	-3.2	16.7	-11.1	0.0
25-Mar-13	-0.7	12.5	-9.8	0.0
26-Mar-13	3.3	8.5	-0.8	0.0
27-Mar-13	4.4	2.7	-1.4	0.0
28-Mar-13	4.8	5.7	-2.0	0.0
29-Mar-13	3.8	18.5	-2.5	0.0
30-Mar-13	5.4	12.6	-0.3	0.0
31-Mar-13	4.2	15.7	-3.4	0.0
1-Apr-13	4.9	13.7	-5.5	0.0
2-Apr-13	5.5	11.7	-3.3	0.0
3-Apr-13	-0.7	13.2	-7.3	0.0
4-Apr-13	-5.0	16.7	-13.6	0.0
5-Apr-13	-12.4	13.9	-15.8	0.0
6-Apr-13	-9.7	13.2	-15.2	0.3
7-Apr-13	-6.3	16.9	-8.8	1.5
8-Apr-13	-3.3	15.6	-7.2	0.8
9-Apr-13	-0.1	14.7	-9.2	0.0
10-Apr-13	3.5	19.5	-0.7	1.3
11-Apr-13	-0.2	14.4	-5.3	0.3
12-Apr-13	-1.5	16.2	-5.5	0.5
13-Apr-13	-2.3	16.1	-3.2	10.2
14-Apr-13	-3.1	13.6	-4.7	3.0
15-Apr-13	-2.3	11.3	-3.6	3.0
16-Apr-13	-1.2	13.1	-5.6	0.8
17-Apr-13	-0.1	8.8	-6.6	0.0
18-Apr-13	3.8	11.7	-0.6	0.3
19-Apr-13	3.6	14.8	-3.9	3.0
20-Apr-13	-7.1	14.2	-9.5	2.8
21-Apr-13	-4.0	16.5	-14.9	1.0
22-Apr-13	3.6	17.7	-3.6	0.0
23-Apr-13	5.1	22.8	-0.8	0.0
24-Apr-13	6.5	12.2	2.9	0.0
25-Apr-13	7.6	13.6	4.9	0.0
26-Apr-13	5.6	20.6	3.1	3.8
27-Apr-13	3.1	23.3	-1.0	9.9
28-Apr-13	1.4	24.8	-1.7	1.3
29-Apr-13	-4.8	24.8	-7.5	1.5
30-Apr-13	-3.4	21.5	-10.4	0.5
1-May-13	1.7	17.9	-5.4	0.3
2-May-13	6.0	19.1	2.8	0.8
3-May-13	8.0	20.4	3.7	0.0
4-May-13	13.3	23.8	4.8	0.3
5-May-13	15.8	23.9	7.1	0.3
6-May-13	13.7	27.1	2.1	0.0

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
7-May-13	8.3	30.7	-1.3	0.0
8-May-13	10.6	20.3	1.3	0.0
9-May-13	12.5	21.2	1.7	0.0
10-May-13	11.0	19.1	3.3	0.0
11-May-13	12.5	12.3	1.8	0.0
12-May-13	12.6	16.1	7.4	4.3
13-May-13	9.4	20.5	4.1	0.0
14-May-13	8.9	24.8	3.0	0.0
15-May-13	7.8	19.3	2.0	0.0
16-May-13	10.0	16.4	2.6	0.3
17-May-13	11.1	13.7	1.2	0.0
18-May-13	10.6	7.7	5.3	0.0
19-May-13	8.7	9.3	4.6	0.0
20-May-13	3.9	13.3	0.8	9.9
21-May-13	1.2	21.4	-0.8	2.5
22-May-13	1.9	25.1	-0.8	0.8
23-May-13	8.7	27.3	2.4	0.5
24-May-13	9.3	24.9	6.0	2.0
25-May-13	9.1	23.8	3.8	1.8
26-May-13	8.6	23.2	4.2	3.3
27-May-13	7.0	21.2	2.2	3.6
28-May-13	8.0	21.3	1.9	10.2
29-May-13	9.7	18.7	4.9	4.8
30-May-13	10.1	19.3	7.2	18.5
31-May-13	9.3	24.3	5.6	0.0
1-Jun-13	10.6	19.6	3.0	0.0
2-Jun-13	9.9	14.4	5.3	2.8
3-Jun-13	9.4	15.0	6.5	1.5
4-Jun-13	13.6	13.0	4.0	0.0
5-Jun-13	10.8	23.8	6.2	0.5
6-Jun-13	10.9	25.8	3.7	0.0
7-Jun-13	11.6	25.0	7.3	0.3
8-Jun-13	9.3	25.4	5.0	0.0
9-Jun-13	7.0	20.8	4.7	4.8
10-Jun-13	9.0	23.8	4.9	0.0
11-Jun-13	7.3	26.3	5.7	0.8
12-Jun-13	8.4	22.5	6.7	8.4
13-Jun-13	9.9	19.1	6.3	3.0
14-Jun-13	10.0	18.1	7.8	12.2
15-Jun-13	10.4	25.6	6.7	9.9
16-Jun-13	11.8	27.5	5.5	0.0
17-Jun-13	13.9	22.8	3.8	0.0
18-Jun-13	10.2	22.5	7.6	7.1
19-Jun-13	11.4	23.6	10.1	9.1
20-Jun-13	15.4	25.6	9.8	0.0
21-Jun-13	16.3	24.2	7.1	0.0
22-Jun-13	17.2	20.1	7.3	0.0
23-Jun-13	17.6	18.8	9.0	0.0
24-Jun-13	14.1	15.6	7.6	2.8
25-Jun-13	11.4	14.0	6.2	5.3
26-Jun-13	13.9	14.3	9.7	0.0
27-Jun-13	16.1	18.0	11.7	0.0
28-Jun-13	17.9	20.6	10.4	0.0
29-Jun-13	18.9	23.3	12.9	0.0
30-Jun-13	18.3	18.0	9.6	2.5
1-Jul-13	20.6	17.1	10.4	2.8
2-Jul-13	16.9	18.8	13.7	0.3
3-Jul-13	15.4	18.2	6.9	0.0
4-Jul-13	14.5	18.0	7.1	0.0
5-Jul-13	9.6	20.6	6.6	10.2
6-Jul-13	10.6	16.9	7.3	4.6
7-Jul-13	12.6	19.6	3.9	0.0
8-Jul-13	17.0	22.5	6.2	0.0

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily Precipitation (mm)
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
9-Jul-13	15.8	25.6	8.8	0.0
10-Jul-13	12.1	26.8	6.8	0.0
11-Jul-13	9.2	21.7	3.5	0.5
12-Jul-13	6.4	21.0	4.1	5.6
13-Jul-13	5.9	19.2	2.5	8.1
14-Jul-13	8.3	24.1	4.8	4.1
15-Jul-13	12.5	23.4	2.0	0.0
16-Jul-13	17.1	19.1	7.6	0.0
17-Jul-13	18.8	21.5	7.6	0.0
18-Jul-13	20.3	27.2	12.4	0.0
19-Jul-13	17.1	28.3	12.8	0.3
20-Jul-13	15.2	24.2	10.0	7.4
21-Jul-13	15.2	23.5	9.4	0.0
22-Jul-13	15.2	28.7	7.3	0.0
23-Jul-13	14.3	16.6	10.9	0.0
24-Jul-13	14.8	14.0	10.5	0.0
25-Jul-13	14.7	13.8	8.4	26.9
26-Jul-13	14.7	15.2	9.5	0.3
27-Jul-13	9.9	20.3	6.0	7.1
28-Jul-13	10.1	13.4	7.4	8.6
29-Jul-13	8.4	10.2	3.5	1.3
30-Jul-13	14.4	11.0	3.5	0.0
31-Jul-13	17.9	10.0	10.7	0.3
1-Aug-13	16.7	6.4	10.0	12.2
2-Aug-13	17.2	10.4	9.2	0.0
3-Aug-13	14.4	8.7	9.8	19.3
4-Aug-13	15.0	10.9	6.9	0.0
5-Aug-13	17.6	9.7	8.0	0.0
6-Aug-13	16.7	4.1	12.2	0.0
7-Aug-13	13.9	7.0	10.3	3.3
8-Aug-13	13.7	5.6	11.7	2.5
9-Aug-13	16.7	9.9	8.6	0.0
10-Aug-13	18.7	9.0	9.6	0.0
11-Aug-13	17.1	8.5	11.8	0.0
12-Aug-13	15.7	10.2	10.6	13.2
13-Aug-13	15.8	9.7	10.2	0.0
14-Aug-13	16.8	5.3	8.4	0.0
15-Aug-13	16.8	5.4	10.9	0.0
16-Aug-13	14.3	5.5	9.8	0.5
17-Aug-13	14.7	5.4	8.8	0.0
18-Aug-13	13.1	6.2	10.5	4.3
19-Aug-13	9.6	9.3	5.6	8.9
20-Aug-13	10.2	13.1	5.4	0.0
21-Aug-13	13.5	11.0	8.9	0.0
22-Aug-13	15.4	10.2	9.2	0.0
23-Aug-13	16.0	13.3	9.2	0.8
24-Aug-13	13.9	13.6	9.4	2.0
25-Aug-13	11.1	12.7	5.5	0.0
26-Aug-13	10.7	15.1	2.6	2.3
27-Aug-13	12.3	13.2	7.0	2.0
28-Aug-13	11.6	12.0	6.5	0.3
29-Aug-13	13.5	12.0	8.6	0.8
30-Aug-13	12.6	16.9	9.2	4.1
31-Aug-13	14.5	15.8	9.3	0.0
1-Sep-13	14.3	11.7	6.9	0.0
2-Sep-13	15.7	4.2	6.5	0.0
3-Sep-13	16.6	4.0	7.2	1.5
4-Sep-13	16.8	9.6	10.5	0.8
5-Sep-13	16.0	9.0	9.7	0.0
6-Sep-13	12.6	7.5	6.7	0.0
7-Sep-13	15.6	4.9	6.5	0.0
8-Sep-13	17.4	-0.1	10.7	0.0
9-Sep-13	14.9	-1.2	8.8	0.0

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
10-Sep-13	15.7	1.0	9.4	0.0
11-Sep-13	15.7	1.0	5.1	0.0
12-Sep-13	19.1	2.8	9.0	0.0
13-Sep-13	17.1	-0.8	9.3	0.0
14-Sep-13	14.1	-0.5	3.7	0.0
15-Sep-13	16.5	-8.3	7.1	0.0
16-Sep-13	12.1	-0.9	7.5	11.4
17-Sep-13	9.3	6.7	3.3	0.0
18-Sep-13	7.4	6.5	2.7	0.0
19-Sep-13	8.8	5.8	1.2	0.0
20-Sep-13	13.3	2.5	5.5	0.0
21-Sep-13	9.9	1.5	5.8	0.8
22-Sep-13	7.4	-8.4	3.8	0.0
23-Sep-13	6.1	-14.9	2.4	2.8
24-Sep-13	5.4	-17.2	-0.1	0.0
25-Sep-13	2.1	-20.1	-1.6	1.5
26-Sep-13	4.2	-7.7	-4.5	0.0
27-Sep-13	5.5	-1.9	2.5	4.1
28-Sep-13	5.8	2.4	2.3	1.0
29-Sep-13	4.9	4.4	0.4	2.3
30-Sep-13	1.9	3.1	-0.4	6.9
1-Oct-13	2.6	4.4	-0.2	12.4
2-Oct-13	2.1	6.9	-0.5	2.5
3-Oct-13	1.9	2.8	-3.0	0.3
4-Oct-13	5.5	5.4	0.3	9.9
5-Oct-13	6.4	2.3	4.6	3.3
6-Oct-13	5.8	3.3	3.3	7.9
7-Oct-13	6.7	-0.3	3.9	0.3
8-Oct-13	1.1	-17.6	-2.1	5.3
9-Oct-13	3.1	-13.5	-1.0	1.5
10-Oct-13	2.8	-13.2	0.6	0.5
11-Oct-13	2.8	-17.9	0.8	0.3
12-Oct-13	3.3	-20.2	-0.4	0.0
13-Oct-13	4.4	-11.6	-0.2	0.8
14-Oct-13	8.0	-3.3	1.1	0.3
15-Oct-13	7.7	-3.6	1.1	0.0
16-Oct-13	2.4	-2.0	-3.6	0.0
17-Oct-13	3.9	-1.1	-3.3	0.5
18-Oct-13	8.7	-17.9	3.5	0.0
19-Oct-13	10.3	1.0	6.2	0.0
20-Oct-13	11.1	4.8	4.9	0.0
21-Oct-13	11.5	4.9	8.3	0.0
22-Oct-13	8.0	-0.1	4.6	0.0
23-Oct-13	6.1	3.3	2.8	0.0
24-Oct-13	12.0	-16.0	4.2	0.0
25-Oct-13	7.0	-7.4	-1.8	0.0
26-Oct-13	9.3	-6.1	4.2	0.0
27-Oct-13	-1.8	-10.3	-4.3	6.4
28-Oct-13	-2.6	4.0	-9.6	1.0
29-Oct-13	3.1	4.7	-3.1	0.0
30-Oct-13	5.8	0.4	3.0	0.3
31-Oct-13	4.7	3.9	0.0	0.0
1-Nov-13	1.9	3.8	-4.1	0.0
2-Nov-13	-2.7	2.0	-6.9	0.0
3-Nov-13	-4.6	-3.5	-10.5	1.3
4-Nov-13	-6.3	2.0	-14.2	0.3
5-Nov-13	-0.7	-15.3	-3.2	0.0
6-Nov-13	0.6	1.2	-3.2	0.0
7-Nov-13	-2.6	1.3	-5.2	3.6
8-Nov-13	-5.5	0.4	-10.6	3.6
9-Nov-13	-10.6	5.9	-12.8	6.9
10-Nov-13	-8.9	9.9	-18.2	0.8
11-Nov-13	-1.0	6.9	-5.6	0.8

Appendix 2. 2013 Murray River Daily Air Temperature and Precipitation Data

Date	Daily Mean Air	Daily Maximum	Daily Minimum	Total Daily
	Temperature (°C)	Air Temperature (°C)	Air Temperature (°C)	
12-Nov-13	2.6	3.0	-1.8	0.8
13-Nov-13	3.7	-2.2	0.7	3.0
14-Nov-13	1.1	-8.1	-0.1	0.3
15-Nov-13	-2.0	-11.7	-8.5	9.7
16-Nov-13	-12.8	-5.9	-15.9	3.3
17-Nov-13	-16.8	-2.2	-19.0	0.0
18-Nov-13	-20.3	2.0	-22.1	0.0
19-Nov-13	-23.7	3.3	-28.6	0.0
20-Nov-13	-14.9	2.5	-28.7	0.0
21-Nov-13	-8.4	4.5	-16.9	0.8
22-Nov-13	-4.0	2.3	-17.1	4.6
23-Nov-13	2.4	-3.6	0.4	0.0
24-Nov-13	0.4	-11.0	-2.9	0.0
25-Nov-13	0.1	-16.8	-3.6	0.0
26-Nov-13	4.1	-18.9	-0.5	0.0
27-Nov-13	-0.4	-16.3	-3.6	0.0
28-Nov-13	3.2	-8.1	1.3	0.0
29-Nov-13	0.9	1.1	-0.6	0.0
30-Nov-13	1.7	-1.7	-1.3	0.0
1-Dec-13	-14.6	0.6	-21.2	9.4
2-Dec-13	-19.4	-0.3	-21.2	0.0
3-Dec-13	-18.2	0.1	-22.3	0.0
4-Dec-13	-19.7	-7.8	-24.8	0.0
5-Dec-13	-21.5	-17.6	-27.7	0.3
6-Dec-13	-25.5	-17.9	-29.2	0.0
7-Dec-13	-15.5	-20.5	-23.6	0.0
8-Dec-13	-9.6	-18.4	-14.3	0.5
9-Dec-13	-6.5	-15.0	-10.1	0.0
10-Dec-13	-8.7	-14.7	-17.2	M
11-Dec-13	-10.8	-5.4	-18.3	M
12-Dec-13	-19.0	-3.4	-20.6	0.0
13-Dec-13	-17.0	-8.2	-20.4	0.5
14-Dec-13	3.0	-9.6	0.9	6.1
15-Dec-13	0.1	-0.6	-2.1	6.4
16-Dec-13	-1.9	2.1	-3.5	3.3
17-Dec-13	-3.2	1.5	-18.1	10.4
18-Dec-13	-19.4	-3.6	-23.1	0.0
19-Dec-13	-10.9	-0.4	-20.5	0.3
20-Dec-13	-9.4	-2.1	-15.2	0.0
21-Dec-13	-15.9	-2.2	-21.5	0.0
22-Dec-13	-7.6	-3.3	-21.4	0.5
23-Dec-13	1.3	-8.8	-2.1	0.3
24-Dec-13	-1.4	-5.1	-2.3	0.0
25-Dec-13	0.7	-6.0	-2.4	2.3
26-Dec-13	2.8	-14.3	1.3	7.6
27-Dec-13	-15.0	-22.9	-23.1	21.3
28-Dec-13	-16.5	-24.5	-22.5	0.5
29-Dec-13	-5.6	-21.7	-15.4	1.5
30-Dec-13	-16.6	-19.0	-19.5	M
31-Dec-13	-8.1	-21.0	-11.8	0.0
1-Jan-14	-27.0	-22.3	-29.3	0.0
2-Jan-14	-14.5	-4.3	-28.9	0.0
3-Jan-14	-2.2	-0.2	-4.8	0.3
4-Jan-14	-4.0	-0.6	-7.7	0.0
5-Jan-14	-1.9	0.4	-6.0	0.0
6-Jan-14	-1.1	-2.2	-7.8	0.0
7-Jan-14				