Section 4

Assessment and Management of Key Environmental Issues

PREAMBLE

This section describes the specific environmental features of the Site and its surrounds that would or may be affected by the Proposal. Information on existing conditions, proposed safeguards and controls and potential impacts the Proposal may have after implementation of these measures is presented for those issues identified in Section 3 as being of greatest significance.

Where appropriate, proposed monitoring programs are also described.

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4.1 BACKGROUND INFORMATION

4.1.1 Topography

Figure 4.1 presents the topography and drainage surrounding the Site. In summary, the land surrounding the Site is predominantly flat, with elevations between approximately 169m AHD and 170m AHD. The Site is located approximately 500m north and west of Box Cowal and approximately 2.5km east of the Bogan River. The Site is within the Central West (Bogan – Macquarie) Catchment Management Area.

Figure 4.2 presents the topography and drainage within the Site. There are no natural drainage lines within the Site, with the surface runoff from rainfall events flowing across the land surface by lateral sheet flow. Water in the vicinity of the Site flows east and south, draining into Box Cowal and eventually into the Bogan River.

4.1.2 Meteorology

4.1.2.1 Introduction

Table 4.1 presents meteorological data sourced from the Nyngan (Nyngan Airport) Bureau of Meteorology station (station number 051039 – 1879 till present). The Nyngan meteorological station is located approximately 3.5km to the southwest of the Site.

It should be noted that rainfall data is available from 1879 to 2012 and temperature data is available from 1920 to 2012. Wind data from 1959 to 2010 is available as annual and monthly 9am and 3pm wind roses. Evaporation data is not available and consequently, monthly evaporation data has been sourced from the 'Annual Average Pan Evaporation' map created by the Bureau of Meteorology.

4.1.2.2 Temperature

January is typically the hottest month of the year with a mean maximum temperature of 34.2°C and mean minimum temperature of 19.5°C. The coldest month of the year is July with a mean maximum temperature of 16.4°C and a mean minimum temperature of 3.7°C.

June is typically the most humid month with average 9am and 3pm relative humidity of 80% and 55% respectively. December is typically the least humid month with average relative humidity of 46% and 29% respectively.

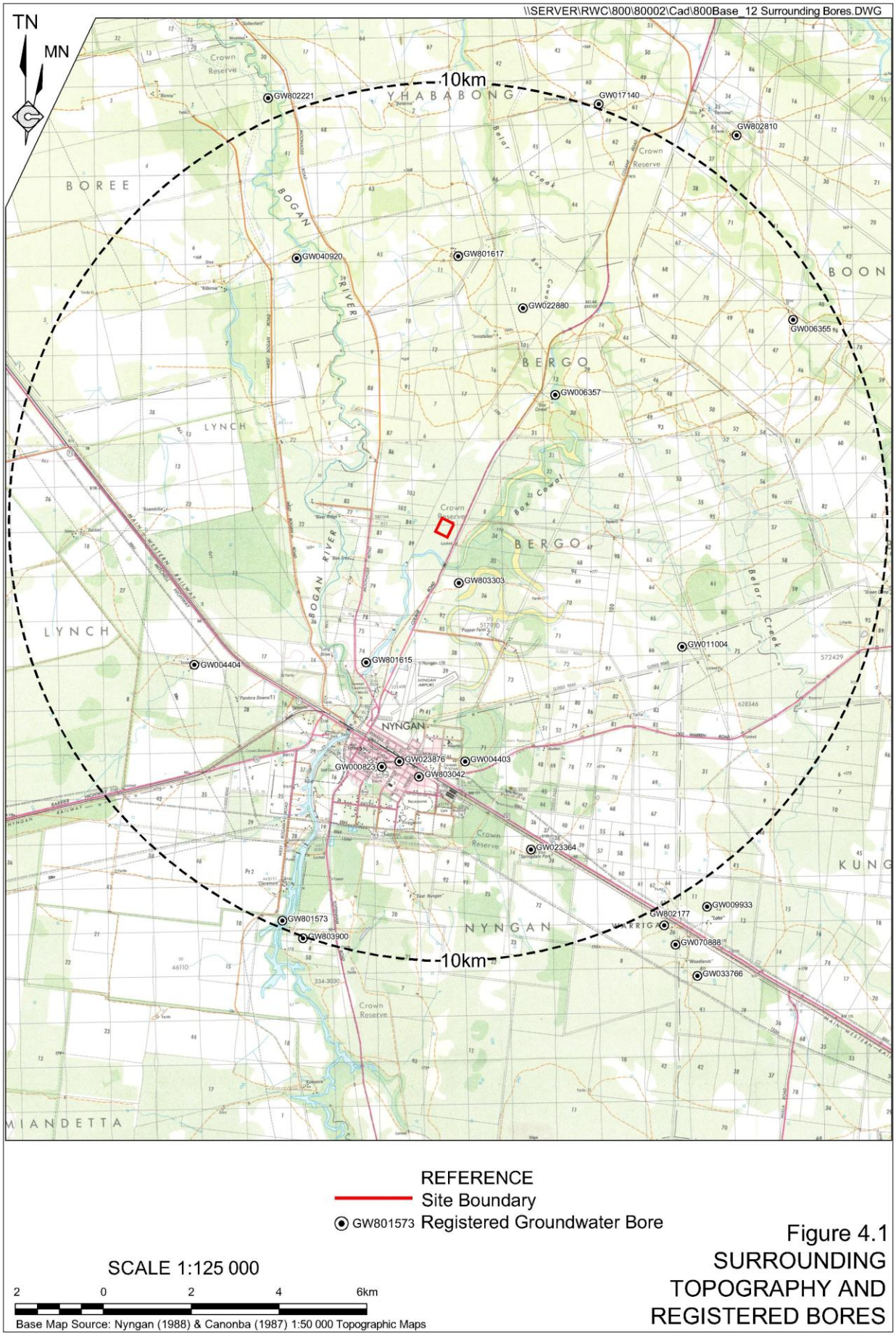


Figure 4.1
SURROUNDING TOPOGRAPHY AND REGISTERED BORES

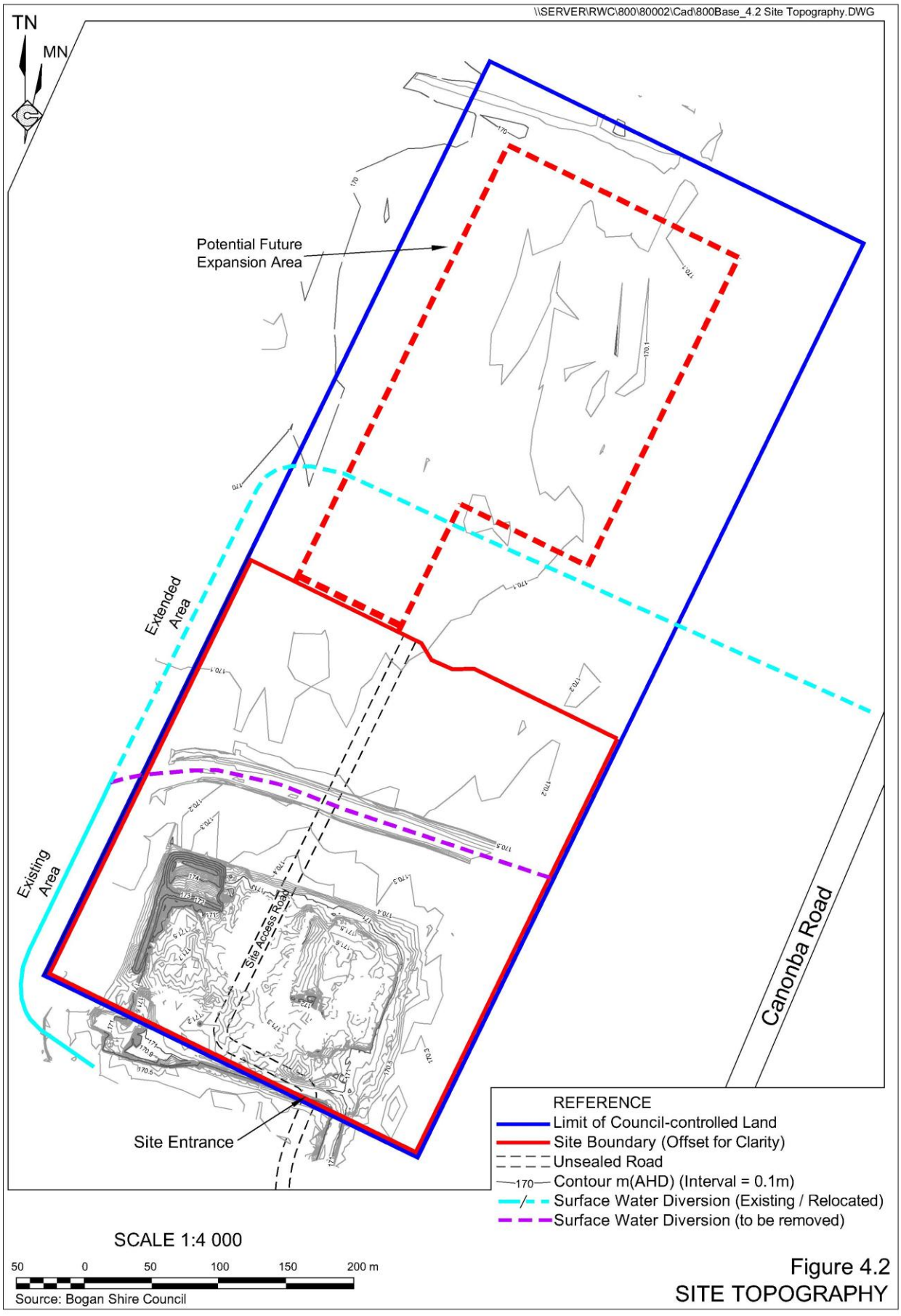


Figure 4.2
SITE TOPOGRAPHY

Table 4.1
Climate Data, Nyngan Airport (Station 051039)

	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
Temperature (°C) and Humidity (%) (1920 to 2012)													
Mean maximum temperature	34.2	33.2	30.5	25.6	20.6	17	16.4	18.5	22.6	26.5	30	32.9	25.7
Mean minimum temperature	19.5	19.2	16.4	11.8	7.7	4.9	3.7	4.7	7.8	11.4	15	17.8	11.7
Mean 9 am relative Humidity	48	53	56	61	72	80	79	70	59	51	47	46	60
Mean 3 pm relative humidity	31	36	37	40	49	55	52	44	38	34	30	29	39
Rainfall (mm) (1879 to 2012)													
Mean rainfall	51.1	47.9	41.5	34.8	36.3	32.4	29.3	29.4	27.7	35	36.6	43.2	444.8
Highest rainfall	275.6	297	233.1	373.4	234	128.8	121	145.2	111.9	150.8	202.6	197.2	1127
Lowest rainfall	0	0	0	0	0	0	0	0	0	0	0	0	169.3
Highest daily rainfall	145	146.1	89.6	193.2	85	57.4	55.1	59.4	54	63	80	102	193.2
Evaporation (mm) (1975 to 2005)													
Mean Monthly Evaporation	300	250	200	125	80	60	60	80	125	175	300	300	2000

Source: Bureau of Meteorology Station – Nyngan Airport NSW (Station No.: 051039), Downloaded 3 December 2012. Evaporation data sourced from 'Annual Average Pan Evaporation' map created by the Bureau of Meteorology.

4.1.2.3 Rainfall and Evaporation

Average annual rainfall recorded at the Nyngan meteorological station is 444.8mm, with the wettest year on record being 1950 when 1 127mm was recorded. Typical of semi-arid areas in Central NSW, rainfall in Summer and Autumn can be associated with intense storms, with a maximum daily rainfall of 193.2mm, or 43% of the average annual rainfall, recorded on 1 April 1989.

January has on average the highest rainfall per month with 51.1mm which equates to approximately 11.5% of the total rain falling throughout the year. September has the least amount of rainfall in the year with only 27.7mm falling which equates to approximately 6.2% of the total rain falling throughout the year.

Evaporation levels fluctuate on a regular basis throughout the year, with the summer months typically experiencing the highest rates of evaporation while the winter months experience the lowest rates of evaporation. In particular, November to January share the highest evaporation rates losing 300mm per month of water to evaporation each month with June and July sharing the lowest rates of evaporation with each only having evaporation rates of 60mm per month. It is noted that in all months, evaporation exceeds average rainfall.

4.1.2.4 Wind

A review of the wind roses produced by the Bureau of Meteorology (**Figure 4.3**) show that annually there is a dominant southerly wind direction with stronger breezes expected from the south and southwest, although winds are experienced from all directions. Seasonally, the southerly winds remain stronger throughout the year, however variations occur where the wind has easterly influences during summer and autumn, and westerly influences in winter and spring.

Stronger winds are experienced in winter and spring. Winter particularly has strong winds from the west and north.

4.1.3 Surrounding Land Ownership, Land Uses and Residences

Land ownership and residences surrounding the Site are shown in **Figure 4.4**.

The Site includes two parcels of land as follows (**Figure 4.4**).

- Lot 7301, DP1161404 is registered to the State of NSW and is identified as a Travelling Stock Route (TSR). TSRs form an extensive network of public land that was established for the droving of sheep and cattle during early European colonisation (NPA 2011) and are administered by local Livestock Pest and Health Authorities. This particular TSR connects Nyngan with Canonba.
- Lot 107, DP822472 is registered to the State of NSW and controlled by the Applicant for the purposes of the existing waste management facility.

Discussions have been held with Catchments and Lands and the Livestock Pest and Health Authority regarding transfer of ownership of the Site to the Applicant. A plan of subdivision has been prepared but has yet to be approved.

Land use surrounding the Site, shown on **Figure 4.5,** comprises the following.

- Agriculture – principally grazing (cattle and sheep) and cropping (wheat).
- Residential and rural residential – the township of Nyngan is located approximately 5km south of the Site.
- Community infrastructure – The Nyngan Aerodrome and Sewage Treatment Works are located to the south of the Site.

4.1.4 Surrounding Community

4.1.4.1 Community Profile

Bogan Local Government Area (LGA) is located in the Orana Region of central northern New South Wales, approximately 600km northwest of Sydney. Bogan LGA is bounded by Brewarrina LGA to the north, Warren LGA to the east, Lachlan LGA to the south and Cobar LGA to the west.

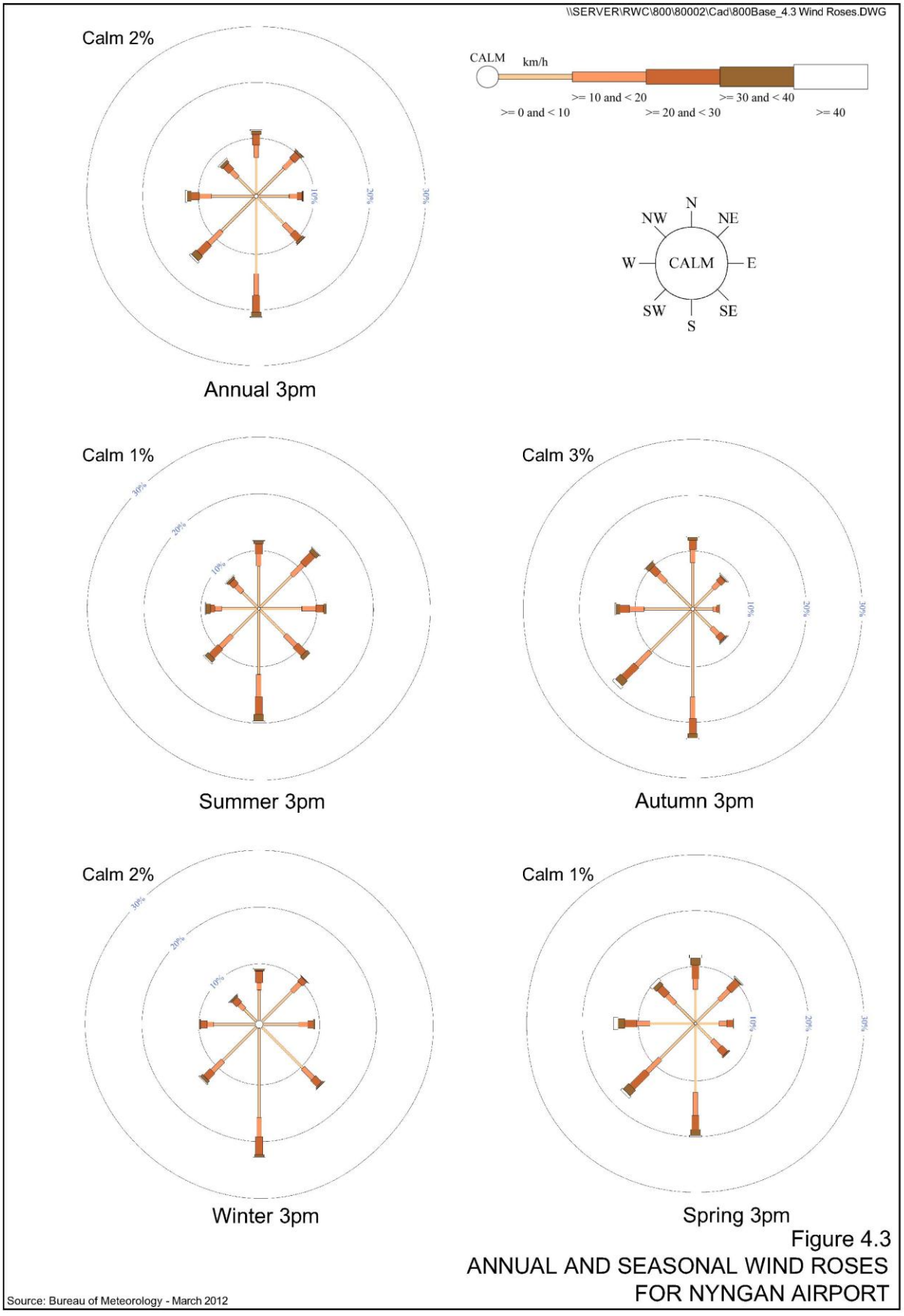
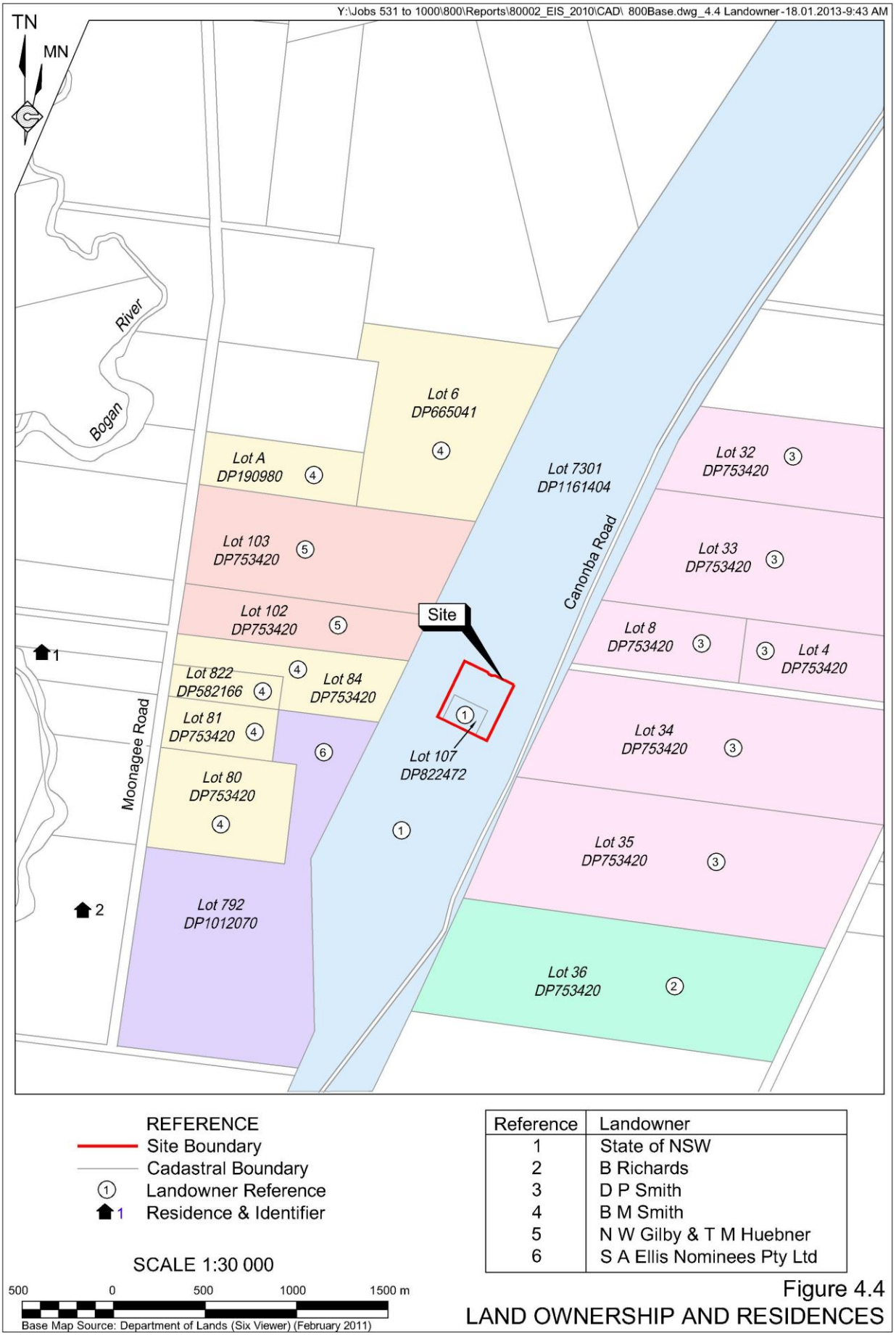


Figure 4.3
ANNUAL AND SEASONAL WIND ROSES FOR NYNGAN AIRPORT



Reference	Landowner
1	State of NSW
2	B Richards
3	D P Smith
4	B M Smith
5	N W Gilby & T M Huebner
6	S A Ellis Nominees Pty Ltd

Figure 4.4
LAND OWNERSHIP AND RESIDENCES

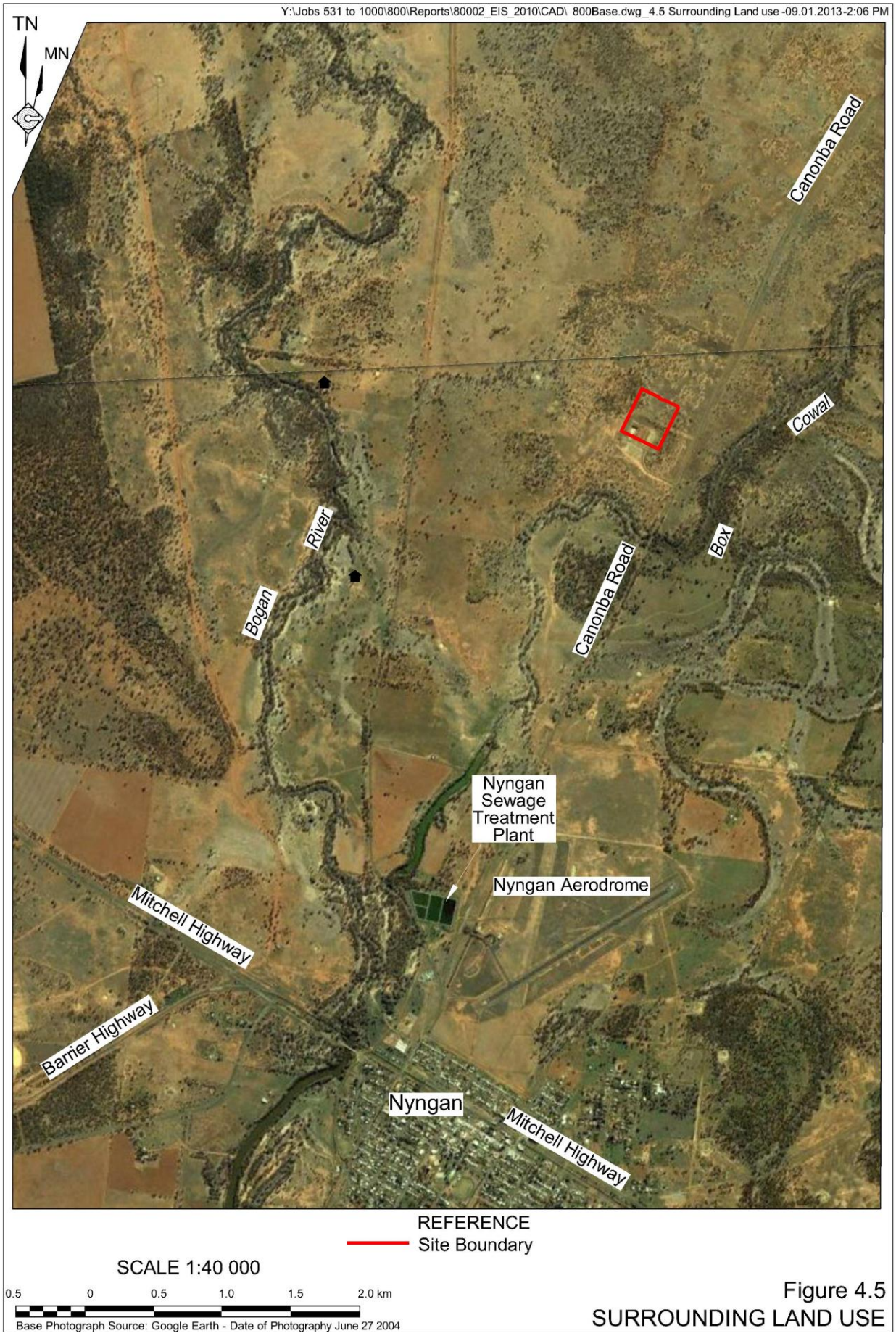


Figure 4.5
SURROUNDING LAND USE

Bogan LGA is predominantly rural with the major centres being Nyngan and surrounding small villages of Canonba, Miandetta and Hermidale. The LGA encompasses a total land area of approximately 14 611km^2. Rural land is used mainly for agriculture, particularly sheep and beef grazing as well as large scale wheat farming operations.

European settlement dates primarily from the 1830s onwards, with land used mainly for grazing purposes. The population in Nyngan grew from 1883 after the Dubbo-Bourke Railway opened allowing goods and services to be easily transported.

Community facilities within Nyngan include the following.

- Nyngan Airport.
- Nyngan District Hospital.
- One high school.
- Two primary schools.
- Police Station.
- Fire Station.
- 50 m swimming pool.
- Racecourse.
- Frank Smith Memorial Oval.

There are a range of Community organisations in Nyngan including the following..

- Nyngan Country Women's Association.
- Nyngan Retired Servicemen League.
- Legacy.
- Bonnie Babes Foundation.
- Girl Guides.
- Mission Australia.
- NSW Farmers Association.
- Nyngan Lions Club.
- Nyngan Show Society.

In addition, Bogan has an active retail centre and a number of businesses operate within the town, including:

- two supermarkets;
- three motels;
- three hotels;
- three service stations; and
- small businesses, including retail outlets, hairdressers and service industries.

Nyngan is connected to Dubbo (and Sydney) to the southeast and Bourke to the northwest via the Mitchell Highway and Broken Hill (and Adelaide) to the west via the Barrier Highway.

Finally, Nyngan has an airport located on a few kilometres north of the town centre. Nyngan Airport is operated by Bogan Shire Council. Three scheduled flights to Sydney (via Dubbo) are conducted weekly. The airport is also used for charter and private flights.

4.1.4.2 2011 Census Data

Information for the existing socio-economic setting of the Bogan Shire has been collected by the Australian Bureau of Statistics from the 2011 Census. The Site is located within the Nyngan State Suburb (referred to hereafter as simply as "Nyngan") 11789, area of 4204.9km^2, and within the Bogan Shire Local Government Area (referred hereafter as the Bogan LGA) 10950 which covers an area of 14600.5km^2.

Table 4.2 presents a summary of the 2011 population statistics for the Nyngan State Suburb, Bogan Shire LGA, and for NSW as a whole.

The Census data indicates that Nyngan has a population of 2 390, with the Bogan LGA as a whole having a population of 2 899, indicating that only 509 residents of the Bogan LGA live outside of Nyngan.

Within Nyngan and the Bogan LGA, children (14 years and younger) and older adults (65 years and older) make up a slight higher proportion of the population than for NSW as a whole. Conversely the proportion of the population of studying or working age is slightly lower than for NSW as a whole. That may be a reflection of the fact that residents of Nyngan and the Bogan LGA are in some cases required to travel to other areas to find work or to study.

Table 4.2
2011 Census Population Statistics

Age Groups		Nyngan		Bogan LGA		NSW	
		Persons	%	Persons	%	Persons	%
Children	0-4 years	198	8.3	229	7.9	458,735	6.6
	5-14 years	364	15.2	452	15.6	873,776	12.6
Studying or Working	15-24 years	287	12.0	328	11.3	893,103	12.9
	25-54 years	862	36.1	1,071	36.9	2,863,576	41.4
Approaching Retirement or Retired	55-64 years	245	10.3	298	10.3	810,290	11.7
	65 years and over	434	18.2	521	18.0	1,018,178	14.7
Total Persons		2,390	100.0	2,899	100.0	6,917,658	100.0
Source: Australian Bureau of Statistics – 2011 Census							

Table 4.3 presents a summary of the 2011 Census statistics relating to industry of employment. This data indicates that, within the Bogan LGA, "Agriculture, forestry and fishing" (34.9%) and "Mining" (14.9%) are the leading industries of employment, followed by "Construction" (7%) and "Public administration and safety" (7%).

Bogan Shire Council's website states that the Bogan LGA's economic base is characterised by agriculture. In addition, the Girilambone and Tritton Copper Mines located within the LGA also provide significant employment and economic stimulus for the local economy.

Table 4.3
2011 Census Industry Employment Statistics

	Nyngan SS		Bogan Shire LGA		NSW	
Industry	**Persons**	**%**	**Persons**	**%**	**Persons**	**%**
Agriculture, forestry and fishing	151	26.6	245	34.9	49,342	2.9
Mining	92	16.2	105	14.9	27,616	1.6
Manufacturing	19	3.4	24	3.4	192,219	11.5
Electricity, gas, water and waste services	16	2.8	15	2.1	26,948	1.6
Construction	48	8.5	49	7.0	200,011	11.9
Wholesale trade	4	0.7	10	1.4	88,554	5.3
Retail trade	40	7.1	45	6.4	139,505	8.3
Accommodation and food services	12	2.1	14	2.0	96,591	5.8
Transport, postal and warehousing	37	6.5	43	6.1	119,854	7.2
Information media and telecommunications	0	0.0	0	0.0	42,154	2.5
Financial and insurance services	0	0.0	0	0.0	77,106	4.6
Rental, hiring and real estate services	3	0.5	4	0.6	25,824	1.5
Professional, scientific and technical services	10	1.8	10	1.4	135,694	8.1
Administrative and support services	8	1.4	7	1.0	49,927	3.0
Public administration and safety	46	8.1	49	7.0	110,886	6.6
Education and training	19	3.4	20	2.8	75,932	4.5
Health care and social assistance	17	3.0	16	2.3	79,129	4.7
Arts and recreation services	7	1.2	8	1.1	24,943	1.5
Other services	18	3.2	17	2.4	66,829	4.0
Inadequately described/Not stated	20	3.5	22	3.1	45,350	2.7
Total	567	100.0	703	100.0	1,674,414	100.0

Source: Australian Bureau of Statistics – 2011 Census

4.2 GROUNDWATER

4.2.1 Introduction

The groundwater assessment has been prepared by RW Corkery & Co. Pty Limited, with information in relation to the groundwater environment within and immediately surrounding the Site sourced from the following reports prepared by The Impax Group.

- Letter Report dated 6 July 2010 (Impax, 2010) describing the installation of eight monitoring bores and the results of water quality testing undertaken at that time.
- Letter report dated 18 January 2012 (Impax, 2012a) describing the results of water quality testing undertaken in January 2012.
- Letter report dated 6 December 2012 (Impax, 2012b) describing the results of water quality testing undertaken in November 2012.

A copy of the above reports are provided as **Appendix 5**.

4.2.2 Existing Environment

4.2.2.1 Regional Groundwater Setting

A search of the NSW Natural Resources Atlas reveals 24 registered bores within approximately 10km of the Site (**Figure 4.1**). **Table 4.4** presents available information in relation to each of the registered bores. In summary these bore intersect three principal aquifer systems, namely:

- the Great Artesian Basin;
- the Central West Alluvium; and
- the Central West Fractured Rock.

These bores are principally used for stock and domestic purposes, with some used for irrigation. Recorded yields vary from 0.75L/s to 5L/s, with standing water levels typically between 4m and 30m below ground level. Water quality is recorded for only two bores, with electrical conductivities of 18 880mS/cm (very saline) and 200mS/cm (good quality).

Table 4.4
Surrounding Registered Bores

Registered Bore	Authorised Purpose	Completion date	Total Depth (mbgl)[1]	SWL[2] (mbgl)[1]	Salinity (mS/cm)	Yield (L/s)	End of hole geology
Great Artesian Basin Groundwater Management Area							
GW040920	Domestic Irrigation, Stock	29/02/2004	102	14.4	18880	5	Sandstone
GW801573	Domestic Irrigation, Stock	12/02/1997	15.24	12.2			
GW802498	Irrigation	5/06/2005	19	4		4	Sand and clay
GW802810	Domestic, Stock	4/05/2006	214	9.8		2.31	Shale
GW803900	Domestic Irrigation, Stock	1/05/2005	111	30	200		Sand, shale and clay
Central West Alluvium Groundwater Management Area							
GW023876	Recreation (Groundwater)		-				Sand and clay
GW802221	Irrigation	3/05/2005	20				Sand
Central West Fractured Rock Groundwater Management Area							
GW006355	Stock	1/07/1938	182.3				Sandstone and shale
GW006357	Stock	1/05/1938	237.1				Shale, sandstone and slate

Table 4.4 (Cont'd)
Surrounding Registered Bores

Registered Bore	Authorised Purpose	Completion date	Total Depth (mbgl)[1]	SWL[2] (mbgl)[1]	Salinity (mS/cm)	Yield (L/s)	End of hole geology
Central West Fractured Rock Groundwater Management Area (Cont'd)							
GW009933	Domestic, Stock	1/02/1952	107.3				Sandstone and shale
GW011004	Domestic, Stock	1/10/1954	154.2				Sandstone and shale
GW017140	Domestic, Stock	1/08/1958	200.2				Sandstone
GW022880	Domestic, Stock	1/07/1965	174.3				Sandstone and shale
GW023364	Domestic, Stock	1/01/1966	18				Sand and clay
GW033766	Domestic , Farming, Irrigation, Stock	1/01/1965	29.3				Shale and dolerite
Unidentified Groundwater Management Area							
GW000823		1/08/1922	153.5				Sandstone
GW004403		1892-02-01					Sandstone and shale
GW004404		1/04/1910	76.2				
GW070888	Domestic, Stock	1/11/1992	248.2				
GW801615	Domestic, Stock	30/08/2002	36	15		2.5	Sand and clay
GW801617	Domestic, Stock	25/09/2002	36	16		4	Sand and gravel
GW802177	Domestic, Stock	16/09/2004	160	18.2		0.75	Sandstone and shale
GW803042	Domestic	3/11/2005	25	11.6		1.2	Sand and clay
GW803303	Domestic, Stock	14/05/2007	40	16		0.87	Sand, clay and silt

Note 1: mbgl = metres below ground level
Note 2: SWL = Standing Water Level
Source: NSW Natural Resources Atlas – Date downloaded – 7 January 2013

4.2.2.2 Local Groundwater Setting

The Applicant engaged The Impax Group to construct eight monitoring bores within land to be transferred to the Applicant's control. In addition, two programs of groundwater quality monitoring have been completed. The results of the bore construction and water quality monitoring programs are presented in **Appendix 5.**

Table 4.5 presents an overview of the bore construction details. All bores were constructed using 50mm Class 18 PVC, with the annulus of the screened section of the bore backfilled with 2mm sand, overlain with a 1m bentonite seal. Each bore intersected clay from surface to between 6.5m and 11.5m below surface, underlain by variable sand, silt and gravel. Recorded standing water levels are between 16.53m and 18.49m below surface.

Table 4.5
Site Monitoring Bore Construction Details[1]

Site Number	Drilled Depth	Completed Depth	Screen Location	SWL[2]	Depth to base of Clay
MW1	20.5	20.5	17.5 – 20.5	16.93	11.5
MW2	20.0	19.0	16.0 – 19.0	17.27	10.0
MW3	20.0	19.3	16.3 – 19.3	17.90	9.0
MW4	24.0	23.0	20.0 – 23.0	16.53	6.5
MW5	20.5	20.5	17.5 – 20.5	16.57	10.0
MW6	20.5	20.5	17.5 – 20.5	16.69	8.5
MW7	20.5	20.0	17.0 – 20.0	18.49	9.5
MW8	20.5	20.0	17.0 – 20.0	17.14	10.5
Note 1: All units metres below ground level Note 2: SWL = Standing Water Level					
Source: Impax (2010)					

Table 4.6 presents an overview of the results of the water quality monitoring programs undertaken in January and November 2012. Full results are presented in Impax (2012a and 2012b). The results indicate the following.

- pH is between 6.7 and 7.0, indicating that groundwater is neither acidic nor alkaline.
- Electrical conductivity is between 34 000µS/cm and 38 000µS/cm, with a single sample returning 51 000µS/cm, indicating that the groundwater is saline to very saline, with limited beneficial uses.

Table 4.6
Site Water Quality

Site Number	pH		EC (µS/cm)		Chromium (µg/L)		Cadmium (µg/L)		Copper (µg/L)	
	Jan	Nov	Jan	Nov	Jan	Nov	Jan	Nov	Jan	Nov
MW1	6.8	7.0	51,000	-	1	-	0.1	-	6	-
MW2	6.9	7.1	38,000	-	8	-	0.2	-	<1	-
MW3	6.9	7.1	38,000	-	8	-	<0.1	-	3	-
MW6	6.9	6.8	37,000	-	16	-	0.1	-	14	-
MW7	6.8	6.9	35,000	-	8	-	<0.1	-	<1	-
MW8	6.6	6.7	34,000	-	18	-	0.2	-	5	-
Note 1: Sites MW4 and MW5 were not sampled because the bores were not accessible.										
Source: Impax (2012a and 2012b)										

4.2.3 Design and Operational Safeguards

The Applicant would implement the following design and operational safeguards throughout the life of the Proposal.

- Ensure that test drilling is undertaken within the footprint of each landfill cell prior to construction to determine the depth to the base of clay material. Where the depth is less than 6.9m below surface, namely the depth required to ensure a 900mm thickness of clay material below the base of the cell, the base of the cell would be adjusted to ensure a minimum clay thickness of 900mm.
- Ensure that the base and walls of the landfilling cells are constructed as described in Section 2.5.3 and in accordance with EPA Benchmark Technique 1.
- Ensure that a leachate collection system is constructed within each cell as described in Section 2.5.3 and in accordance with the requirements of EPA Benchmark Technique 2.
- Ensure that each cell is capped as described in Section 2.5.3.
- Continue to implement a groundwater monitoring using bores MW1 to MW3 and MW6 to MW8. Indicatively field measurements (standing water level, pH and electrical conductivity) would be undertaken monthly, with laboratory analyses undertaken annually or in the event that a departure from historic values for the field measurements identified in the *Landfill Environmental Management Plan* are observed. Groundwater samples would be extracted using the methodology identified in the *Murray-Darling Basin Groundwater Quality Sampling Guidelines.* The groundwater monitoring program would be implemented in accordance with the requirements of EPA Benchmark Techniques 4 to 6.

4.2.4 Assessment of Impacts

The anticipated groundwater-related impacts associated with the Proposal would be negligible for the following reasons.

- The permeability of the base and walls of the landfilling cells would comply with the requirements of EPA Benchmark Technique 1, namely 1 x 10^{-9}m/s over 900mm.
- Leachate would be collected and evaporated in accordance with the requirements of EPA Benchmark Technique 2.
- Groundwater within and immediately surrounding the Site would be monitored in accordance with the requirements of EPA Benchmark Techniques 4 to 6.
- There are no anticipated adverse impacts on surrounding groundwater users. In addition, given the depth to the standing water level and surrounding topography, the Applicant contends that no natural discharge of groundwater would occur in the vicinity of the Site and as a result, there would be no adverse impacts on groundwater dependent ecosystems.

4.3 SURFACE WATER

4.3.1 Introduction

The surface water assessment has been prepared by RW Corkery & Co. Pty Limited.

4.3.2 Existing Environment

A description of the existing surface water environment within and surrounding the Site is provided in Section 4.1.1. In summary, the existing surface water environment may be described as follows.

- No surface water drainages occur within the Site, with a small man-made structure to be relocated during the life of the Proposal.
- The Site is located approximately 500m north and west of Box Cowal and approximately 2.5km east of the Bogan River.
- The Applicant contends, based on the observed areas of inundation during the 1991 floods, that the Site is not on flood-prone land.

4.3.3 Design and Operational Safeguards

The Applicant would implement the following design and operational safeguards throughout the life of the Proposal.

- Ensure that the existing man-made diversion structure is relocated during the life of the Proposal.
- Ensure that a surface water diversion bund is constructed around the perimeter of the Site to prevent flow of clean water onto the Site or discharge of dirty water from the Site within six months of the commencement of landfilling operations under the Proposal.
- Ensure that all cells are internally draining and that all water collected within the leachate collection system is either evaporated *in situ* or is pumped to the Leachate Evaporation Pond for evaporation in accordance with EPA Benchmark Technique 3.
- Implement a program of surface water monitoring, including a leachate monitoring program, in conjunction with the groundwater monitoring program as described in Section 4.2.3 and in accordance with EPA Benchmark Techniques 7 and 8.

- Ensure that operational sections of the Site, including the selected waste drop off area, are internally draining or drain to the active landfill cell in accordance with EPA Benchmark Technique 3.
- Ensure that appropriate sediment controls are installed within and surrounding the soil and VENM stockpiling areas to ensure that sediment is not permitted to flow to other sections of the Site in accordance with EPA Benchmark Technique 3.

4.3.4 Assessment of Impacts

The anticipated surface water-related impacts associated with the Proposal would be negligible for the following reasons.

- All surface water within the Site would be retained within the Site, with all leachate or potentially-contaminated water evaporated in accordance EPA Benchmark Technique 3.
- Surface water within the Site would be monitored in accordance with EPA Benchmark Techniques 7 and 8.
- No impacts on Box Cowal or the Bogan River are anticipated given the distance from the Site to each.

4.4 BIODIVERSITY

4.4.1 Introduction

The biodiversity assessment has been prepared by OzArk Environmental and Heritage Management Pty Ltd. The resulting report, referred to hereafter as OzArk (2013) is presented as **Appendix 6**. The following presents a brief overview of that assessment.

4.4.2 Assessment Methodology

The biodiversity assessment was undertaken in accordance with the following guidelines.

- *Biodiversity Survey Guidelines Working Draft* published by the then Department of Environment and Conservation in 2004.
- *Threatened Species Survey and Assessment Guidelines* published by the then Department of Environment and Climate Change in 2007.
- *Field Survey Methods* published by the then Department of Environment and Climate Change and Water in 2009.

In summary, the biodiversity survey comprised the following.

- An initial database search to identify threatened species and endangered ecological communities with the potential to occur in the vicinity of the Site. This search was initially undertaken on 8 and 9 June 2010, with an undated search undertaken on 14 January 2013.
- A field survey undertaken on 27 May 2010.

4.4.3 Existing Environment

4.4.3.1 Database Search Results

Appendix 1 of OzArk (2013) presents the result of the database searches for listed species and ecological communities that have been observed in the vicinity of the Project Site. In summary, the searches indicated the following.

- NSW Office of Environment and Heritage Threatened Species Database – 66 results were returned, including:
  - one amphibian;
  - four bats;
  - 40 birds;
  - six mammals;
  - one reptile;
  - five endangered ecological communities; and
  - nine plants.
- Commonwealth Protected Matters Search – 22 results were returned, including:
  - three endangered ecological communities;
  - nine threatened species; and
  - ten migratory species.

4.4.3.2 Vegetation Communities

Figure 4.6 presents the vegetation communities identified by OzArk (2013) within and surrounding the Site.

- Myall Woodland EEC - Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions Endangered Ecological Community. This community comprises 11 individual trees within a small area approximately 75m in diameter. This community is identified as and Endangered Ecological Community under the NSW *Threatened Species Conservation Act 1995*, however, it is not classified as a Matter of National Environmental Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- Benson 144 - Leopardwood woodland of alluvial plains.
- Benson 49 - Windmill Grass - Curly Windmill Grass - Button Grass alluvial plains grasslands in the dry subtropical climate zone.
- Disturbed areas.

It is noted that the Proposal has been redesigned in light of the identification of the Myall Woodland EEC to ensure that none of that community would be disturbed and that the community would be re-established within the Site as a visual screen.

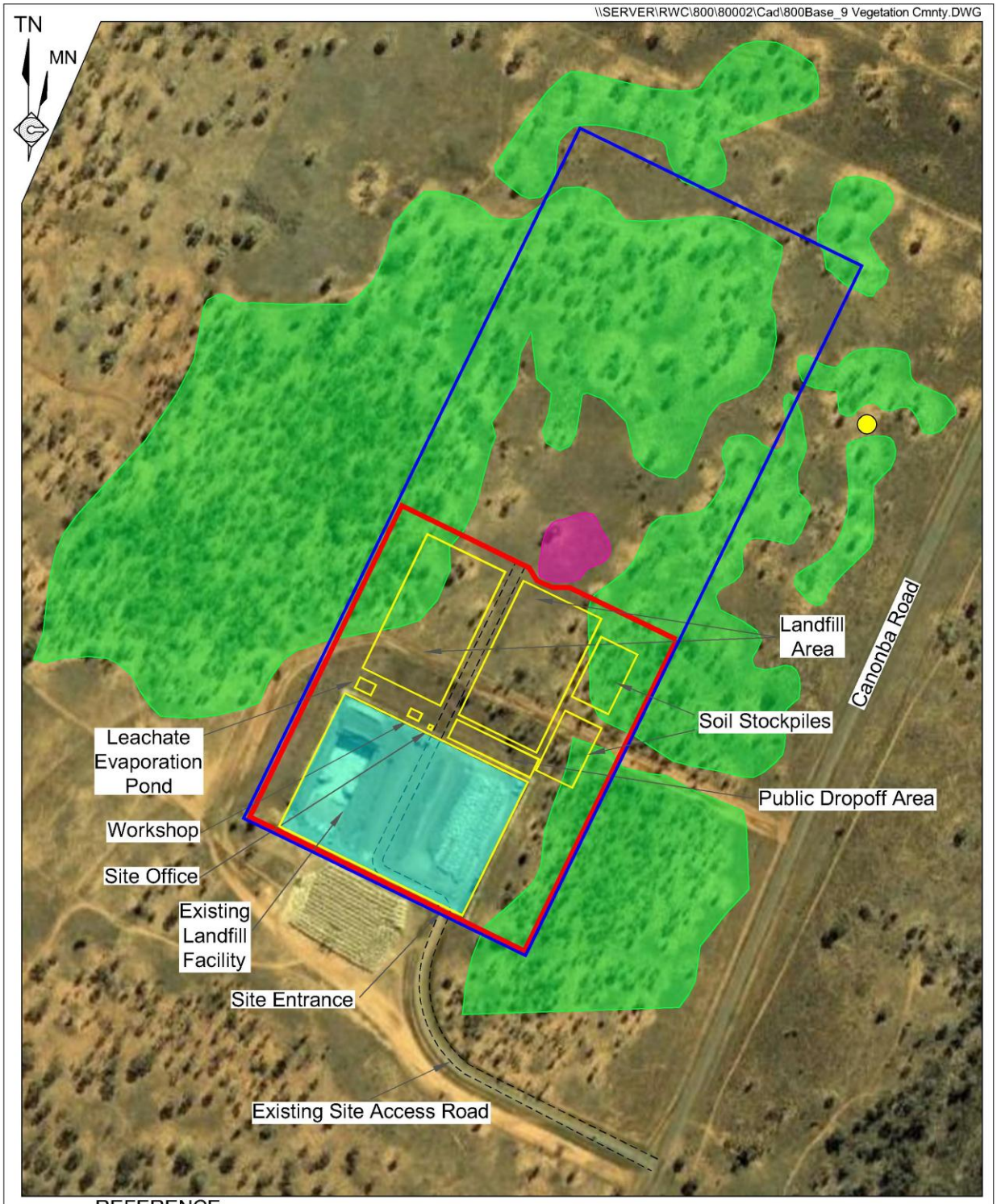
4.4.3.3 Threatened Species

One family of Grey-crowned Babblers were identified adjacent to Council-controlled land (**Figure 4.6**). No nests for this species were observed and OzArk (2013) state that it is likely that the species would only use the land surrounding the Site for foraging purposes.

No other threatened fauna for flora species were observed.

4.4.3.4 Noxious Weeds

African boxthorn (*Lycium ferocissimum*), a Class 4 Noxious Weed was recorded within the area surveyed.



Vegetation Community	Area within Council-controlled Land	Area to be Disturbed by the Proposal
Myall Woodland EEC	0.4ha	0ha
Benson 144	9.5ha	0.6ha
Benson 49 (Remainder)	9.3ha	2.6ha
Disturbed Land	2.9ha	2.9ha

Figure 4.6
VEGETATION COMMUNITIES

4.4.4 Design and Operational Safeguards

The Applicant would implement the following design and operational safeguards throughout the life of the Proposal.

- Ensure that land preparation and rehabilitation is undertaken progressively to minimise the total disturbed area any one time.
- Ensure that the boundaries of areas to be disturbed are clearly marked on the ground to minimise the potential for inadvertent over clearing.
- Ensure that the existing area of Myall Woodland EEC is fenced and signs erected indicating the presence and importance of the community and indicating that disturbance is not permitted.
- Strip topsoil with the vegetation to ensure soil structure and seed bank is maintained in accordance with the procedures identified in Section 4.12.3.
- Establish the visual amenity screens as identified in Section 2.4 using species representative of the Myall Woodland EEC.
- Manage weeds within Council-controlled land, with particular focus on managing African Boxthorn.

4.4.5 Assessment of Impacts

Appendix 2 of OzArk (2013) presents seven-part tests of significance for the following.

- Myall Woodland EEC – No significant impacts anticipated.
- Grey-crowned Babbler – No significant impacts anticipated.

As a result, the Applicant contends that the Proposal would not result in a significant adverse impact on any threatened species or endangered ecological community. In addition, taking into account the proposed use of species consistent with the Myall Woodland EEC within the Site, the Proposal is likely to result in additional areas of this community becoming established.

4.5 LITTER

4.5.1 Introduction

The litter assessment has been prepared by RW Corkery & Co. Pty Limited.

4.5.2 Existing Environment

Plates 4.1 and **4.2** present an overview of litter within the Site during the Planning Focus Meeting on 7 November 2012. In summary, litter has at times presented a management issue for the Applicant. This has largely been the result of uncontrolled placement of waste by the public and the fact that the Site is an unmanned site open 24 hours per day, 7 days per week and that the use of a thin daily cover of clay has not been feasible.

Plate 4.1: View of the active landfill cell looking southeast
(date of photograph: 7 November 2012)
(Ref: B071112\DSC_0025)

Plate 4.2: View of the active landfill cell looking south .
(date of photograph: 7 November 2012)
(Ref: B071112\DSC_0026)

4.5.3 Design and Operational Safeguards

The Applicant would implement the following design and operational safeguards throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 31.

- Ensure that the waste placement measures identified in Section 2.5.4 are implemented throughout the life of the Proposal, including managing placement of waste and, where required, use of intermediate covers.
- Construct a perimeter fence around the Site prior to the commencement of activities under this Proposal.

- Construct and progressively relocated a litter fence around the active landfilling cell(s) throughout the life of the Proposal.
- Ensure that waste is placed in the manner described in Section 2.5.4 and that intermediate covers are used as required throughout the life of the Proposal.
- Implement a litter inspection program within and surrounding the Site during and following periods of high winds and collect windblown litter as required.

4.5.4 Assessment of Impacts

The anticipated litter-related impacts associated with the Proposal would be negligible for the following reasons.

- Placement of waste and the use of daily covers would be able to be managed in a manner that is more appropriate than is currently possible. This would reduce the generation of windblown litter.
- The use of litter fences would limit the distribution of any windblown litter that may be generated.
- A daily inspection program and follow up collection of windblown litter would ensure that litter that does accumulate is identified and removed within a reasonable timeframe.

4.6 NOISE

4.6.1 Introduction

The noise assessment has been prepared by RW Corkery & Co. Pty Limited.

4.6.2 Existing Environment

Background noise levels surrounding the Site are typical of a rural environment with minor contributions from traffic noise and agricultural and domestic activities. The principal sources of noise that contribute to background noise level include:

- traffic on Canonba Road;
- landfilling activities within the existing facility;
- farm equipment such as tractors and cultivators;
- domestic activities such as lawn mowers and chainsaws;
- insects such as cicadas, especially during spring and summer months;
- livestock and other farm and native animals; and
- wind through vegetation within the Site and surrounding areas.

The Applicant anticipates that background noise levels would be less than the *Industrial Noise Policy* default background level of 30dB(A).

As described in Section 4.1.3, the surrounding land uses are primarily agricultural in nature, and as such there are only two sensitive receptors in the vicinity. **Figure 4.4** identified the location of the sensitive receptors and **Table 4.7** identifies the direction and distance from the Site to the identified receptors.

Table 4.7
Direction and Distance to Sensitive Receptors

Receptor	Description	Direction from Site	Distance from Site
1	Residence	West	2.2km
2	Residence	Southwest	2.1km

4.6.3 Design and Operational Safeguards

The Applicant would implement the following noise management and mitigation measures throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 37.

- Strictly comply with the proposed hours of operation identified in Section 2.12.
- Regularly service all equipment on site to ensure sound power levels of each item remains at or below the default/or factory-set values.
- Ensure that all truck drivers are required to comply with the Council's Driver Code of Conduct outlining procedures for reducing noise impacts during transportation within the Site and off site.
- Maintain an open dialogue with the surrounding community and neighbours to ensure any concerns over noise or vibration are addressed.

4.6.4 Assessment of Impacts

The anticipated noise-related impacts associated with the Proposal would be negligible for the following reasons.

- Noise produced from the sources attributable to the Proposal are unlikely to be significant in the context of the surrounding land uses. In addition, the Proposal would not result in an increase in the noise levels currently produces within the Site.
- The remoteness of the area and distance to the sensitive receptors would allow for the dissipation of noise.
- Operational hours restrict noise emissions to daytime only.
- No noise related complaints have been received for the existing facility.

4.7 AIR QUALITY, ODOUR AND GREENHOUSE GASES

4.7.1 Introduction

The air quality, odour and greenhouse gas assessment has been prepared by RW Corkery & Co. Pty Limited.

4.7.2 Existing Environment

The existing levels of dust in the vicinity of the Site are typical of a rural area where the principal sources of dust would be from agricultural activities, wind erosion from bare areas and limited vehicle movements on the surrounding road network. No issues in relation to odour have been identified during the operation of the existing waste facility.

Greenhouse gas emissions associated with the existing operations include the following.

- Limited emissions associated with combustion of diesel used by machinery within the Site.
- Limited emissions associated with methane generation from small volumes of putrescible waste.

4.7.3 Design and Operational Safeguards

The Applicant would implement the following air quality management and mitigation measures throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 34.

- Water or treat internal roads with chemical suppressants, where appropriate, to minimise dust generation.
- Restrict vehicle speed to 20 km/hr within the Site.
- Ensure that completed sections of the active landfill cell are progressively rehabilitated to reduce the area of non-vegetated surfaces.

Potential odour and greenhouse gas sources within the Site include the following.

- Decomposition of residual waste (general solid (putrescible)) within landfill cells.
- Stockpiling of garden organics waste (grass, leaves, trees, shrubs and timber) within the Selected Waste Drop-off Area.
- Leachate evaporation.

The Applicant would implement the following odour management and mitigation measures throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 36.

- Minimise the area of uncovered waste within the active cell by operating the smallest active tipping face practicable and through the use of intermediate covers.
- Control the pH of the leachate that is evaporated to minimise its odour, if necessary.
- Manage stockpiles to ensure that development of anaerobic conditions in the stockpiled greenwaste is minimised.
- Install airtight fittings on leachate risers, if required.
- Install and operate an aerator on the leachate evaporation pond, if required.

Given the minimal quantities of waste proposed to be collected at the facility, it is not anticipated measures are required to monitor, capture or dispose of landfill gas.

4.7.4 Assessment of Impacts

The anticipated air quality-related impacts associated with the Proposal would be negligible for the following reasons.

- Dust and odour produced from the sources attributable to the Proposal are unlikely to be significant in the context of the area. In addition, the Proposal would not result in a significant increase in the amount of waste managed at the Site. No air quality or odour related complaints have been received for the existing facility.
- The remoteness of the area and distance to the sensitive receptors would allow for the dissipation of dust and odour.

4.8 FIRE

4.8.1 Introduction

The fire assessment has been prepared by RW Corkery & Co. Pty Limited.

4.8.2 Existing Environment

Current practice is to surround the active cell on all sides with a cleared track/firebreak which separates the cell from the surrounding grassland. In addition, a water tank with sufficient capacity is maintained onsite for fire-fighting purposes.

The Applicant notes that fires within the existing landfill have occurred on several occasions since the construction of the existing facility in the early 1990s. The Applicant understands that these fires were started through inappropriate placement of waste and vandalism. On each occasion, the fires have been extinguished without spreading beyond the active landfilling cell through a combination of application of water and extraction and spreading of waste material within the active landfill cell.

4.8.3 Design and Operational Safeguards

Materials which could present a fire risk within the Site would include:

- stockpiles of combustible recyclable materials (green waste, timer, paper, cardboard, tyres and plastics) stored within the Selected Waste Drop-off Area;
- emplaced waste containing a high proportion of combustible materials noted above; and
- used oils.

The Applicant would implement the following fire management and mitigation measures throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 13 and 38.

- Limit the size of stockpiles of combustible materials.
- Maintain separate stockpiles of combustible materials so that, in the event that a stockpile did catch fire, the fire would not spread to other stockpiles.
- Regularly remove stockpiles of combustible material so that the risk of spontaneous combustion is minimised.
- Ensure that emplaced waste materials with high proportions of combustible materials are covered regularly to minimise the risk a fire within the landfill cell.
- Regularly inspect all residual waste, recyclable material and green waste stockpiles and active landfill cells for fires and any potential fire risks.
- Maintain a buffer zone (in the form of an unsealed track road and/or stormwater diversion channel) around the active sections of the Site.
- Oxidise gas generated from the putrescible waste using means that does not risk initiating a fire.
- Restrict public entry to the Site to identified operating hours and ensure that the Site is staffed during these hours.
- Maintaining appropriate fire extinguishers and other fire fighting equipment within the Site.

4.8.4 Assessment of Impacts

The anticipated fire-related impacts associated with the Proposal would be negligible for the following reasons.

- Due to the volumes of waste, gas is not expected to be an ignition source.
- Potential sources of ignition will be managed through the security measures and management of public on the Site.
- Combustible materials will be managed such that if a fire does start, there will be limited fuel available to keep the fire going.

- In the event a fire does start on the Site, there will be adequate fire fighting equipment to extinguish the fire.
- Fires on the Site will be contained to the Site by a buffer zone.
- The Site will be protected from fires from outside the Site via the buffer zone.

4.9 VISIBILITY

4.9.1 Introduction

The visibility assessment has been prepared by RW Corkery & Co. Pty Limited.

4.9.2 Existing Environment

Plate 4.3 presents a view of the existing landfill facility. In summary, the existing facility is separated from surrounding land by a fence, with no visual screening. Due to the flat topography surrounding the Site, activities within the Site are visible for a short distance in all directions, including from Canonba Road.

Plate 4.3 View of the existing landfill facility looking southwest (date of photograph 26 February 2010) (Ref: E800A_001)

4.9.3 Design and Operational Safeguards

The Applicant would implement the following design and operational safeguards throughout the life of the Proposal.

- Establish a tree/visual screen adjacent to the western, southern and eastern boundaries of the Site progressively throughout the life of the Proposal.
- Ensure that the waste placement measures identified in Section 2.5.4 are implemented throughout the life of the Proposal, including managing placement of waste and implementation of intermediate covers.
- Construct a perimeter fence around the Site prior to the commencement of activities under this Proposal.
- Construct and progressively relocated a litter fence around the active landfilling cell(s) throughout the life of the Proposal.
- Ensure that waste is placed in the manner described in Section 2.5.4 and that intermediate covers are used as required throughout the life of the Proposal.
- Implement a litter inspection program within and surrounding the Site during periods of high winds and collect windblown litter as required.

4.9.4 Assessment of Impacts

The anticipated visual amenity-related impacts associated with the Proposal would be negligible for the following reasons.

- A tree/visual amenity screen would be established to effectively screen the Site from surrounding land.
- Wind-blown litter would be minimised to the greatest extent practicable.

4.10 TRAFFIC

4.10.1 Introduction

The traffic assessment has been prepared by RW Corkery & Co. Pty Limited.

4.10.2 Existing Environment

Access to the Site is via Canonba Road. Canonba Road a two-way sealed road approximately 6m wide with no marked centre line and shoulders approximately 0.5m wide on each side of the road. No traffic count data exists for the road, however, it is noted that traffic is consistent with rural collector roads within the Bogan LGA, namely typically light traffic, with annual peak traffic volumes associated with grain harvests and agricultural operations.

4.10.3 Design and Operational Safeguards

The Applicant would implement the following measures to ensure that the Proposal does not result in unacceptable traffic-related impacts.

- Ensure that all Council-related drivers are required to adhere to Bogan Shire Council's "Driver Code of Conduct" during the delivery of materials to the site or transport of materials from the site.
- Regularly inspect and clear long grass and bushes that grow on the Canonba Road shoulder to maintain the maximum possible sight distance.
- Restrict vehicle speed to 20 km/hr within the Site.
- Ensure that public drop-off of materials is be restricted to the nominated operating hours (see Section 2.8.2).

4.10.4 Assessment of Impacts

The anticipated traffic-related impacts associated with the Proposal would be negligible for the following reasons.

- The Proposal would not significantly increase traffic levels from those that currently use Canonba Road.
- The Proposal would not adversely impact upon the road safety and traffic flow along Canonba Road.

4.11 HERITAGE

4.11.1 Introduction

The biodiversity assessment has been prepared by OzArk Environmental and Heritage Management Pty Ltd. The resulting report, referred to hereafter as OzArk (2012) is presented as **Appendix 7**. The following presents a brief overview of that assessment.

4.11.2 Assessment Methodology

OzArk undertook a two stage archaeological investigation to establish the presence of any Aboriginal heritage within the Site. This included a background search for existing heritage items in the area, assessment of the landscape and cultural context, and a field survey on 20 November 2012. The survey was conducted in the presence of a representative from Nyngan Local Aboriginal Land Council (NLALC).

4.11.3 Existing Environment

The desktop assessment identified two Aboriginal sites with 3km of the Site, with no Aboriginal sites previously recorded within the Site. The survey undertaken for the proposal did not identify any sites of Aboriginal heritage significance.

A background analysis of the landscape of the Site, coupled with the survey undertaken for the Proposal revealed a landscape primarily of transitional use. In terms of the local fauna, there did not appear to be a fixed habitat. Floral resources were also limited, but both animals and plants of some use could be found in the area. No outcroppings or substantial occurrences of stone suitable for tool-making were apparent.

The Site is not close to permanent water and rainfall in the area is low. The Site is beyond the flood zone of the Bogan River and drainage is considered to be poor in times of heavy rain. No major alluvial deposits were present, limiting the potential for buried evidence of human activity within the last few hundred years.

The Site has been disturbed by agricultural practices, but not to an extent that would have removed evidence of other human activity.

4.11.4 Design and Operational Safeguards

Given no Aboriginal sites were identified during the survey or have previously recorded, no management or mitigation measures in respect of Aboriginal heritage is required. However, in the unlikely event that objects of suspected Aboriginal heritage significance are encountered, the unanticipated finds protocol identified in Appendix 3 of the OzArk (2012) would be followed.

4.11.5 Assessment of Impacts

The anticipated Aboriginal heritage-related impacts associated with the Proposal would be negligible for the following reasons.

- No Aboriginal sites were identified in the survey or previously recorded on the Site. Furthermore, it is unlikely Aboriginal sites will be identified during the construction and operation of the Proposal.
- An unanticipated finds protocol will be followed in the event Aboriginal sites or artefacts are identified during construction and operation of the Proposal.

4.12 SOILS, LAND CAPABILITY AND AGRICULTURAL SUITABILITY

4.12.1 Introduction

The soils, land capability and agricultural suitability assessment has been prepared by RW Corkery & Co. Pty Limited.

4.12.2 Existing Environment

The NSW Natural Resource Atlas suggests that soils surrounding the Site are dominated by Red Kandosol and Red Earth soil types. Topsoil typically extends to a depth of approximately 250mm below surface, with subsoils occurring from the base of the topsoil to a depth of more than 750mm.

The Site is considered to be located within a relatively low to moderate rainfall erosivity zone in accordance with the Landcom (2004). Given the topography of the Site, and based on the Applicant's experience working with the soils, it is likely the soils within the Site have a low to moderate erosion potential.

Given the surrounding land uses of the Site, it is likely the soils are classed as Class 3 (Grazing land or land well suitable to pasture improvement) or Class 4 (land suitable for grazing but not for cultivation) in accordance with the classification system described in the document *Agricultural land Classification* published by NSW Agriculture.

Rehabilitation has been ongoing for the current facility. An inspection of the existing facility identified the successful placement of topsoils over the completed landfill cells with germination of native grasses commencing.

4.12.3 Design and Operational Safeguards

The Applicant would implement the following soil management and mitigation measures throughout the life of the Proposal. These measures would be implemented in accordance with EPA Benchmark Technique 28.

- Minimise handling of all soils to minimise their structural damage.
- Strip topsoils to a depth of approximately 250mm and store in stockpiles no more than 2m high.
- Strip subsoil to a depth of approximately 250mm below the base of the topsoil and store in stockpiles no more than 3m in high.
- Refrain from stripping or placing soils during wet conditions.
- Place stripped soils directly onto areas undergoing progressive rehabilitation where practicable. Where that is not practicable, ensure that stripped material is placed neatly and uniformly so that the stockpile does not require further forming prior to establishment of vegetation cover.
- Avoid driving of machinery on the topsoil and subsoil stockpiles to minimise compaction and further degradation of soil structure.
- Ensure that the formed soil stockpile surfaces have a generally uneven surface that is as 'rough' as possible, in a micro-sense, to assist in surface water runoff control and seed retention and germination.
- Sow the soil stockpiles with stabilising groundcover species as soon as practicable after placement and water if necessary to speed up establishment and attain a cover of at least 30%.

- Ensure that during soil placement operations soil is placed directly onto a scarified surface without compaction and in correct order, namely topsoil overlying subsoil.
- Add, where appropriate, organic matter comprising composted cleared vegetation.
- Ensure that soil management procedures are developed in accordance with Landcom (2004).

4.12.4 Assessment of Impacts

The anticipated soils, land capability and agricultural suitability-related impacts associated with the Proposal would be negligible for the following reasons.

- Soils would be excavated from within the footprint of the landfill cells and would be used for onsite rehabilitation. No soils from off-site would be brought to the Site for rehabilitation purposes.
- Soils would be appropriately stockpiled and handled.
- Experience has shown the proposed measures to be appropriate and successful in managing soils on the Site, and achieving successful rehabilitation.

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