STATE COMMISSION ASSESSMENT PANEL
A COMMITTEE OF THE STATE PLANNING COMMISSION

APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Type of development:	SECTION 49 - PUBLIC INFRASTRUCTURE
Development Number:	145/V012/18
Applicant:	LMS Energy Pty Ltd c/- URPS
Nature of Development:	Construction of a renewable energy facility - landfill gas power generation
Subject Land:	112 Bakewell Drive, McLaren Vale
Development Plan:	Onkaparinga Council Development Plan, consolidated 20 December 2018.
Zone / Policy Area:	Urban Employment Zone/Infrastructure Policy Area 13
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Consultation Start Date:	29 May 2019
Consultation Close Date:	20 June 2019
During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders St, Adelaide, during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).	

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapreps@sa.gov.au
Fax Number: (08) 8303 0753

DEVELOPMENT ACT, 1993
S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	LMS Energy c/- URPS
Development Number:	145/V012/18
Nature of Development:	Construction of a renewable energy facility - landfill gas power generation
Zone / Policy Area:	Urban Employment Zone/Infrastructure Policy Area 13
Subject Land:	112 Bakewell Drive, McLaren Vale
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Close Date:	Thursday 20 June 2019

My Name: _____ My phone number: _____

Primary method(s) of contact: Email: _____

Postal Address: _____

_____ Postcode: _____

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
(please tick one)

- ☐ owner of local property
- ☐ occupier of local property
- ☐ a representative of a company/other organisation affected by the proposal
- ☐ a private citizen

The address of the property affected is: _____

_____ Postcode _____

My interests are:
(please tick one)

- ☐ I support the development
- ☐ I support the development with some concerns
- ☐ I oppose the development

The specific aspects of the application to which I make comment on are: _____

_____

_____

_____

_____

I: *(please tick one)*

- ☐ wish to be heard in support of my submission
- ☐ do not wish to be heard in support of my submission
  (Please tick one)

By: *(please tick one)*

- ☐ appearing personally
- ☐ being represented by the following person
  (Please tick one)

Signature: _____

Date: _____

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 /or
Email: scapreps@sa.gov.au

URPS

LMS Energy Pty Ltd
17ADL-0268
21 May 2019

Planning Report
Section 49 Development
Seaford Heights Renewable Energy Facility – Landfill Gas Power Generation

112 Bakewell Road, McLaren Vale

Planning Report

21 May 2019

Lead consultant	URPS
Prepared for	LMS Energy Pty Ltd
Consultant Project Manager	Simon Channon, Associate
	Suite 12/154 Fullarton Road (cnr Alexandra Ave) Rose Park, SA 5067 Tel: (08) 8333 7999 Email: simon@urps.com.au
URPS Ref	R002_v2_180626.docx

Document history and status

Revision	Date	Author	Details
1	25 June 18	SC	Draft for review.
2	26 June 18	SC	Final
3	30 July 18	SC	Minor Correction
4	21 May 19	SC	Update Following Receipt of Additional Information

www.urps.com.au
ABN 55 640 546 010

H:\Synergy\Projects\17ADL\17ADL-0268 112 Bakewell Drive McLaren Vale - Joule Energy Solar\Development Application\Draft Documents\R002_v2_180626.docx

Contents

1.0 Application Overview

Renewable Energy Facility – Landfill Gas Power Generation	
Applicant	LMS Energy Pty Ltd
Property location	112 Bakewell Road, McLaren Vale
Description of land	Certificate of Title 6199/629
Ownership	Southern Region Waste Resource Authority
Site area	54 hectares
Council	City of Onkaparinga
Development Plan	Onkaparinga Council consolidated 20 February 2018
Zone and Policy Area	Urban Employment Zone - Infrastructure Policy Area 13
Current land use	Landfill site
Description of development	Landfill Gas Power Generation Facility
Assessment Pathway	Section 49 (Public Infrastructure) of the *Development Act 1993*
Cost of development	$5.24 million
Public notification	Required
Relevant Authority	The Minister for Planning
Referrals	City of Onkaparinga Environment Protection Authority
Plans and details accompanying application	• Development application form and electricity declaration • Certificates of Title • Plans and details prepared by LMS Energy • Electricity Generation Licence • Environmental Noise Assessment prepared by Sonus • Air Quality Assessment for Seaford Heights Energy Facility prepared by Katestone Environmental • Seaford Heights Renewable Energy Facility Geotechnical Stability Report prepared by Tonkin • Seaford Heights Renewable Energy Facility Desktop Landfill Gas Risk Assessment prepared by Tonkin, and • Email and attachments from LMS Energy to the EPA dated 28 August 2018.
Contact person	Simon Channon, URPS, 8333 7999 Grazio Maiorano, URPS, 8333 7999

2.0 Introduction

URPS has been engaged by LMS Energy Pty Ltd (LMS Energy), the applicant in this matter, to provide a planning statement regarding this proposed development. The proposed development involves the installation of a landfill gas power generation facility at the Southern Region Waste Resource Authority (SRWRA) site at 112 Bakewell Road, McLaren Vale.

The proposed facility will replace existing landfill gas power generation equipment currently installed on the land.

A separate application for a solar array on the SRWRA has been lodged with the State Commission Assessment Panel.

The applicant has received sponsorship for the development under Section 49 of the *Development Act 1993* (the Act), through the Department of Energy and Mining.

Appended with this report are:

- Completed application forms
- Certificate of Title
- Proposal plans prepared by the applicant
- Environmental Noise Assessment prepared by Sonus
- A copy of the Electricity Generation Licence issued by the Essential Services Commission of South Australia
- Air Quality Assessment for Seaford Heights Energy Facility prepared by Katestone Environmental
- Seaford Heights Renewable Energy Facility Desktop Landfill Gas Risk Assessment prepared by Tonkin
- Seaford Heights Renewable Energy Facility Geotechnical Stability Report prepared by Tonkin (appended within the above report), and
- Email and attachments from LMS Energy to the EPA dated 28 August 2018.

3.0 Subject Land and Locality

3.1 Subject Land

The subject land comprises one allotment being Pieces 192 and 193 in Deposited Plan 116986, Certificate of Title 6199/629.

The subject land forms part of a larger site owned by SRWRA and used as a landfill site. The above land parcel is the largest parcel under the SRWRA ownership and contains the bulk of the current landfill operations. It also contains a number of buildings, principally sheds, with a network of internal roads/circulation areas and vegetation. Other parcels within the SRWRA have formerly been used for landfill and have since been capped. There is also a compound containing the existing landfill gas power generation facility.

Image 1 **View of the subject looking south-east from Bakewell Drive (Streetview March 2017)**

3.2 Locality

The subject land is located within a semi-rural locality approximately midway between McLaren Vale and Seaford Heights. The land is located some 250 metres to the south of Victor Harbor Road where it is separated by an existing vineyard. Vineyards and an olive grove are located to the east and partly to the west of the subject land. Other land uses within the locality include a horse stable and agricultural land to the west of the site and rural-residential land uses to the east.

The nearest dwelling is approximately 280 metres from the site of the development, the next nearest dwelling is some 500 metres to the east of the site. Both of these dwellings are located on land owned by the applicant which has secured much of the land surrounding its landfill operations.

Image 2 **View of adjoining olive grove and vineyard in the background to the south-east of the subject land (Streetview January 2014)**

Image 3 **View of the horse stable and agricultural land in the background to the west of the subject site (Streetview March 2017)**

The site and locality are also illustrated on the following page.

SITE PLAN 112 BAKEWELL DRIVE, McLAREN VALE - LMS ENERGY LANDFILL GAS

0 75 150m

JOB REF.	17ADL-0268
PREPARED BY.	ML
DATE.	17.05.18
REVISION.	2
DATA SOURCE.	Property Location Browser, Onkaparinga DP

LEGEND
- Cadastre
- Zone Boundary
- Dwelling

ZONES
- **DU** Deferred Urban
- **PrPro** Primary Production
- **UE** Urban Employment

URPS

4.0 Proposal

The proposal is illustrated in the proposed site plan and elevations prepared by LMS Energy and enclosed with this report.

The development comprises a landfill gas power generation facility comprising:

- 3 x 1.06 MW Jenbacher J320 spark-ignition reciprocating engines
- 2 x gas conditioning skid
- 3 x HV transformer
- 3 x HV reactor
- HV switching unit
- Control room
- Coverage storage bund
- Workshop shed
- 10,000 litre water tank, and
- 2 x 20 metre lightning poles.

The above infrastructure will be installed within a compound having an area of 45 metres by 30 metres. It is to be located within an existing cleared area on the land and no earthworks are required to accommodate the proposed development.

The proposed development will replace an existing landfill gas power generation facility on the land.

The landfill gas power generation facility is expected to produce approximately 26 GWh of electricity per annum which will be exported to the grid.

5.0 Procedural Considerations

5.1 Section 49 of the Development Act 1993

The applicant has received sponsorship through the Department of Energy and Mining for this application to be submitted under section 49 of the Act.

The State Commission Panel is the relevant authority in this case (in the place of the former Development Assessment Commission), pursuant to Schedule 8 of the Planning, Development and Infrastructure Act 2016.

5.1.1 Public Notification

Section 49(7d) of the Development Act 1993 prescribes public notification procedure where the total cost of a development is greater than $4,000,000. The proposed development has a cost of $5,240,000 and therefore public notification is required.

5.1.2 Referrals

Pursuant to section 49(4a) – (6), the application will be referred to the City of Onkaparinga, being the area within which the subject land is located.

It is understood that this development will also require a referral to the Environment Protection Authority as the proposed development will involve an "Activity of Major Environmental Significance". The development will involve the use of fuel burning equipment at a rate of heat release exceeding 5 megawatts. The site is currently licensed by the EPA and has an existing landfill gas power generation facility on the land. The existing facility is to be replaced by the proposed development.

5.2 Zoning

The subject land is located wholly within the Infrastructure Policy Area 13 of the Urban Employment Zone of the Onkaparinga Council Development Plan (consolidated 20 February 2018).

6.0 Development Assessment

Our assessment of the proposed development is made under the following headings:

- zone and land use, and
- interface with adjoining land.

6.1 Zone and Land Use

The proposed development comprises a landfill gas power generation facility associated with an existing and continuing land fill operation.

The provisions of the Infrastructure Policy Area 13 support the development of renewable energy facilities in conjunction with existing landfill development:

Industry Zone – Infrastructure Policy Area 13

Objective 1 **Primarily, a policy area for the provision of infrastructure including water, waste water, waste management and renewable energy technologies.**

Desired Character Statement

It is envisaged that development within this section of the policy area will primarily comprise activities involving or ancillary to the reuse, recycling, recovery, treatment, transfer and disposal of waste materials, and the generation of energy from renewable resources, including the associated distribution networks and plant and equipment associated with the extraction of landfill gas.

Land in this section of the policy area which is no longer needed for landfill or waste management will be remediated or revegetated (as necessary) and may be used for purposes consistent with the applicable Urban Employment Zone and which do not detract from the ongoing landfill land waste management operations. These uses will not detrimentally impact on the amenity or appearance of the surrounding locality or the environment nor impair ongoing operations on the balance of the landfill site. (underlining added)

Principle 1 **The following forms of development are envisaged in the policy area:**

- **…renewable energy facility…**

The proposed development of a landfill gas power generation facility in conjunction with the existing landfill operation is clearly an anticipated land use.

The proposed built form components will be located an on existing benched area clear of vegetation. It is located such that it will be generally screened from view from nearby public streets and adjoining properties. Additionally, it will involve generally low height and scale infrastructure that may otherwise be anticipated on a landfill site. It is also acknowledged that existing landfill gas power generation equipment located near the proposed development will be removed from the site.

6.2 Interface with Adjoining Land

Being an existing landfill site, there are few dwellings within close proximity to the subject site. Most land nearby is used for some kind of primary production use (such as vineyards, agriculture and olive growing), with the proposed development being compatible with these activities.

The nearest dwelling is approximately 280 metres from the site of the development (that dwelling is to the north west), the next nearest dwelling is some 500 metres to the east of the site.

The nearest dwellings are unlikely to have views of the proposed development given the existing vegetation and land contour. In any event, the proposed infrastructure is closely located existing buildings and other site infrastructure and so I consider that the development will not have a material visual impact on any nearby dwellings.

Having regard to the General Section's Interface and Land Use provisions, I consider the following provision to be relevant:

General Section – Interface between Land Uses

Principle 1 **Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:**

- **(a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants**
- **(b) noise**
- **(c) vibration**
- **(d) electrical interference**
- **(e) light spill**
- **(f) glare**
- **(g) hours of operation**
- **(h) traffic impacts.**

Principle 2 **Development should be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality.**

With respect to the matters in Principle 1 above, the impact of fumes and noise are considered the most likely to have the potential to impact nearby sensitive receivers. I address each of these matters in detail below.

I also acknowledged that the site is adjacent a Deferred Urban Zone; a zone set aside for future residential development. Interface between Land Uses Principle 2 states that development should minimise impacts on "potential future land uses desired in the locality". The Deferred Urban Zone is a Zone that still requires further rezoning before it is suitable to accommodate residential development. Furthermore, the Desired Character of that Zone states the land at Seaford Rise (the area adjacent the subject land) should only occur when "it can be demonstrated that the land is no longer required as a buffer to mining

and waste operations". It follows that while the landfill site is operational, the adjoining Deferred Urban Zone will not be used for residential purposes. In any event, it is noted that the majority of land within the Deferred Urban Zone is under the same ownership as the landfill site and, therefore, there would be no demand for residential development while the landfill site is operational. For the above reasons, the proposed development is not going to prejudice and future land uses that may be desired in the locality.

6.2.1 Noise

The following provisions are relevant in the consideration of the potential noise impact of the proposed development:

General Section – Interface between Land Uses

Principle 7 **Development that emits noise (other than music noise) should include noise attenuation measures that achieve the relevant Environment Protection (Noise) Policy criteria when assessed at the nearest existing noise sensitive premises.**

Principle 8 **Development with the potential to emit significant noise (e.g. industry) should incorporate noise attenuation measures that prevent noise from causing unreasonable interference with the amenity of noise sensitive premises. (underlining added)**

Sonus' Environmental Noise Assessment indicates:

- That the two nearest dwellings would have the following noise goal levels:
  - The dwelling within the Deferred Urban Zone - an average (L_{eq}) noise level of 46 dB(A) at night (10pm to 7am), and
  - The dwelling within the Primary Production Zone - an average (L_{eq}) noise level of 48 dB(A) at night (10pm to 7am).
- The noise from an energy facility would be constant in nature and should not attract a penalty at the nearest dwellings
- With:
  - The machinery operating to specification
  - A larger generator being modelled
  - All equipment operating continuously, and
  - Modelling undertaken to the CONCAWE noise propagation algorithm with weather Category 6

  The modelling predicts noise levels of:
  - 43 db(A) at the dwelling in the Deferred Urban Zone, and
  - 36 db(A) at the dwelling in the Primary Production Zone.
- The proposed development "will easily achieve the goal noise levels of the Policy at all residences, without the implementation of any specific treatments".

Given the findings by Sonus that the proposed development will comply with the Environment Protection (Noise) Policy, it is considered that the proposed development satisfies the above provisions and will not unreasonably interfere with the amenity of nearby noise sensitive premises.

6.2.2 Air Emissions

The following provisions are relevant in the consideration of the potential emissions impact of the proposed development:

General Section – Interface between Land Uses

Principle 11 **Development with the potential to emit harmful or nuisance-generating air pollution should incorporate air pollution control measures to prevent harm to human health or unreasonable interference with the amenity of sensitive uses within the locality.**

Principle 12 **Chimneys or exhaust flues associated with commercial development (including cafes, restaurants and fast food outlets) should be designed to ensure they do not cause a nuisance or health concerns to nearby sensitive receivers by:**

(a) incorporating appropriate treatment technology before exhaust emissions are released to the atmosphere

(b) ensuring that the location and design of chimneys or exhaust flues maximises dispersion and takes into account the location of nearby sensitive uses

The Air Quality Assessment modelling has been prepared in accordance with the EPA requirements. The Assessment has identified that:

- *Predicted ground-level concentrations of NO_2, CO and SO_2 due to the Project and ambient background levels comply with the Air EPP maximum ground level concentrations at the nearest sensitive receptors.*
- *Ground-level concentrations plus ambient background levels at sensitive receptors are predicted to be, at most, 29% of the maximum concentrations specified in the Air EPP.*

Based on the assessment prepared by Katestone and that the development complies with the EPA's *Environment Protection (Air Quality) Policy 2016*, it is considered that the development has been sited and designed to prevent harm to human health and unreasonably interference with the amenity of sensitive uses within the locality.

7.0 Summary and Conclusion

The proposed development comprises a replacement landfill gas power generation facility at an existing landfill site. The proposed development is considered appropriate and to warrant Approval on the basis that:

- the activity is associated with an existing landfill site and will not impact the continuation of that use
- renewable energy facilities are supported in the subject Zone and Policy Area where they are in associated with landfill activities
- the proposed development is located some 250 metres from adjoining dwellings where it will not have an unreasonable visual impact
- the perimeter of the subject land is largely vegetated and will, in part, screen views of the development from much of the adjoining road network
- the development will comply with the *Environment Protection (Noise) Policy*, and
- the development will comply with the *Environment Protection (Air Quality) Policy*.

Appendix A

Development Application Forms

DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: ONKAPARINGA

APPLICANT: LMS ENERGY PTY LTD

Postal Address: 79 KING WILLIAM ROAD

UNLEY SA 5061

Owner: SRWRA

Postal Address: 112 BAKEWELL DR

SEAFORD HEIGHTS SA 5169

BUILDER: _____

_____

Postal Address: _____

_____

_____ Licence No: _____

CONTACT PERSON FOR FURTHER INFORMATION

Name: OLIVER SCHEIDEGGER

Telephone: 8291 9044 [work] _____ [Ah]

COMPLIANCE@LMS.COM.AU

Fax: _____ [work] _____ [Ah]

EXISTING USE: LANDFILL SITE

FOR OFFICE USE

Development No: _____

Previous Development No: _____

Assessment No: _____

☐ Complying	Application forwarded to DA
☐ Non Complying	Commission/Council on
☐ Notification Cat 2	/ /
☐ Notification Cat 3	Decision: _____
☐ Referrals/Concurrences	Type: _____
☐ DA Commission	Date: / /

	Decision required	Fees	Receipt No	Date
Planning:				
Building:				
Land Division:				
Additional:				
Development Approval				

DESCRIPTION OF PROPOSED DEVELOPMENT: LANDFILL GAS POWER GENERATION FACILITY

LOCATION OF PROPOSED DEVELOPMENT: _____

House No: 112 Lot No: 192 Street: BAKEWELL DR Town/Suburb: MCLAREN VALE

Section No [full/part] _____ Hundred: WILLUNGA Volume: 6199 Folio: 629

Section No [full/part] _____ Hundred: _____ Volume: _____ Folio: _____

LAND DIVISION:

Site Area [m^2] _____ Reserve Area [m^2] _____ No of existing allotments _____

Number of additional allotments [excluding road and reserve]: _____ Lease: **YES** ☐ **NO** ☐

BUILDING RULES CLASSIFICATION SOUGHT: _____ Present classification: _____

If Class 5,6,78 or 9 classification is sought, state the proposed number of employees: Male: _____ Female: _____

If Class 9a classification is sought, state the number o persons for whom accommodation is provided: _____

If Class 9b classification is sought, state the proposed number of occupants of the various spaces at the premises: _____

DOES EITHER SCHEDULE 21 OR 22 OF THE DEVELOPMENT REGULATIONS 2008 APPLY? **YES** ☐ **NO** ☐

HAS THE CONSTRUCTION INDUSTRY TRAINING FUND ACT 2008 LEVY BEEN PAID? **YES** ☐ **NO** ☐

DEVELOPMENT COST [do not include any fit-out costs]: $ 5.24 MILLION

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the Development Regulations 2008.

SIGNATURE: O. Scheidegger Dated: 26 / 6 / 2018

_____

DEVELOPMENT REGULATIONS 1993
Form of Declaration
(Schedule 5 clause 2A)

To: SCAP

From: LMS ENERGY PTY LTD

Date of Application: 26/ 6 / 2018

Location of Proposed Development: .....

House No: 112. Lot No: 192 Street: BAKEWELL DR Town/Suburb. MCLAREN VALE

Section No (full/part): .....Hundred: .....WILLUNGA

Volume: 6199..... Folio: .....629.....

Nature of Proposed Development: LANDFILL GAS POWER GENERATION FACILITY

I ...OLIVER SCHEIDEGGER.....**being the applicant/ a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the regulations prescribed for the purposes of section 86 of the *Electricity Act 1996*. I make this declaration under clause 2A(1) of Schedule 5 of the *Development Regulations 1993*.**

Date: 26 / 6 / 2018

Signed: .....O. Scheidegger.....

Note 1
This declaration is only relevant to those development applications seeking authorisation for a form of development that involves the construction of a building (there is a definition of 'building' contained in section 4(1) of the *Development Act 1993*), other than where the development is limited to –

a) an internal alteration of a building; or
b) an alteration to the walls of a building but not so as to alter the shape of the building.

Appendix B

Certificates of Title

Product	Register Search (CT 6199/629)
Date/Time	07/06/2018 11:07AM
Customer Reference	Lot 192
Order ID	20180607004142
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Certificate of Title - Volume 6199 Folio 629

Parent Title(s) CT 5696/771

Creating Dealing(s) RTD 12810212

Title Issued 10/11/2017 **Edition** 1 **Edition Issued** 10/11/2017

Estate Type

FEE SIMPLE

Registered Proprietor

SOUTHERN REGION WASTE RESOURCE AUTHORITY
OF 112 BAKEWELL DRIVE SEAFORD HEIGHTS SA 5169

Description of Land

ALLOTMENT COMPRISING PIECES 192 AND 193 DEPOSITED PLAN 116986
IN THE AREAS NAMED MCLAREN VALE AND SEAFORD HEIGHTS
HUNDRED OF WILLUNGA

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED D ON D116986 (TG 8662892)

Schedule of Dealings

NIL

Notations

Dealings Affecting Title NIL

Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes

PLAN FOR LEASE PURPOSES VIDE G24/1996

Administrative Interests NIL

Appendix C

Proposal Plans

SCALE 1:2000 FOR A1 SIZE
SCALE 1:4000 FOR A3 SIZE
GDA94 / MGA ZONE 54
NEARMAP PTY LTD AERIAL IMAGE DATED 22 JUNE 2017

FOR INFORMATION

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
B	18/06/18	OS	–	–	DGM	LAYOUT UDPATED
A	19/07/16	OS	DGM	DGM	DGM	ORIGINAL ISSUE

REVISIONS

LMS ENERGY

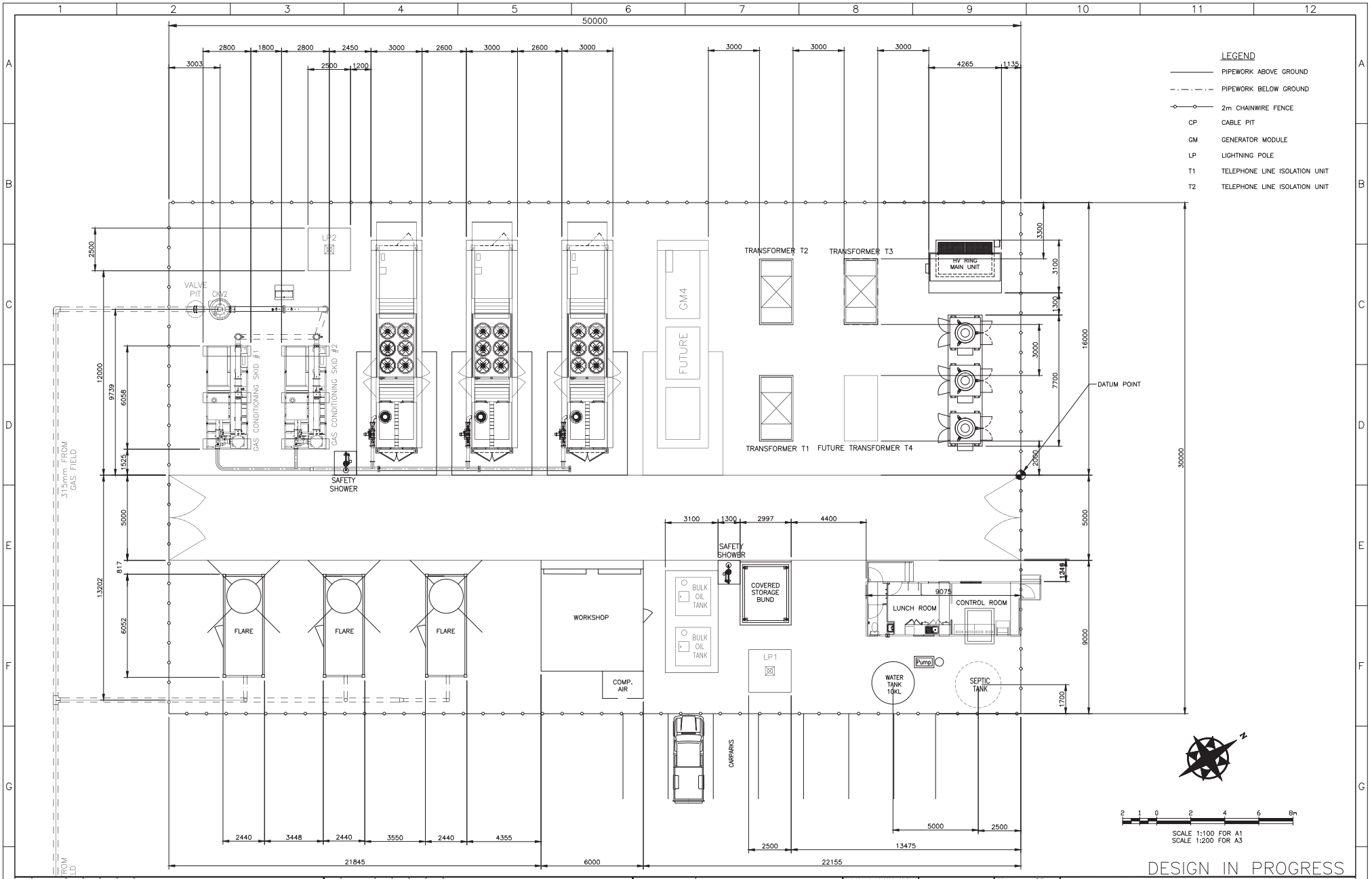
DRAWN:	OS
DATE:	19/07/16
DESIGN:	DGM
DATE:	19/07/16
APPRVD:	DGM
DATE:	19/07/16
A.B.N.	39 059 428 474

SEAFORD HEIGHTS RENEWABLE ENERGY FACILITY

POWER STATION
LOCALITY PLAN

SCALE	DRAWING NUMBER	PAGE	SIZE	REV
1:2000	50043-GA-002	1 OF 1	A1	B

LAST PLOTTED TIME: PLOTTED DATE: LAST MODIFIED TIME: MODIFIED DATE:



DESIGN IN PROGRESS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
C	10/05/18	JRH	JRH			REVISED TRANSFORMER LOCATION
B	18/04/18	JRH	JRH	DGM	DGM	REVISED BASED ON GEOTECH
A	26/04/17	OS	DGM			DIP – ORIGINAL ISSUE

REVISIONS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION

REVISIONS

DRAWING NUMBER	DESCRIPTION

REFERENCE DRAWINGS

LMS ENERGY

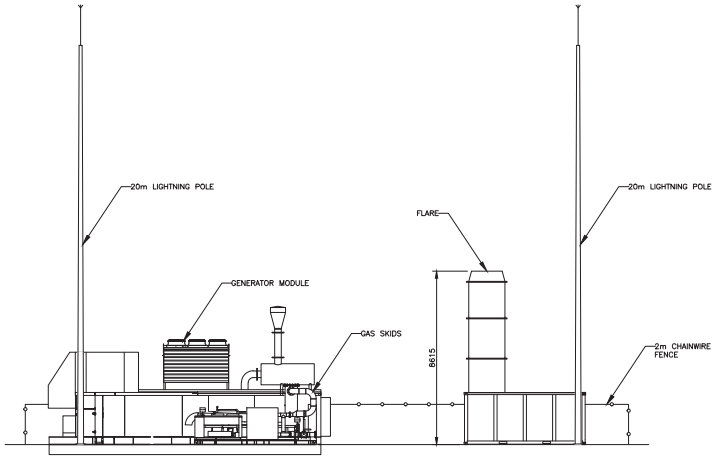
DRAWN:	OS
DATE:	26/04/17
DESIGN:	DGM
DATE:	26/04/17
APPRVD:	
DATE:	
A.B.N. 39 059 428 474	

LAST PLOTTED TIME: PLOTTED DATE: LAST MODIFIED TIME: MODIFIED DATE:

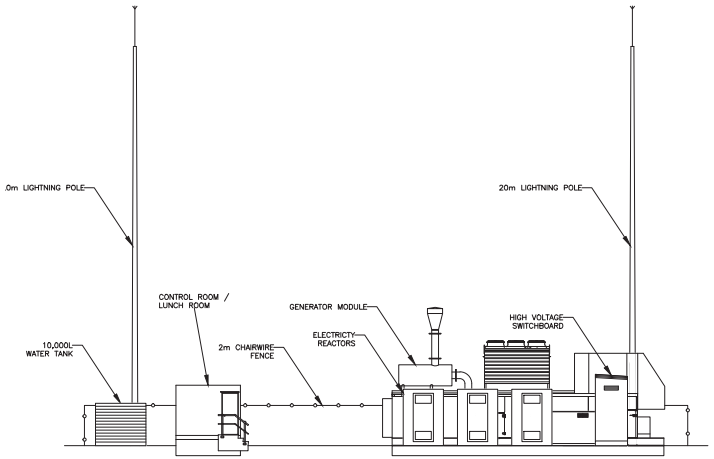
SEAFORD HEIGHTS RENEWABLE ENERGY FACILITY

POWER STATION
SITE LAYOUT

SCALE	DRAWING NUMBER	PAGE	SIZE	REV
1:100	50043-GA-001	1 of 2	A1	C



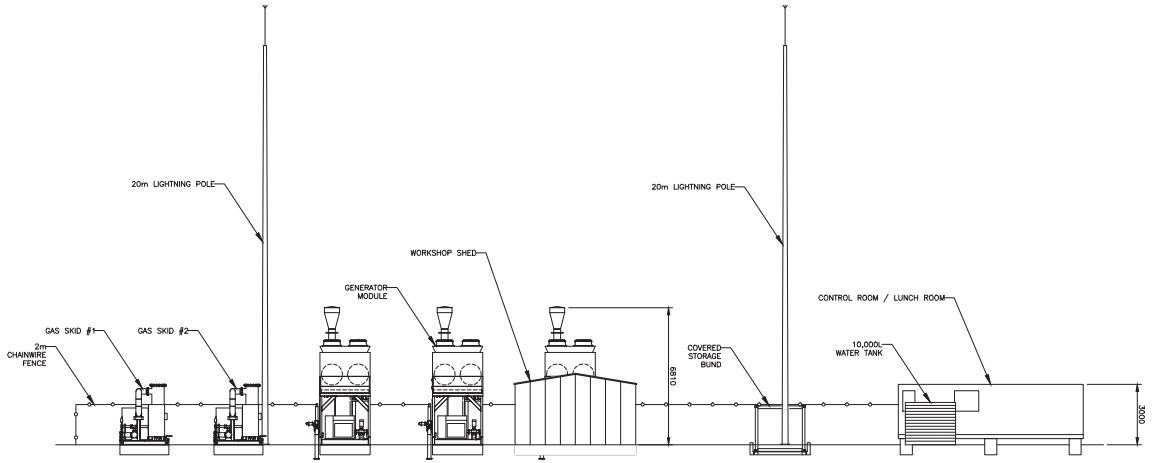
LEFT END ELEVATION
CKV, SAFETY SHOWER AND WORKSHOP SHED
REMOVED FOR CLARITY



RIGHT END ELEVATION
COVERED STORAGE BUND, OIL TANKS, FLARES AND
SHED REMOVED FOR CLARITY

LEGEND

———	PIPEWORK ABOVE GROUND
—·—·—	PIPEWORK BELOW GROUND
—o—o—	2m CHAINWIRE FENCE
CP	CABLE PIT
GM	GENERATOR MODULE
LP	LIGHTNING POLE
T1	TELEPHONE LINE ISOLATION UNIT
T2	TELEPHONE LINE ISOLATION UNIT



FRONT ELEVATION
FLARES, GAS SKIDS, OIL TANKS, TRANSFORMERS,
REACTORS AND RMU REMOVED CLARITY

DESIGN IN PROGRESS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
C	10/05/18	JRH	JRH			REVISED TRANSFORMER LOCATION
B	18/04/18	JRH	JRH	DGM	DGM	REVISED BASED ON GEOTECH
A	26/04/17	OS	DGM			DIP – ORIGINAL ISSUE

REVISIONS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION

REVISIONS

DRAWING NUMBER	DESCRIPTION

REFERENCE DRAWINGS

LMS ENERGY

DRAWN:	OS
DATE:	26/04/17
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A.B.N. 39 059 428 474	

SEAFORD HEIGHTS RENEWABLE ENERGY FACILITY

POWER STATION
ELEVATIONS

SCALE	DRAWING NUMBER	PAGE	SIZE	REV
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Appendix D

Electricity Generation Licence

Electricity

Licence

Electricity Generation Licence

LMS Energy Pty Ltd

ABN 39 059 428 474

Issued by the Essential Services Commission of South Australia on 27 September 2017.

Variation history

Amendment number	Variation date	Reason

1 Definitions and interpretation

1.1 Words appearing in bold like **this** are defined in Part 1 of Schedule 1.

1.2 This licence must be interpreted in accordance with the rules set out in Part 2 of the Schedule.

2 Grant of licence

2.1 The **licensee** is licensed under Part 3 of the **Act,** and subject to the conditions set out in this licence, to generate electricity using the **electricity generating plant** as specified in the Annexure.

3 Term

3.1 This licence commences on the date it is issued and continues until it is:

(a) surrendered by the **licensee** under section 29 of the **Act**; or

(b) suspended or cancelled by the **Commission** under section 37 of the **Act**.

4 Fees

4.1 The **licensee** must pay the applicable licence fees in accordance with section 20 of the **Act**.

5 Access

5.1 The **licensee** must:

(a) in accordance with, and to the extent required by, the **Electricity Transmission Code**, grant to a **network service provider**, rights to use, or have access to, those parts of the **licensee's electricity generating plant** that are interconnected or interface with the **network service provider's** assets for the purpose of ensuring the proper integrated operation of the South Australian power system and the proper conduct of the operations authorised by the **network service provider's transmission licence** or **distribution licence**; and

(b) in the absence of agreement as to the terms on which such rights are to be granted, comply with a determination of the **Commission** as to those terms.

6 Dispute resolution

6.1 A dispute relating to the granting of rights to use or have access to the interconnecting assets of the **licensee's electricity generating plant** referred to in clause 5 shall be resolved in accordance with any applicable **industry code** developed by the **Commission** for the resolution of disputes.

6.2 Clause 6.1 does not apply to the extent the dispute is subject to resolution in accordance with or under the **National Electricity Rules**.

7 Compliance with Codes

7.1 The **licensee** must:

(a) comply with all applicable provisions of the **Electricity Transmission Code**, the **Electricity Distribution Code** and the **Electricity Metering Code**;

(b) comply with all applicable provisions of any other **industry code** or **rule** made by the **Commission** from time to time; and

(c) notify the **Commission** if it commits a material breach of the **Electricity Transmission Code**, the **Electricity Distribution Code** or the **Electricity Metering Code** within 3 days after becoming aware of that breach.

8 Safety, reliability, maintenance and technical management plan

8.1 The **licensee** must:

(a) within 12 months of the commencement of this licence, or within 3 months of the date (as advised by the **licensee**) of final commissioning and plant acceptance, whichever is the later, prepare a safety, reliability, maintenance and technical management plan dealing with matters prescribed by regulation and submit the plan to the **Commission** for approval;

(b) annually review, and if necessary update, the plan to ensure its efficient operation, and submit the updated plan to the **Commission** for approval;

(c) comply with the plan prepared in accordance with clause 8.1(a) and as updated from time to time in accordance with clause 8.1(b);

(d) not amend the plan without the approval of the **Commission**; and

(e) undertake annual audits of its compliance with its obligations under the plan and report the results to the **Technical Regulator**, in a manner approved by the **Technical Regulator**.

9 National electricity market

9.1 The **licensee** must hold and comply with the conditions of any registration required under the **National Electricity Rules** granted by **AEMO** (or the person responsible for the granting of such registrations under the **National Electricity Law** or the **National Electricity Rules**) at all times that such registration is required for the operations authorised by this licence.

10 Information to AEMO

10.1 The **licensee** must, following a request from **AEMO**, provide to **AEMO** such documents and information as **AEMO** may reasonably require for the performance of its functions.

11 System controller

11.1 The **licensee** must comply with any directions given to it by the **System Controller**.

12 Information to the Commission

12.1 The **licensee** must, from time to time, provide to the **Commission**, in a manner and form determined by the **Commission**:

(a) details of the **licensee's** financial, technical and other capacity to continue the operations authorised by this licence; and

(b) such other information as the Commission may require from time to time.

12.2 The **licensee** must notify the **Commission** of any changes to its **officers,** and (if applicable) major shareholders, within 30 days of that change.

13 Operational and compliance audits

13.1 The **licensee** must undertake periodic audits of the operations authorised by this licence and of its compliance with its obligations under this licence and any applicable **industry codes** in accordance with the requirements of any applicable guideline issued by the **Commission** for this purpose.

13.2 The **licensee** must also conduct any further audits at a frequency and in manner approved by the **Commission**.

13.3 The results of audits conducted under this clause must be reported to the **Commission** in a manner approved by the **Commission**.

13.4 The **Commission** may require the licensee to use an independent expert approved by the **Commission** to conduct audits under this clause.

13.5 The **Commission** may require the costs of using an independent expert approved by the **Commission** to conduct audits under this clause to be met by the **licensee**.

14 Confidentiality

14.1 The **licensee** must, unless otherwise required by law, this licence, an **industry code**, or the **National Electricity Rules**, comply with any **rules** made by the **Commission** from time to time relating to the use of information acquired by the **licensee** in the course of operating the business authorised by this licence.

15 Community service

15.1 The **licensee** must comply with the requirements of any scheme approved and funded by the Minister for the provision by the State of customer concessions or the performance of community service obligations by the **electricity entities**.

16 Compatibility

16.1 The **licensee** must not do anything to its **electricity generating plant** affecting the compatibility of its **electricity generating plant** with any **distribution network** or **transmission network** so as to prejudice public safety or the security of the power system of which the **electricity generating plant** forms a part.

17 Insurance

17.1 The **licensee** must undertake and maintain during the term of this licence insurance against liability for causing bush fires.

17.2 The **licensee** must provide to the **Commission** a certificate of the insurer or the insurance broker by whom the insurance was arranged (in a form acceptable to the **Commission**) to the effect that such insurance is adequate and appropriate, given the nature of the **licensee's** activities conducted under this licence and the risks associated with those activities.

18 Compliance with laws

18.1 The **licensee** must comply with all applicable laws including, but not limited to, any technical or safety requirements or standards contained in regulations made under the **Act**.

19 Variation

19.1 This licence may only be varied in accordance with section 27 of the **Act.**

20 Transfer

20.1 This licence may only be transferred in accordance with section 28 of the **Act**.

This licence was issued by the **Commission** on 27 September 2017.

The **COMMON SEAL** of the)
ESSENTIAL SERVICES)
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Australia was hereunto)
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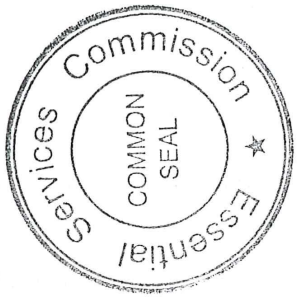

.....

Commissioner

27 September 2017

Date

Schedule 1: Definitions and Interpretation

Part 1 – Definitions

In clauses 1 to 20 (inclusive) of this licence:

Act means the Electricity Act 1996 (SA).

AEMO means the Australian Energy Market Operator Ltd (ACN 072 010 327).

business day means a day on which banks are open for general banking business in Adelaide, excluding a Saturday or Sunday.

Commission means the Essential Services Commission established under the **ESC Act**.

distribution licence means a licence to operate a **distribution network** granted under Part 3 of the **Act**.

distribution network has the meaning given to that term under the **Act**.

Electricity Distribution Code means the code of that name made by the **Commission** under section 28 of the **ESC Act** which regulates connections to a **distribution network** and the supply of electricity by distributors.

electricity generating plant includes all **generating units** and all other equipment involved in generating electrical energy authorised to be operated by the **licensee** under this licence.

Electricity Metering Code means the code of that name made by the **Commission** under section 28 of the **ESC Act** which regulates the installation, maintenance and testing of meters.

Electricity Transmission Code means the code of that name made by the **Commission** under section 28 of the **ESC Act**.

ESC Act means the Essential Services Commission Act 2002 (SA).

generator means a holder of a licence to generate electricity granted under Part 3 of the Act.

generating unit has the same meaning given to the term under the **National Electricity Rules**

industry code means any code made by the **Commission** under section 28 of the **ESC Act** from time to time.

licensee means LMS Energy Pty Ltd (ABN 39 059 428 474).

National Electricity Rules has the meaning given to that term in the **National Electricity Law**.

National Electricity Law means the National Electricity Law referred to in the National Electricity (South Australia) Act 1996 (SA).

network service provider means the holder of a **distribution licence** or a **transmission licence** (as the case may be) issued by the **Commission** under Part 3 of the **Act**.

rule means any rule issued by the **Commission** under section 28 of the **ESC Act**.

System Controller means the person licensed under Part 3 of the **Act** to exercise system control over a power system.

Technical Regulator means the person holding the office of Technical Regulator under Part 2 of the **Act**.

transmission licence means a licence to operate a **transmission network** granted under Part 3 of the **Act**.

transmission network has the meaning given to that term under the **Act**.

Part 2 - Interpretation

In this licence, unless the context otherwise requires:

(a) headings are for convenience only and do not affect the interpretation of this licence;

(b) words importing the singular include the plural and vice versa;

(c) words importing a gender include any gender;

(d) an expression importing a natural person includes any company, partnership, trust, joint venture, association, corporation or other body corporate and any governmental agency;

(e) a reference to any statute, regulation, proclamation, order in council, ordinance or bylaw includes all statutes, regulations, proclamations, orders in council, ordinances or by-laws varying, consolidating, re-enacting, extending or replacing them and a reference to a statute includes all regulations, proclamations, orders in council, ordinances, by-laws and determinations issued under that statute;

(f) a reference to a person includes that person's executors, administrators, successors, substitutes (including, without limitation, persons taking by novation) and permitted assigns;

(g) a reference to a document or a provision of a document includes an amendment or supplement to, or replacement or novation of, that document or that provision of that document;

(h) an event which is required under this licence to occur on or by a stipulated day which is not a **business day** may occur on or by the next **business day**.

ANNEXURE

The generating plant consisting of:

1. One Caterpillar 3516 reciprocating engine with a nameplate capacity of 1.13MW, and
2. 11,040 Caterpillar PVT115 photovoltaic panels with a nameplate capacity of 1.15MW

located at NAWMA Balefill Landfill site at Uleybury.

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Appendix E

Environmental Noise Assessment

Seaford Heights Renewable Energy Facility

Environmental Noise Assessment

S5656C3

June 2018

sonus.

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Senior Associate
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Prepared by	**Reviewed by**
Jason Turner (MAAS)	Chris Turnbull (MAAS)

sonus.

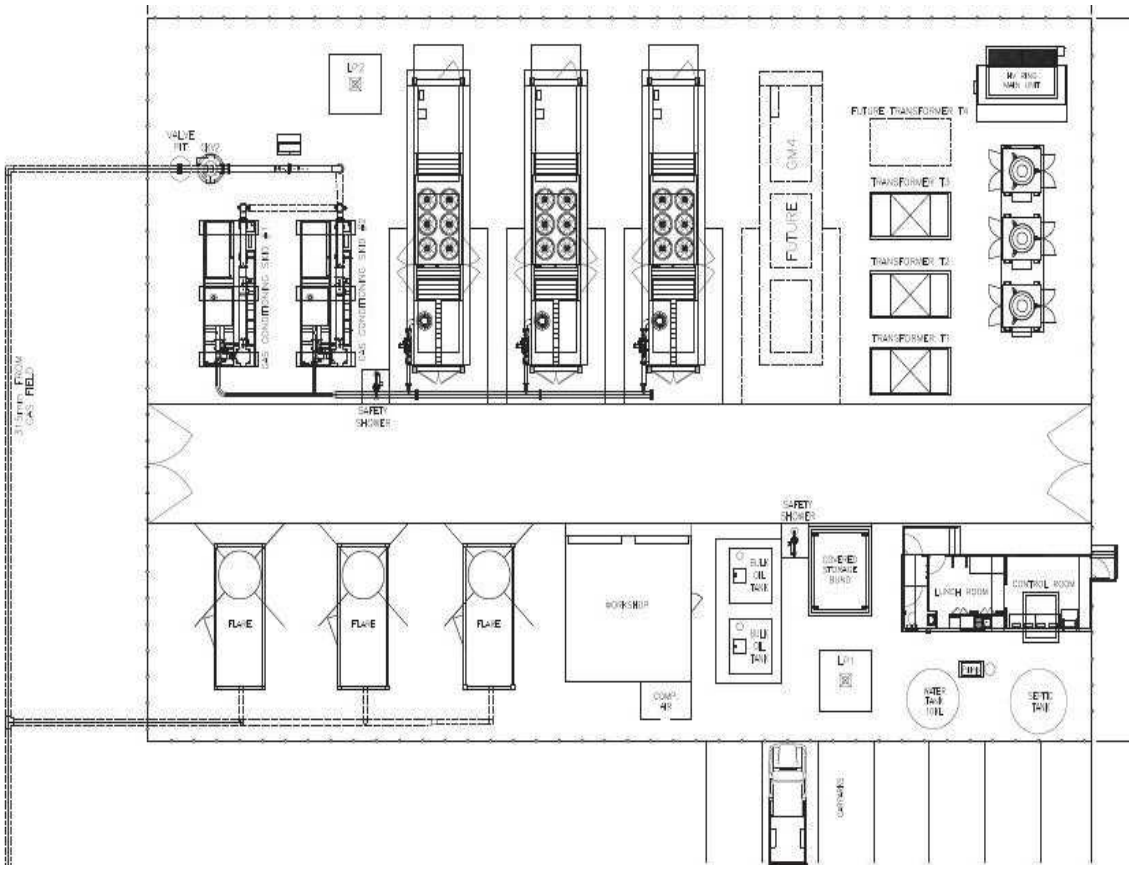
Document Title	:	Seaford Heights Renewable Energy Facility Environmental Noise Assessment
Document Reference	:	S5656C3
Date	:	June 2018
Author	:	Jason Turner, MAAS
Reviewer	:	Chris Turnbull, MAAS

INTRODUCTION

An environmental noise assessment has been made of the proposed LMS renewable energy facility located at Seaford Heights.

Typical Layout

The proposed development consists of a workshop and control room, three gas fired generators, three transformers and ancillary operations, as depicted in the site layout below. The assessment addresses the noise emitted from the proposed layout.



Appendix A shows the relative location of the proposed renewable energy facility and the closest existing residences to the subject site. The closest residences are located to the northwest and east of the proposed facility, within a Deferred Urban Zone and Primary Production Zone of the Onkaparinga Council Development Plan, respectively.

A previous energy facility is being de-commissioned and is located 60m from the proposed facility as shown in Appendix A.

Additionally, the owner of dwelling R1 depicted in Appendix A is also the owner of the subject land, however, an assessment has still been conducted at the respective location due to the dwelling being situated on a separate allotment to that of the site.

The locality includes a Deferred Urban Zone of the Onkaparinga Council Development Plan. The Deferred Urban Zone does not principally promote residential land use, and therefore no further assessment is made in this zone.

This assessment predicts the noise from the facility to the closest existing dwellings (R1 and R2 in Appendix A) and compares the predicted levels with the appropriate noise criterion to ensure the proposal does not detrimentally impact on the amenity of the locality.

The assessment has been based on:

- LMS Energy drawing of the proposed development location, numbered "50043-GA-002" and dated 19 July 2016;
- LMS Energy drawing of the proposed site layout, numbered "50043-GA-001" and dated 26 April 2017;
- "Roots" Type Positive Displacement Oil Free Air Blowers and Vacuum Pumps product information from PDA Blower Company Pty Ltd;
- Sound Pressure level of GE Jenbacher JGC420 at 10m from the container, provided by email correspondence on 23 May 2018 and supplemented by similar measurement data from the Orbost Gas Plant;
- LMS Energy data for "Typical Engine Noise Sources" provided for the NAWMA Uleybury facility;
- Measurements conducted of the GE Jenbacher JGC420 at 10m for the Orbost Gas Plant; and,
- Topographical contours of the assessment location provided by email correspondence on 21 May 2018.

CRITERIA
Development Plan

The proposed facility is located within a Urban Employment Zone of the Onkaparinga Council Development Plan[1] (the Development Plan). The residence to the east (R1 in Appendix A) is located within a Primary Production Zone and the residence to the north-west of the site (R2 in Appendix A) is within a Deferred Urban Zone of the Development Plan. The Development Plan has been reviewed and particular regard has been given to the following relevant provisions:

General Section - Interface Between Land Uses

OBJECTIVES

1. *Development located and designed to minimise adverse impact and conflict between land uses.*
2. *Protect community health and amenity from adverse impacts of development.*
3. *Protect desired land uses from the encroachment of incompatible development.*

PRINCIPLES OF DEVELOPMENT CONTROL

1 *Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:*
(b) noise

2 *Development should be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality.*

Noise Generating Activities

7 *Development that emits noise (other than music noise) should include noise attenuation measures that achieve the relevant Environment Protection (Noise) Policy criteria when assessed at the nearest existing noise sensitive premises.*

8 *Development with the potential to emit significant noise (e.g. industry) should incorporate noise attenuation measures that prevent noise from causing unreasonable interference with the amenity of noise sensitive premises.*

[1] Consolidated 20th February 2018

Environment Protection (Noise) Policy 2007

Principle of Development Control 7 of the Development Plan references the *Environment Protection (Noise) Policy 2007*, which provides goal noise levels to be achieved at residences.

The Policy is based on the World Health Organisation Guidelines to prevent annoyance, sleep disturbance and unreasonable interference on the amenity of an area. Therefore, compliance with the Policy is considered to be sufficient to satisfy all provisions of the Development Plan relating to environmental noise.

The goal noise levels are based on the principally promoted land uses of the Development Plan Zones in which the noise source (the development) and the noise receivers (the residences) are located. Based on the land uses and the assumption that the new renewable energy facility will operate during the night time, the following goal noise levels are provided by the Policy to be achieved at residences from these aspects of the proposal:

Within a Primary Production Zone;

- An average (L_{eq}) noise level of 48 dB(A) at night (10pm to 7am).

Within a Deferred Urban Zone;

- An average (L_{eq}) noise level of 46 dB(A) at night (10pm to 7am).

The Policy enables these levels to be relaxed in recognition of the existing facility; however, for the purposes of conservatism, the above “greenfields” levels have been used for the assessment.

When measuring or predicting noise levels for comparison with the Policy, adjustments may be made to the average goal noise levels for each “annoying” characteristic of tone, impulse, low frequency, and modulation of the noise source. The characteristic must be considered dominant in the acoustic environment and therefore the application of a penalty varies depending on the assessment location, time of day, the noise source being assessed, and the predicted noise level. The noise from an energy facility will be constant in nature and should not attract a penalty at the separation distances to dwellings R1 and R2.

ASSESSMENT

The noise level at nearby residences from the proposed activities at the facility has been predicted based on:

- three GE Jenbacher JGC320 engines with manufacturers standard noise mitigation package;
- the sound power levels provided in Appendix B. In the absence of specific sound power level data for the GE Jenbacher JGC320 engine, measured noise data for the JGC420 unit have been used. The JGC420 unit is larger than the JGC320 and should therefore provide a conservative assessment;
- all equipment operating continuously and at any time of day;
- the CONCAWE noise propagation algorithm, which accounts for local topography, ground and air absorptions, separation distance and meteorological conditions; and,
- CONCAWE Weather Category 6 which are conditions that are most conducive to noise propagation, resulting in the highest noise levels at the receivers.

Based on the assessment above, the predicted noise level at the closest dwellings in reference to the required criterion is summarised in the table below.

Dwelling	Zone	Criteria	Predicted Noise Level dB(A)
R1	Deferred Urban	46 dB(A)	43
R2	Primary Production	48 dB(A)	36

The predicted noise levels in the above table indicate that the noise from the proposed landfill gas facility will easily achieve the goal noise levels of the Policy at all residences, without the implementation of any specific acoustic treatments other than ensuring that the sound power levels of the proposed equipment are no greater than that detailed in Appendix B and that the procured equipment does not exhibit any atypical operating characteristics.

CONCLUSION

An environmental noise assessment has been made of the proposed renewable energy facility at Seaford Heights.

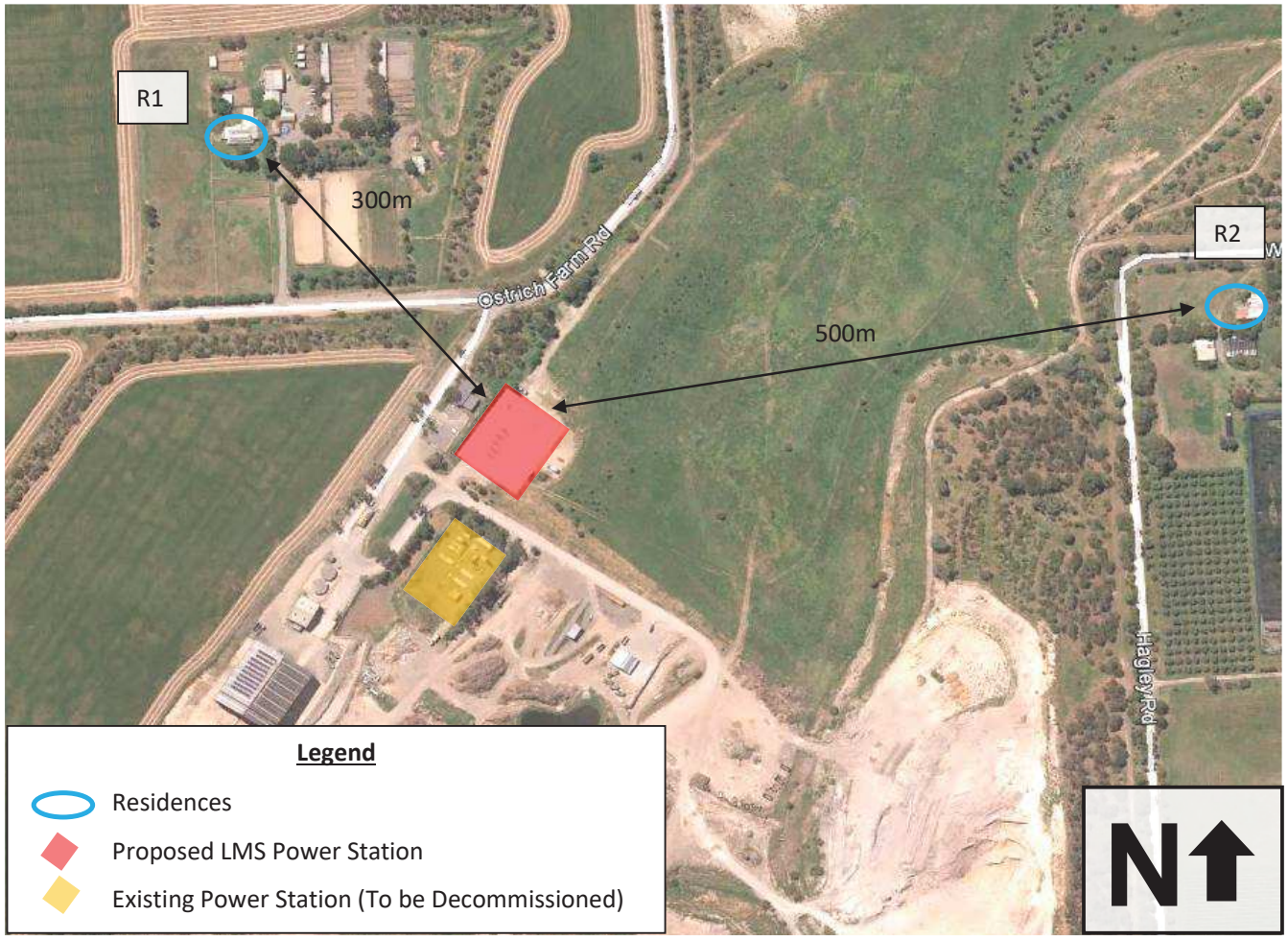
The assessment considers noise levels from the proposed equipment at the closest residences.

The appropriate noise criteria have been derived from the *Environment Protection (Noise) Policy 2007,* based on the land uses promoted by the Onkaparinga Council Development Plan zones where the noise source and receiver are located.

An acoustic model has been developed to predict the levels at the nearby residences. The model uses the sound power levels for the proposed equipment as summarised in Appendix B and under worst case (highest noise level) weather conditions. The predicted noise levels from the development will achieve the relevant requirements of the *Environment Protection (Noise) Policy 2007*, without the implementation of acoustic treatment other than ensuring the sound power levels of the procured equipment are consistent with Appendix B.

It is therefore considered that the facility has been designed to *minimise negative impacts*, *avoid unreasonable interference on amenity*, and *will not detrimentally affect the locality by way of noise*, thereby achieving the relevant provisions of the Development Plan related to environmental noise.

APPENDIX A: Subject Site, Residences and Noise Predictions



APPENDIX B: Sound Power Level Data

Noise Source		Units	Height (m)	Reference	Sound Power Levels (dB(A))									
					Sum	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Gas Conditioning Skid		2	2	Vacuum Pump	95	45	54	65	78	92	90	89	79	64
Transformers (1.2MVA)		3	2	LMS Energy data for "Typical Engine Noise Sources"	67	35	49	58	62	61	61	56	45	48
JGC420 Jenbacher engine	Stack	3	7	LMS Energy data for "Typical Engine Noise Sources" supplemented by the sound pressure level of JGC420 at 10m and measurements conducted of JGC420 at 10m.	92	61	74	84	86	86	87	84	78	72
	Cooling Front		2.6		84	44	61	72	74	79	80	76	70	64
	Cooling Rear		2.6		88	43	63	74	80	82	84	79	75	70
	Door Front		2.6		82	48	59	69	70	74	78	75	66	61
	Door Rear		2.6		84	44	58	70	72	74	79	81	70	65
	Side Front		2.6		75	42	55	68	67	68	70	68	57	49
	Side Rear		2.6		75	42	55	68	67	68	70	68	57	49

Appendix F

Air Quality Assessment for Seaford Heights Energy Facility

katestone
www.katestone.com.au

Air Quality Assessment for the Seaford Heights Renewable Energy Facility

Prepared for:

LMS Energy

July 2018

Final

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Document Control

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Client:	LMS Energy
Document reference:	D17107-4 Air Quality Assessment for Seaford Heights Renewable Energy Facility_V1.0
Prepared by:	Tania Haigh and Natalie Shaw
Reviewed by:	Simon Welchman
Approved by:	
	Simon Welchman
	16 July 2018

Disclaimer

http://katestone.com.au/disclaimer/

Contents

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Contour Plates

Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
°C	degrees Celsius
km	kilometre
km/h	kilometre per hour
MW	megawatt
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
Nomenclature	**Definition**
CO	carbon monoxide
CO_2	carbon dioxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
SO_2	sulfur dioxide
Abbreviations	**Definition**
Air Quality EPP	*Environment Protection (Air Quality) Policy 2016*
SA EPA	South Australia Environment Protection Authority
TAPM	The Air Pollution Model

EXECUTIVE SUMMARY

Katestone Environmental Pty Ltd (Katestone) was commissioned by LMS Energy to complete an Air Quality Assessment of the Seaford Heights Renewable Energy Facility (the Project) located at Seaford Heights, South Australia.

LMS Energy proposes to construct and operate a renewable energy facility at the Southern Region Waste Resource Authority (SRWRA) landfill that will comprise of three Jenbacher G320 engines fired using landfill gas, which will supply electricity to the local distribution network.

The air quality assessment has used a regulatory dispersion modelling approach. A site-specific meteorological data file has been generated using the TAPM and CALMET meteorological models. The meteorological modelling has accounted for local terrain and land use features of the surrounding region.

Emission rates and stack characteristics have been determined from information provided by LMS Energy and air quality assessments of similar generators. Emission rates and stack characteristics of the proposed units have been selected to provide a worst-case estimate of the potential impact of the Project on air quality, where possible.

The CALPUFF dispersion model has been used to predict ground-level concentrations of nitrogen dioxide (NO_2), carbon monoxide (CO) and sulfur dioxide (SO_2). The assessment has also accounted for ambient concentrations of these pollutants.

The air quality assessment has shown that:

- Predicted ground-level concentrations of NO_2, CO and SO_2 due to the Project and ambient background levels ***comply*** with the Air EPP maximum ground level concentrations at the nearest sensitive receptors.
- Ground-level concentrations plus ambient background levels at sensitive receptors are predicted to be, at most, 29% of the maximum concentrations specified in the Air EPP.

1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by LMS Energy to complete an Air Quality Assessment of the Seaford Heights Renewable Energy Facility (the Project) located at Seaford Heights, South Australia, approximately 30km south of Adelaide.

LMS Energy proposes to construct and operate a renewable energy facility at the Southern Region Waste Resource Authority (SRWRA) landfill that will comprise three Jenbacher G320 internal combustion engines fired using landfill gas, which will supply electricity to the local distribution network.

The existing power station to the northwest of the SRWRA landfill will be decommissioned. The existing flares will be relocated within the Project area.

This assessment has addressed the following scope of works:

- Describe the legislative context relevant to air emissions from the Project
- Construct a site-specific meteorological data file
- Describe the existing environment in terms of local terrain, meteorological patterns, land uses, and existing air quality
- Estimate emissions to air of key pollutants from the Project
- Predict ground-level concentrations of key pollutants using a dispersion model
- Assess the dispersion model results by comparison with the relevant air quality objectives, accounting for a representative ambient background concentration where relevant.

2. THE PROJECT

Since 1995, landfill gas extracted from the SRWRA landfill has been combusted in either internal combustion engines to generate electricity or in flares at the EDL LFG (SA) Pty Ltd, Pedler Creek LFG Power Station at McLaren Vale. This power station has now been decommissioned and all landfill gas is currently being combusted in three flares.

The Project includes the installation of a new power station in 2019 that will combust the landfill gas. The Project will be located to the northeast of the decommissioned power station (Figure 1). The Project will include three Jenbacher G320 internal combustion engines. The three existing flares will be relocated to the Project site to treat excess gas for example during times when one or more engines are offline for maintenance. Liquid fuel will not be used. The site layout is shown in Figure 2.

Figure 1 **Project location (provided by LMS Energy)**

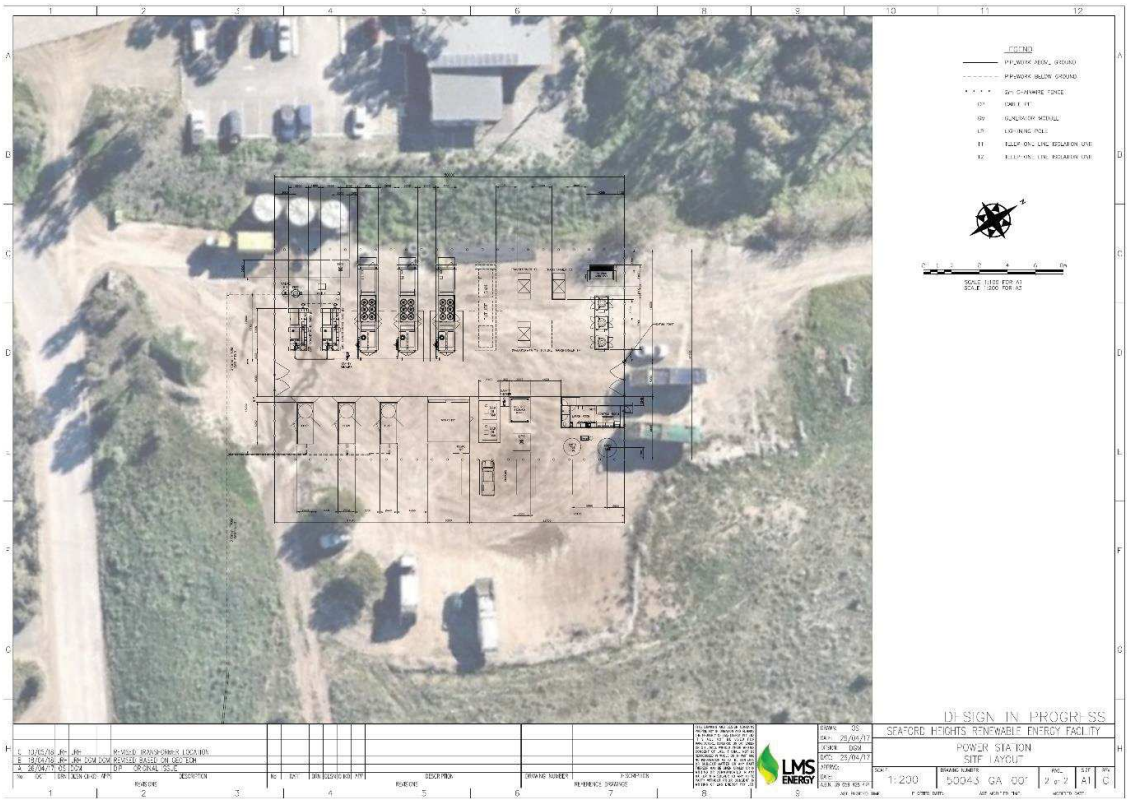

Figure 2 Proposed site layout

3. AIR QUALITY ASSESSMENT METHODOLOGY

3.1 Overview

The assessment is based on a regulatory dispersion modelling study incorporating source characteristics and operational activity data with meteorology that is representative of the site and surrounding region. The assessment has been prepared in accordance with the SA EPA's requirements and, in particular:

- The document: Ambient air quality assessment (SA EPA, 2016)
- Regulatory requirements that are outlined in Section 1 of this report
- Best practice regulatory modelling approaches.

SA EPA was consulted during the development of the assessment methodology.

The site location and surrounding environment has been described in Section 5 in terms of:

- Land-use
- Terrain features
- Sensitive receptor locations.

The existing air quality in the region has been described in Section 5 based on:

- National Pollutant Inventory (NPI) database for sources in the region
- Ambient air quality monitoring data recorded by the SA EPA's monitoring network.

The local meteorology at the site, including wind speed, direction, atmospheric stability and mixing height, have been described using site-specific data generated by the TAPM and CALMET meteorological models (Section 6).

The assessment has considered emissions of nitrogen dioxide (NO_2) as this is the key pollutant emitted to the atmosphere from the generators. Emissions of carbon monoxide (CO) and sulfur dioxide (SO_2) have also been considered for completeness.

Emission rates and stack characteristics have been based on information provided by LMS Energy (Section 0).

Predicted ground-level concentrations of NO_2, CO and SO_2 due to the Project have been predicted using the CALPUFF dispersion model, driven by the site-specific meteorological data generated by TAPM/CALMET. Ground-level concentrations have been determined across a Cartesian grid of receptors and at the nearest sensitive receptor locations (Section 8).

The potential cumulative impact of the Project and other existing sources of emissions in the vicinity have been estimated using background concentrations derived from monitoring data recorded at the nearest SA EPA ambient air quality monitoring stations. The predicted ground-level concentrations of NO_2, CO and SO_2 due to the Project plus existing sources have been assessed by comparison with the legislated maximum concentration criteria (Section 8).

3.2 Meteorology

The prognostic model TAPM (developed by the Commonwealth Scientific and Industrial Research Organisation [CSIRO], version 4.0.5) and the diagnostic meteorological model CALMET (developed by EarthTec, version 6.5.0) were used to generate the three-dimensional meteorological dataset for the region. Following discussions with the SA EPA, 2009 was selected for the meteorological model simulation as a representative year. The suitability of the dataset generated by TAPM was evaluated by comparison with monitoring data from the Bureau of Meteorology's

monitoring site at Noarlunga, and this data was assimilated to improve TAPM's performance. This evaluation is presented in Appendix A.

The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the innermost nested grid. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

The three-dimensional wind field produced by TAPM/CALMET was then used to create a meteorological file suitable for use with the CALPUFF dispersion model.

Details of the model configuration and evaluation are presented in Appendix A.

3.3 Emission rates

Emission rates and stack characteristics have been provided by LMS Energy.

3.4 Dispersion modelling

The CALPUFF dispersion model was used to predict ground-level concentrations of nitrogen dioxide across the model domain due to the Project. CALPUFF is an advanced non-steady-state air quality modelling system. Twelve months of modelled meteorological data was used as input for the dispersion model in order to include all weather conditions likely to be experienced in the region during a typical year. The modelling has been used to predict maximum ground-level concentrations of air pollutants across a Cartesian grid and at the locations of the nearest sensitive receptors.

Source characteristics and pollutant emission rates were incorporated into a dispersion modelling study. The study was conducted using a standard and regulated model developed by EarthTec, the CALPUFF model (version 7.2.1). Emission sources were configured in CALPUFF according to the characteristics summarised in Section 0. Air emissions have been modelled as constantly emitting over 24 hours/day for the entire year.

Technical details of the configuration of the CALPUFF model are presented in Appendix A.

3.5 Methods for the conversion of NOx to NO_2

Nitric oxide (NO) that is emitted by power stations and other combustion processes can undergo chemical transformation in the atmosphere to form nitrogen dioxide (NO_2). NO_2 is more toxic than NO and therefore it is important to quantify the transformation of NO to NO_2 in the atmosphere. Measurements around power stations in Central Queensland show, under worst possible cases, a conversion of 25-40% of the nitric oxide to nitrogen dioxide occurs within the first 10 kilometres of plume travel. During days with elevated background levels of hydrocarbons (generally originating from bush-fires, hazard reduction burning or other similar activities), the resulting conversion is usually below 50% in the first 30 kilometres of plume travel (Bofinger et. al., 1986). For this air dispersion modelling assessment, a ratio of 30% conversion of the oxides of nitrogen to nitrogen dioxide has been assumed. This is highly conservative considering the relatively short travel time of the plume to the maximum ground-level concentrations.

3.6 Cumulative impacts

To determine the potential cumulative impact of the Project in conjunction with existing emission sources, an estimate of the background levels of NO_2, CO and SO_2 has been made using data recorded by the SA EPA's ambient air quality monitoring network. As discussed in Section 5.3.2, data from the Christies Beach, Netley, Northfield and Adelaide CBD monitoring sites have been analysed to determine ambient background values.

4. LEGISLATIVE FRAMEWORK FOR AIR QUALITY

4.1 *Environment Protection Act 1993*

In SA, environmental protection from the effects of emissions to air are managed by a range of policies and guidelines, with the foundation provided by the *Environment Protection Act 1993* (EP Act). Section 25 of the EP Act imposes a general environmental duty on all persons undertaking activities that pollute or might pollute the environment. All reasonable and practicable measures must be taken to prevent or minimise any resulting environmental harm.

The *Environment Protection (Air Quality) Policy 2016* (Air EPP) was made under Section 28 of the EP Act. The Air EPP provides specific requirements for air quality regulation and management across the state. In determining applications for environmental authorisations and development authorisations under Part 6 of the EP Act, the SA EPA must take into account the matters specified under Part 4 of the Air EPP including maximum ground-level concentrations of air pollutants and stack emission limits.

Under Part 4, Section 18(1)(a) of the Air EPP, the SA EP must consider whether an activity may result in the concentration of a pollutant exceeding the maximum ground level concentrations specified in Schedule 2 of the Air EPP. The specified maximum ground level concentrations are based on protecting public health and amenity, or other environmental factors. Proponents must use a prescribed testing, assessment, monitoring or modelling methodology to evaluate whether pollutants may exceed the maximum ground level concentrations.

The guidance document *Ambient air quality assessment* (SA EPA, 2016) is intended to assist owners and operators of facilities to meet their obligations for air quality under the EP Act and to understand what is required for submissions for proposals referred to the SA EPA under the *Development Act* 1993. The guidance document provides methodologies to allow proponents to assess pollutant concentrations associated with an activity and determine if they are likely to be less than the maximum concentrations specified in Schedule 2 of the Air EPP at sensitive receptors.

Maximum ground level concentrations of relevance to the Project are reproduced in Table 1.

Table 1 Maximum ground level concentrations used in the assessment (Schedule 2 of the Air Quality EPP)

Pollutant	Classification	Averaging time	Maximum ground level concentration	
			µg/m³	ppm
Nitrogen dioxide	Toxicity	1-hour	250	0.12
		Annual	60	0.03
Carbon monoxide	Toxicity	1-hour	31,240	25
		8-hour	11,250	9.0
Sulfur dioxide	Toxicity	1-hour	570	0.2
		24-hour	230	0.08
		Annual	60	0.02

Under Part 4, Section 18(1)(c) of the Air EPP, the SA EP must consider whether certain activities may result in the emission of a pollutant through a chimney, flue or vent at a level exceeding the maximum pollutant level specified in Schedule 4 of the Air EPP. Maximum pollutant levels of relevance to the Project are reproduced in Table 2. There are no maximum pollutant levels specified in the Air EPP relating to the emission of oxides of nitrogen or sulfur dioxide from internal combustion engines.

Table 2 Stack emission limits (Schedule 4 of the Air Quality EPP)

Pollutant	Activity	Maximum pollutant level
Carbon monoxide	Any activity	1000 mg/m^3
Table note: * All volumes (m^3) are expressed as volume of dry gas at 0°C and 101.3 kPa.		

4.2 Onkaparinga Council Development Plan

The Project site is located within the Onkaparinga Council Development Plan area. The zoning in the vicinity of the Project, as defined by the Onkapararinga Council Development Plan, is shown in Figure 3.

The Project is located within an Urban Employment Zone. The area to the east of the Project is a Primary Production Zone, and to the northwest is a Deferred Urban Zone.

4.2.1 General Section

The Onkaprainga Council Development Plan describes the following objectives and purposes for these zones:

General Section – Industrial Development – Objectives:

- *Industrial development occurring without adverse effects on the health and amenity of occupiers of land in adjoining zones.*

General Section – Interface Between Land Uses:

1. *Development located and designed to minimise adverse impact and conflict between land uses.*
2. *Protect community health and amenity from adverse impacts of development.*
3. *Protect desired land uses from the encroachment of incompatible development.*

General Section – Interface Between Land Uses – Principles of Development Control:

1. *Development with the potential to emit harmful or nuisance-generating air pollution should incorporate air pollution control measures to prevent harm to human health or unreasonable interference with the amenity of sensitive uses within the locality.*

4.2.2 Zone Codes

The zone codes for the Project site and surrounding areas include the following objectives.

Urban Employment Zone - Objectives:

- *A mixed use employment zone that accommodates a wide range of industrial land uses together with other related employment and business activities.*
- *The effective location and management of activities at the interface of industrial/commercial activity with land uses that are sensitive to these operations.*

The zone code also states that "*Activities which are potentially hazardous or produce negative off-site impacts, such as noise, air, water and waste emissions, significant volumes of industrial traffic or have a detrimental impact on the amenity of properties should not be located adjacent residential or similar environmentally sensitive zones*."

Primary Production Zone – Objectives:

1. *The long term continuation of primary production where natural resources are not jeopardised.*

Deferred Urban Zone – Objectives:

1. *A zone accommodating a restricted range of rural uses that are not prejudicial to development of the land for urban purposes and maintain the rural appearance of the zone.*
2. *A zone comprising land to be used primarily for broad-acre cropping and grazing purposes until required for future urban expansion.*
3. *Prevention of development likely to be incompatible with long-term urban development, or likely to be detrimental to the orderly and efficient servicing and conversion of the land for urban use.*

The Development Plan also notes that urban development within the deferred urban zone will only occur following the rezoning of the land and the completion of detailed structure planning.

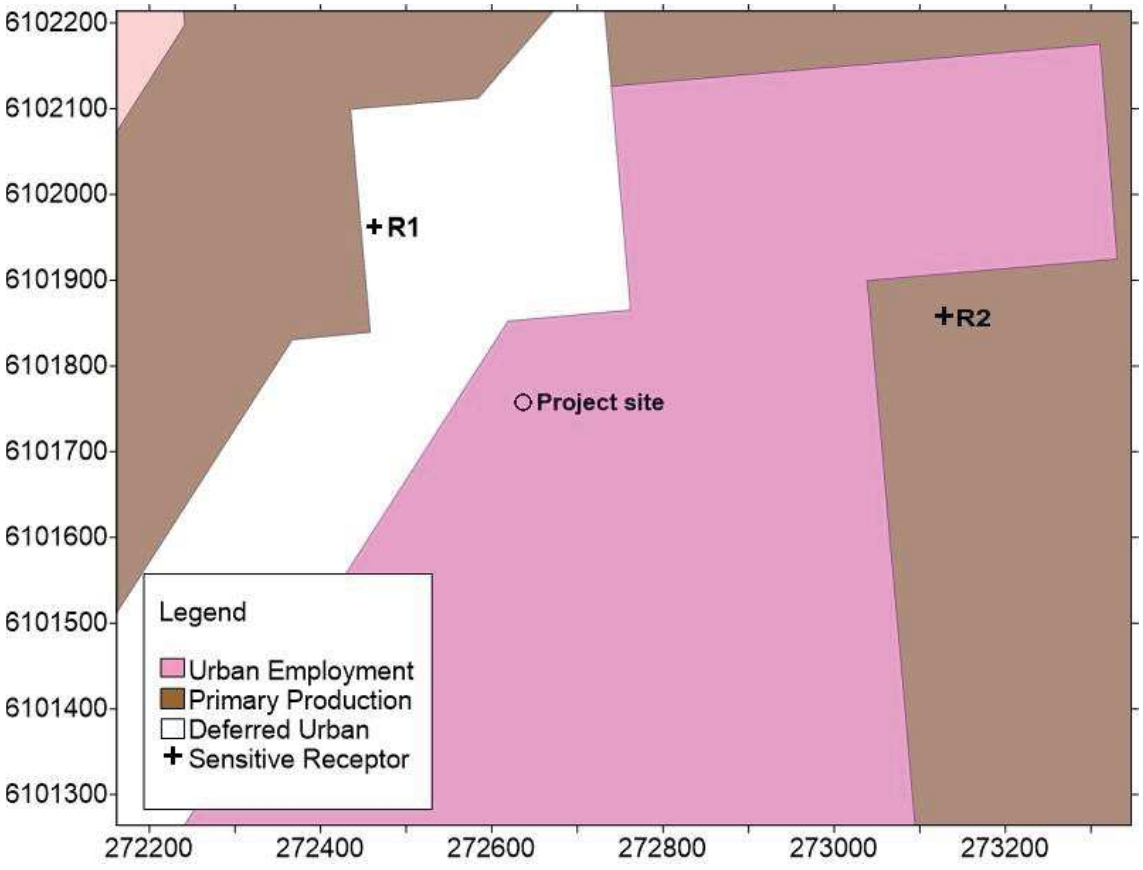

Figure 3 Zoning in the vicinity of the Project (Onkaparinga Council Development Plan)

5. EXISTING ENVIRONMENT

5.1 Local terrain and land-use

The Project is located approximately 3km from the coast, and approximately 1km east of the residential suburb of Seaford Heights. The immediate surrounds are predominantly grassland, with scattered rural residences to the east and exposed areas associated with the SRWRA landfill to the south (Figure 4).

Figure 4 Local land-use and sensitive receptors

The Project site is at an elevation of approximately 80m, and terrain slopes gently towards the western coastline. Terrain rises towards the northeast to elevations of 200m approximately 5km from the Project site. Terrain across the model domain is presented in Figure 5.

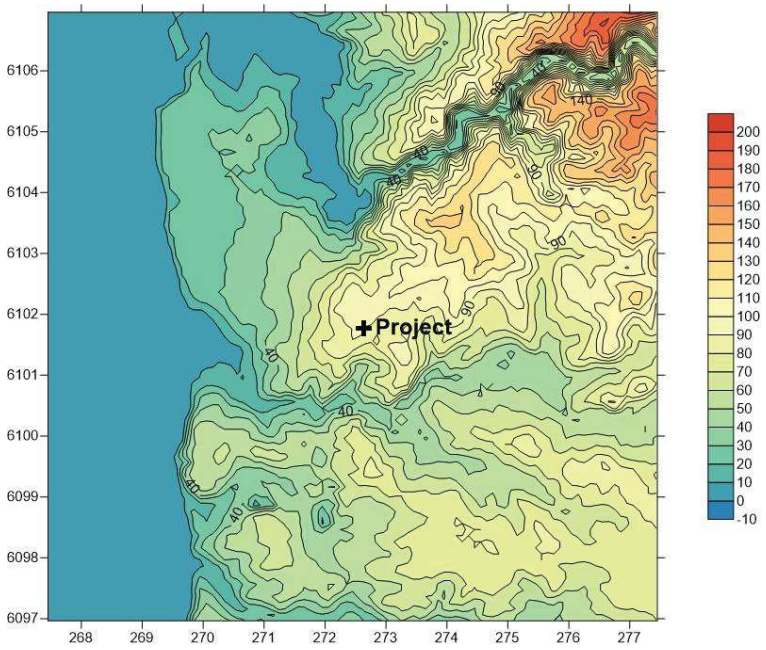

Figure 5 Terrain elevation (m)

5.2 Sensitive receptors

The SA EPA defines a sensitive receptor as:

> *Fixed location such as a house, building, other premises or open area where health, property or amenity is affected by emissions that increase the concentration of the emitted parameter above background levels*.

The two closest sensitive receptors are residences located to the northwest and east-northeast of the Project. The location of these receptors is shown in Figure 4 and Table 3.

Table 3 Nearest sensitive receptors to the Project

Receptor ID	Description	Easting (m)	Northing (m)	Distance and direction from the Project
R1	Residence	272,462	6,101,964	270m NW
R2	Residence	273,127	6,101,859	500m ENE

5.3 Existing air quality

5.3.1 Existing sources of emissions

A search of the National Pollutant Inventory for the 2016-2017 reporting year identified a total of nine facilities with emissions of the same key pollutants as the Project. A summary of these industries, and the reported emissions of key pollutants is presented in Table 4. The most significant sources of NOx are the Linwood Quarry and the Glenshera mineral sand mine, however, these are both located over 15km from the Project. The closest sources of NOx are the SRWRA landfill site and the waste depot and these are not significant sources of emissions of NOx and other key pollutants.

Table 4 Emissions inventory of NO_x, CO, SO_2 and particulates for facilities within 20km of the Project, as reported to the NPI for the 2016-2017 reporting year

Facility	Main activity	Distance and direction from Project	Emission rate (kg/year)				
			NOx	CO	SO_2	PM_{10}	$PM_{2.5}$
Linwood Quarry	Extractive Industry / Quarrying	16km N	28,683	12,331	15	385,688	1,888
Glenshera	Silica sand mining. Silica sand wet processing/washing. Silica sand drying	18km SE	7,011	2,491	4	40,744	490
Pt Stanvac Power Station	Pt Stanvac power station is a peak electricity demand supply facility, generally run when SA electricity demand is high or a generation supply shortage exists.	10km N	5,890	1,868	12	287	273
Christies Beach Wastewater Treatment Plant	Treatment of wastewater	8.8km NNW	5,666	801	54	246	246
Lonsdale Power Station	Lonsdale power station is a peak electricity demand supply facility, generally run when SA electricity demand is high or a generation supply shortage exists	10km N	3,557	1,128	7	174	165
Centennial Park Cemetery Authority	Cemetery	24km NNE	2,258	886	269	176	161
Southern Region Waste Resource Authority	Landfill site	0.2km SW	709	864	172	304	288
Monroe Clovelly Park	Ride control products for the automotive industry	22km NNE	317	877	11	72	72
Southern Waste Resourceco	Waste Depot	2.0km SSW	108	131	23	46	44

5.3.2 Existing ambient air quality

The EPA carries out air quality monitoring of criteria air pollutants for the Air NEPM at various locations in and around Adelaide, including Christie Downs, Netley, Adelaide CBD, Kensington Gardens and Northfield. The Christie Downs monitoring stations is the closest to the Project site and is located approximately 7km north in the residential area of Christies Beach, approximately 2.5km from the coast. This station is expected to be representative of the Project area. Data from other sites located in the Adelaide City area has also been presented here for comparison.

5.3.2.1 NO_2

Data from the Christie Downs monitoring station is presented in Table 5. NO_2 measurements from the Netley and Northfield monitoring stations are also presented, for comparison. The measured NO_2 concentrations from the Netley and Northfield sites are on average, higher than those measured at Christie Downs, which is to be expected given their location within urban areas. All sites have recorded concentrations that are significantly lower than the Air NEPM standards and the maximum ground level concentrations in the Air EPP.

Table 5 Ambient concentrations of NO_2 recorded at SA EPA monitoring station

Monitoring site	Year	1-hour average NO_2 ($\mu g/m^3$)[1]			Annual average NO_2 ($\mu g/m^3$)[1]
		Maximum	90th percentile	70th percentile	
Christie Downs	2013	81.7	23.6	8.2	8.3
	2014	77.9	24.3	8.5	8.1
	2015	71.8	22.6	10.3	8.5
	2016	65.6	20.5	6.2	7.4
	2017	73.8	26.7	10.3	10.4
Netley	2013	84.7	37.6	16.7	13.2
	2014	94.0	41.0	20.2	15.9
	2015	96.4	39.0	18.5	14.7
	2016	80.0	34.9	14.4	13.1
	2017	82.0	39.0	20.5	15.9
Northfield	2013	73.8	29.4	13.0	11.5
	2014	83.0	30.4	14.7	12.8
	2015	75.9	32.8	16.4	14.3
	2016	80.0	28.7	12.3	11.4
	2017	77.9	32.8	14.4	14.0
Air EPP maximum ground level concentrations		**250**			**60**

Table note:
[1] Based on conversion from parts per million (ppm) to $\mu g/m^3$ at 0°C and 1atm.

5.3.2.2 SO_2

The Le Fevre and Northfield monitoring stations measure SO_2. Data from these stations is summarised in Table 6. All sites have recorded concentrations that are significantly lower than the Air NEPM standards and the maximum ground level concentrations in the Air EPP.

Table 6 Ambient concentrations of SO_2 recorded at SA EPA's Le Fevre and Northfield monitoring stations

Monitoring site	Year	1-hour average SO_2 ($\mu g/m^3$)[1]			24-hour average SO_2 ($\mu g/m^3$)[1]			Annual average SO_2 ($\mu g/m^3$)[1]
		Max	90th percentile	70th percentile	Max	90th percentile	70th percentile	
Le Fevre	2013	72.9	2.4	0.0	9.2	2.3	0.9	0.8
	2014	83.4	2.9	0.0	10.7	2.4	1.2	1.0
	2015	97.2	2.9	0.0	5.8	2.4	1.0	0.8
	2016	62.9	2.9	0.0	7.1	1.9	0.7	0.5
	2017	48.6	5.7	0.0	10.0	3.9	2.1	1.5
Northfield	2013	31.5	1.9	0.0	19.3	1.3	0.3	0.4
	2014	51.5	0.0	0.0	4.5	0.6	0.1	0.2
	2015	28.6	0.0	0.0	5.3	1.0	0.1	0.2
	2016	31.5	0.0	0.0	4.0	0.8	0.1	0.2
	2017	51.5	0.0	0.0	7.8	0.8	0.0	0.2
Air EPP maximum ground level concentrations		**570**			**230**			**60**

Table note:
[1] Based on conversion from parts per million (ppm) to $\mu g/m^3$ at 0°C and 1atm.

5.3.2.3 CO

The Adelaide CBD and Elizabeth Downs stations are the only monitoring stations operated by the SA EPA in the Adelaide area that measure CO. The Adelaide CBD station was commissioned during 2014 and data from 2015 onwards has been analysed to determine an ambient background. This will be a conservative representation of ambient CO levels in the vicinity of the Project.

Table 7 Ambient concentrations of CO recorded at SA EPA's Adelaide CBD monitoring station

Year	1-hour average CO ($\mu g/m^3$)[1]			8-hour average CO ($\mu g/m^3$)[1]		
	Maximum	90th percentile	70th percentile	Maximum	90th percentile	70th percentile
2015	2,675	500	313	2,425	463	313
2016	2,800	425	263	2,600	400	263
2017	2,850	513	325	2,625	488	338
Air EPP maximum ground level concentrations	**31,240**			**11,250**		

Table note:
[1] Based on conversion from parts per million (ppm) to $\mu g/m^3$ at 0°C and 1atm.

All sites have recorded concentrations of CO that are significantly lower than the Air NEPM standards and the maximum ground level concentrations in the Air EPP.

5.3.2.4 Ambient background concentrations

Table 8 presents the ambient background concentrations that have been used in the dispersion modelling assessment.

Table 8 Ambient background concentrations used in the assessment

Pollutant	Averaging time	Ambient background ($\mu g/m^3$)	Source
NO_2	1-hour	20.5	Max 70th %tile from Christie Downs, Netley and Northfield between 2013 and 2017
	Annual	15.9	Highest average from Christie Downs, Netley and Northfield between 2013 and 2017
CO	1-hour	325	Maximum 70th percentile from Adelaide CBD between 2015 and 2016
	8-hour	338	
SO_2	1-hour	5.72	Maximum 90th percentile from Northfield or Le Fevre between 2013 and 2013 (70th percentile is 0)
	24-hour	2.05	Maximum 70th percentile from Northfield or Le Fevre between 2013 and 2013
	Annual	1.51	Highest average from Northfield or Le Fevre between 2013 and 2013

6. METEOROLOGY

This section presents an analysis of the site-specific meteorological data generated by the TAPM/CALMET meteorological modelling system. Analysis of the meteorological data extracted from the meteorological dataset at the location of the Project is presented in the following sections as this data has been used to drive the dispersion model CALPUFF.

6.1 Wind Speed and Direction

Wind speed and wind direction are important meteorological parameters that will influence the dispersion of air pollutants. Figure 6 illustrates the annual wind speed distribution during 2009 at the Project site, as predicted by CALMET. The average wind speed at the site is 4.4 m/s, and the strongest wind speed of 12.3 m/s. The strongest winds are predicted to occur from easterly directions. Winds occur from most directions, with north-easterlies and south to south-westerlies the least frequent.

Figure 7 illustrates that there is a marked variation in wind directions throughout the year, with summer being characterised by predominant south-easterlies, which persist through to autumn. Winds during winter are predominantly from the north-west and north, whilst during spring winds occur from most directions.

Figure 8 illustrates that there is also a variation in wind directions also throughout the day and night. Wind directions during the afternoon (midday – 6pm) are predominantly from westerly directions due to the site's proximity to the coast. Overnight (6pm – 6am), winds are predominantly from easterly directions and during the morning (6am – midday) there is a predominant northerly wind.

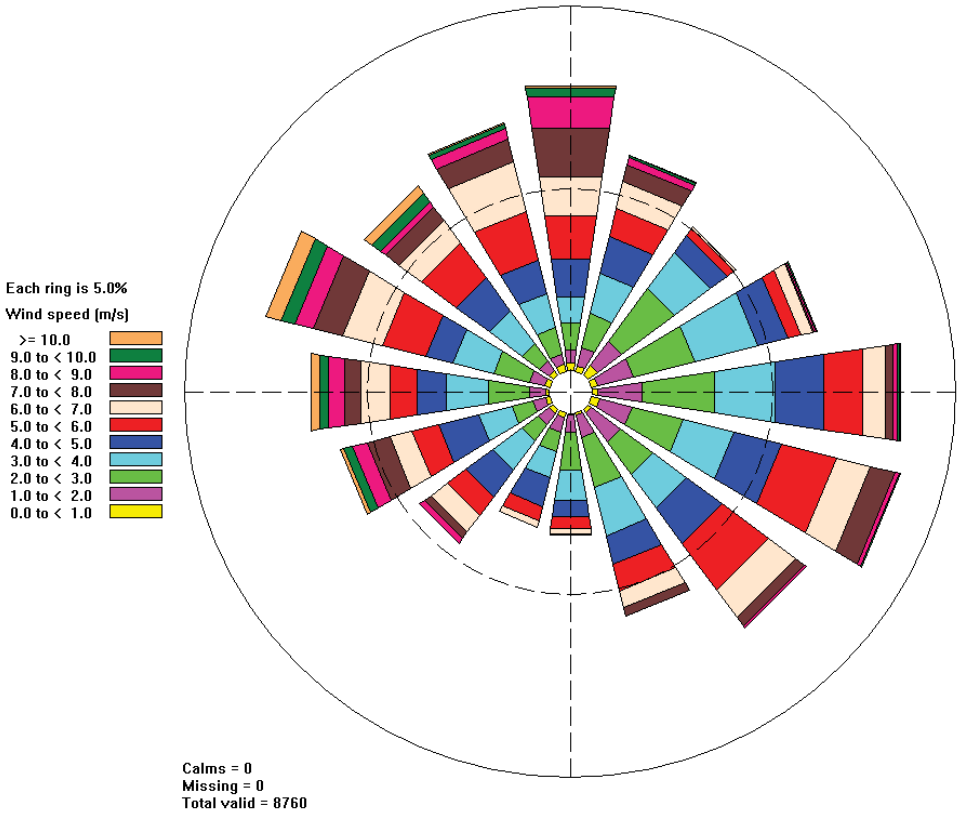

Figure 6 Annual wind rose at the Project site (CALMET)

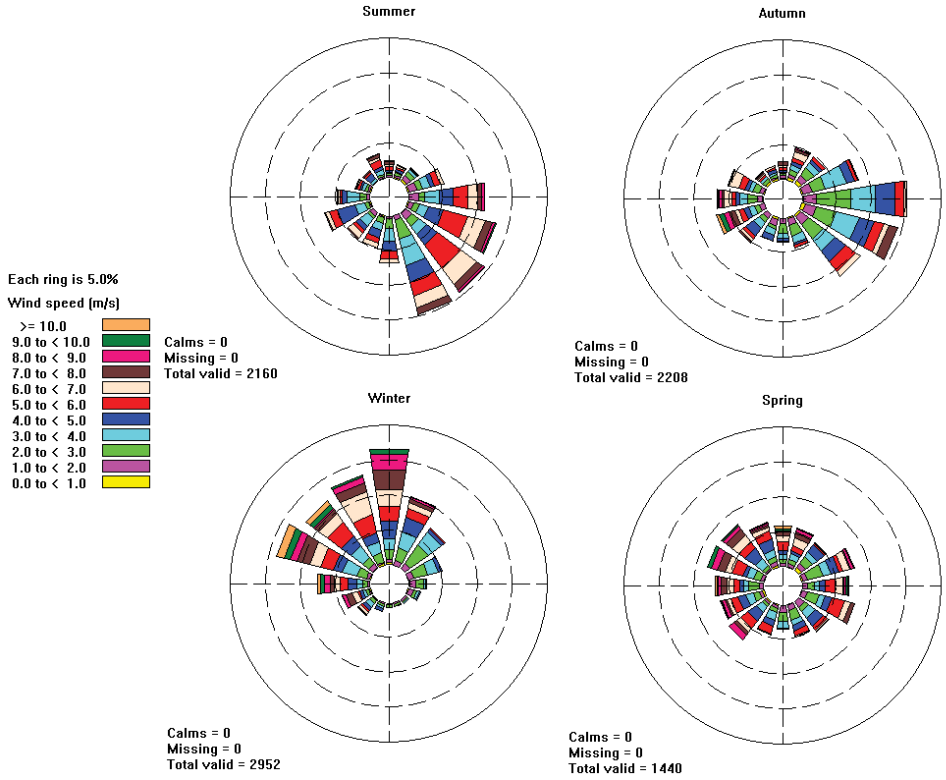

Figure 7 **Seasonal wind rose at the Project site (CALMET)**

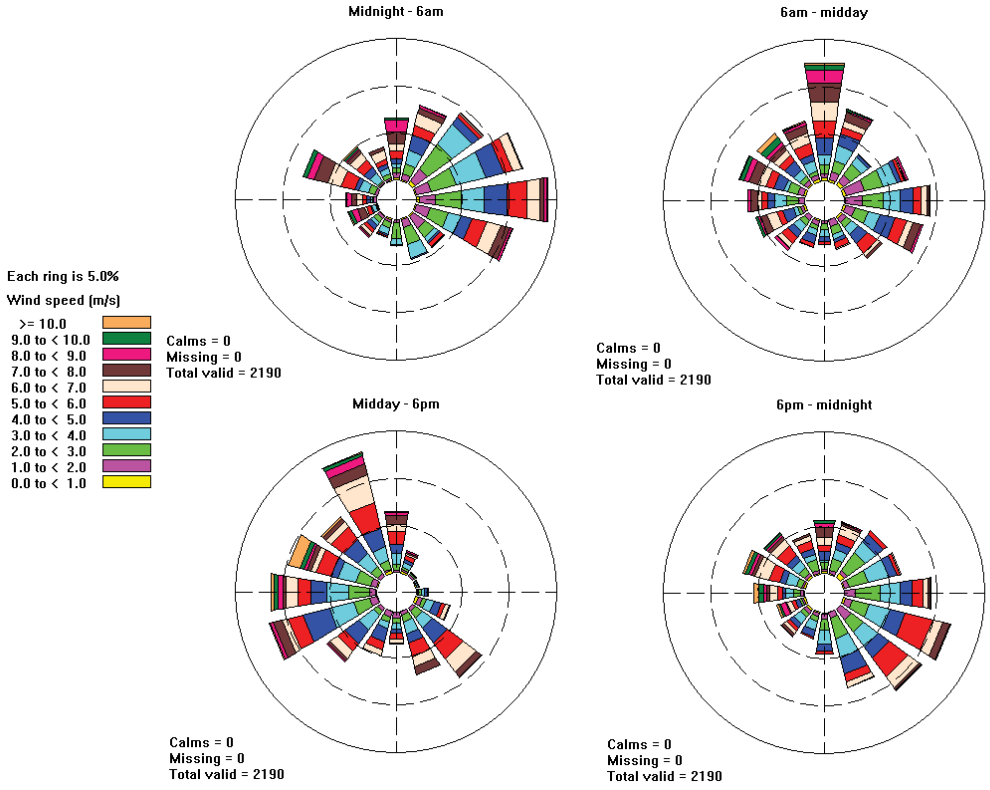

Figure 8 **Diurnal wind rose at the Project site (CALMET)**

6.2 Atmospheric stability

Stability classification is a measure of the stability of the atmosphere and can be determined from wind measurements and other atmospheric observations. The stability classes range from A class, which represents very unstable atmospheric conditions that may typically occur on a sunny day to F class stability, which represents very stable atmospheric conditions that typically occur during light wind conditions at night. Unstable conditions (Classes A to C) are characterised by strong solar heating of the ground that induces turbulent mixing in the atmosphere close to the ground. This turbulent mixing is the main driver of dispersion during unstable conditions. Dispersion processes for the most frequently occurring Class D conditions are dominated by mechanical turbulence generated as the wind passes over irregularities in the local surface. During the night, the atmospheric conditions are generally stable (often classes E and F).

Table 9 shows the overall percentage of stability classes at the project site, and Figure 9 illustrates the diurnal distribution of stability classes. Class D stability occurs approximately 57% of the time due to moderate wind speeds generated by the site's proximity to the coastline and sea breezes. Class F stability occurs approximately 12% of the time and represents calm nights.

Table 9 Frequency of occurrence (%) of surface atmospheric stability at the project site under the Pasquil-Gifford stability classification scheme (as predicted by CALMET)

Pasquil-Gifford stability class	Classification	Frequency (%)
A	Extremely unstable	1%
B	Unstable	6%
C	Slightly unstable	10%
D	Neutral	57%
E	Slightly stable	14%
F	Stable	12%

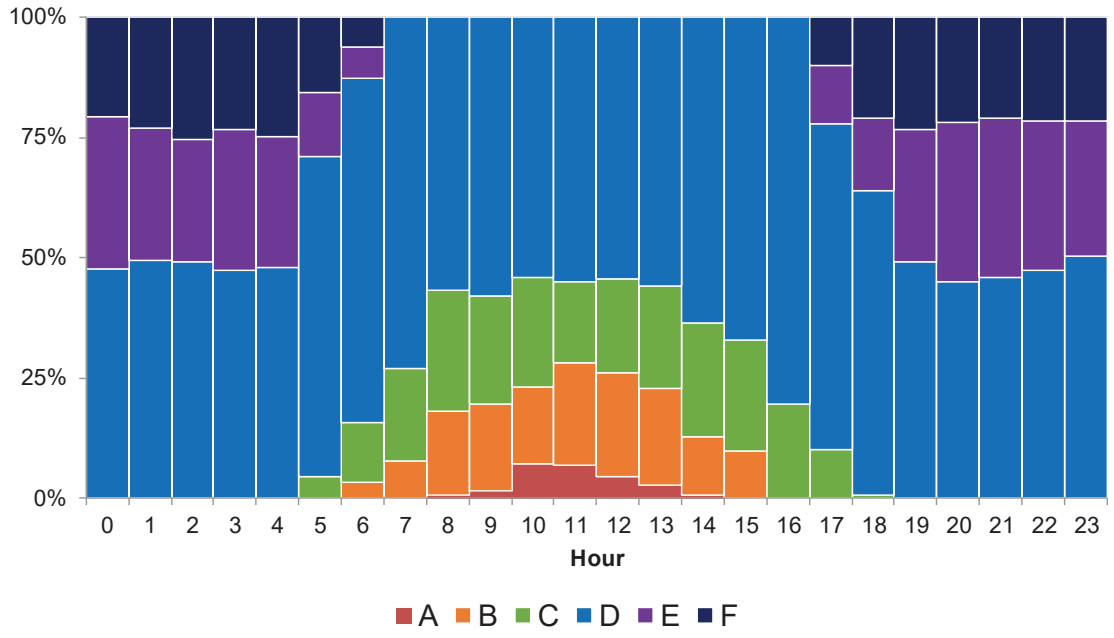

Figure 9 Diurnal distribution of stability classes at the project site

6.3 Mixing height

The mixing height refers to the height above ground within which air pollutants released at or near ground can mix with ambient air. During stable atmospheric conditions, the mixing height is often quite low and dispersion is limited to within this layer. During the day, solar radiation heats the air at the ground level and causes the mixing height to rise. The air above the mixing height during the day is generally cooler. The growth of the mixing height is dependent on how well the air can mix with the cooler upper level air and therefore depends on meteorological factors such as the intensity of solar radiation and wind speed. During strong wind speeds, the air will be well mixed, resulting in a high mixing height.

Mixing height information at the Project site is presented in Figure 10 at the Project site (CALMET). The data shows that the mixing height develops around 6am and reaches a peak around 2pm before descending rapidly until 6pm.

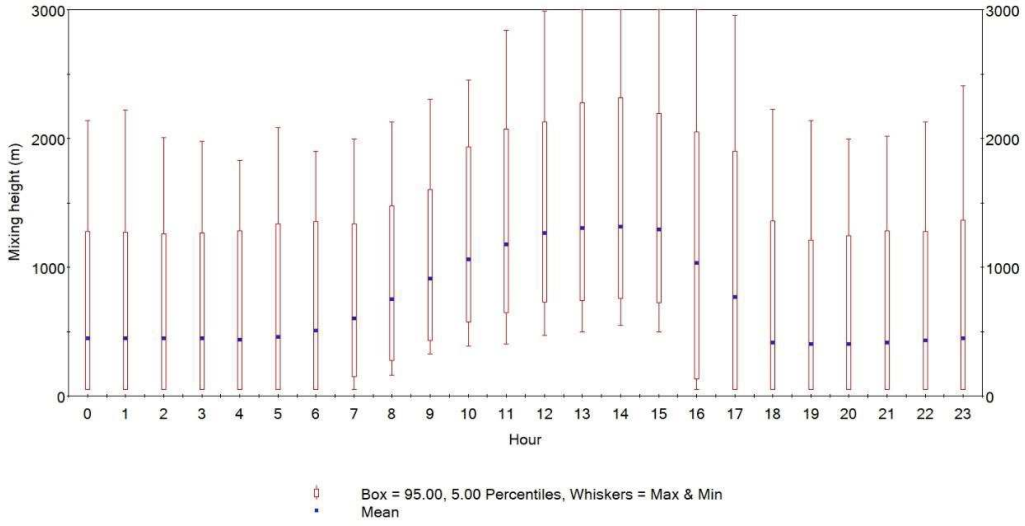

Figure 10 Diurnal profile of modelled mixing height at the Project site (CALMET)

7. EMISSIONS TO THE ATMOSPHERE

For this assessment, emission rates and stack characteristics have been provided by LMS Energy and are based on the results of annual stack testing of CAT 3516 units or manufacturer's specifications for Jenbacher JGC320GS generators. Table 10 presents the characteristics and emission rates of the proposed units.

Table 10 Stack characteristics and emission rates used in the dispersion modelling

Parameter	Units	Value (per unit)
Number of units	number	3
Stack height[1]	m	7.4
Diameter[1]	m	0.325
Temperature[2]	°C	490
Exit velocity[4]	m/s	40
Normalised flow rate, dry	Nm^3/s	1.5[3]
NOx (as NO_2)	g/s	0.75[3]
	mg/Nm^3	500[5]
CO	g/s	2.0[3]
	mg/Nm^3	1,333[5]
SO_2	g/s	0.01[3]
	mg/Nm^3	6.7[5]

Table notes:

[1] Provided by LMS Energy

[2] Lowest temperature from the Jenbacher JGC320GS spec sheet and typical temperature range for CAT 3516 provided by LMS Energy based on stack test results

[3] Provided by LMS Energy. Selected as the approximate maximum from annual stack test results of CAT 3516 units

[4] Exit velocities measured during annual stack testing of CAT 3516 units are approximately 60 m/s at full load. 40 m/s has been selected for use in the dispersion modelling to provide a conservative assessment.

[5] Calculated, assuming normalised flow rate is at 7% O_2

8. RESULTS

This section presents the results of the dispersion modelling assessment of NO_2, SO_2, and CO. Table 11, Table 12 and Table 13 present the maximum ground-level concentrations (glc) of NO_2, CO and SO_2, respectively, at sensitive receptors due to the Project and ambient background concentrations.

Plate 1 to Plate 7 present contours of the predicted concentrations of NO_2, CO and SO_2 due to the Project with background.

The results show that the ground-level concentrations of NO_2, CO and SO_2 ***comply*** with the air quality criteria at both sensitive receptors. The most critical pollutant compared to the air quality criteria is NO_2, and this is predicted to be at most 29% of the Air EPP criteria at the sensitive receptors. Predicted concentrations of NO_2 including background across the model domain are at most 208 µg/m^3, which complies with the Air EPP criteria.

If emission limits are to be included in the license limits for the Project, it is recommended that these be based on the emission concentrations presented in this report plus a 15% buffer. As the emissions information was selected from a review of stack testing, this allows for any variation between the tested units and those proposed to be used for the Project. The dispersion modelling results are such that a 15% increase in emissions would still result in compliance at sensitive receptors. The following limits are recommended, if required (7% O_2):

- NO_2 – 575 mg/Nm^3
- CO – 1,533 mg/Nm^3
- SO_2 – 7.7 mg/Nm^3.

Table 11 Ground-level concentrations of NO_2 due to the Project (µg/m^3)

Receptor	Maximum 1-hour average concentration of NO_2		Annual average concentration of NO_2		% of Air EPP maximum glc
	Project	Project plus background	Project	Project plus background	
R1	34.5	55.0	1.5	17.4	29%
R2	18.2	38.7	0.4	16.4	27%
Background	-	20.5	-	15.9	-
Air EPP maximum glc	**250 µg/m^3**		**60 µg/m^3**		-

Table 12 Ground-level concentrations of CO due to the Project (µg/m^3)

Pollutant	Maximum 1-hour average concentration of CO		Maximum 8-hour average concentration of CO		% of Air EPP maximum glc
	Project	Project plus background	Project	Project plus background	
R1	306.5	631.5	242.4	579.9	5%
R2	162.0	487.0	70.2	407.7	4%
Background	-	325	-	338	-
Air EPP maximum glc	**31,240 µg/m^3**		**11,250 µg/m^3**		-

Table 13 Ground-level concentrations of SO_2 due to the Project (µg/m^3)

Pollutant	Maximum 1-hour average concentration of SO_2		Maximum 24-hour average concentration of SO_2		Annual average concentration of SO_2		% of Air EPP maximum glc
	Project	Project plus background	Project	Project plus background	Project	Project plus background	
R1	1.5	7.3	0.7	2.7	0.07	1.58	3%
R2	0.8	6.5	0.2	2.3	0.02	1.53	3%
Background	-	5.7	-	2.1	-	1.51	-
Air EPP maximum glc	**570 µg/m^3**		**230 µg/m^3**		**60 µg/m^3**		-

9. LIMITATIONS

Where uncertainty exists in some properties of the Project, the assessment has erred on the side of caution and conservative inputs have been selected.

Some uncertainty exists in the selection of emissions data from the provided information. It is possible that the characteristics do not cover all operating scenarios (e.g. lower loads). Parameters have been selected to provide a conservative estimate of emission characteristics where possible.

Alternative methods exist for estimating the concentration of NO_2 generated by the conversion of NO_x as the plume disperses. However, due to the magnitude of the predicted ground-level concentrations in the assessment, the use of a more detailed method than a 30% conversion will not change the outcome of the assessment.

It is also important to note that numerical models are based on an approximation of governing equations and will inherently be associated with some degree of uncertainty. The more complex the physical model, the greater the number of physical processes that must be included.

There will be physical processes that are not explicitly accounted for in the model and, in general, these approximations tend to lead to an over prediction of air pollutant levels.

Overall, whilst there are a number of limitations and assumptions associated with this study, given the magnitude of the predicted ground-level concentrations of pollutants assessed (which are at most, 30% of the air quality criteria with the inclusion of a conservative ambient background) these features are unlikely to change the outcome of the assessment.

10. CONCLUSIONS

Katestone Environmental Pty Ltd (Katestone) was commissioned by LMS Energy to complete an Air Quality Assessment of the Seaford Heights Renewable Energy Facility (the Project) located at Seaford Heights, South Australia.

The air quality assessment has used a regulatory dispersion modelling approach. A site-specific meteorological data file has been generated using the TAPM and CALMET meteorological models. The meteorological modelling has accounted for local terrain and land use features of the surrounding region.

Emission rates and stack characteristics have been determined from information provided by LMS Energy and air quality assessments of similar generators. Emission rates and stack characteristics of the proposed units have been selected to provide a worst-case estimate of the potential impact of the Project on air quality, where possible.

The CALPUFF dispersion model has been used to predict ground-level concentrations of nitrogen dioxide (NO_2), carbon monoxide (CO) and sulfur dioxide (SO_2). The assessment has also accounted for ambient concentrations of these pollutants.

The air quality assessment has shown that:

- Predicted ground-level concentrations of NO_2, CO and SO_2 due to the Project and ambient background levels ***comply*** with the Air EPP maximum ground level concentrations at the nearest sensitive receptors.
- Ground-level concentrations plus ambient background levels at sensitive receptors are predicted to be, at most, 29% of the maximum concentrations specified in the Air EPP.

11. REFERENCES

Bofinger ND, Best PR, Cliff DI and Stumer LJ (1986), “The oxidation of nitric oxide to nitrogen dioxide in power station plumes”, Proceedings of the Seventh World Clean Air Congress, Sydney, 384-392.

Environment Protection Authority, (2016), Ambient air quality assessment.

Office of Parliamentary Counsel, Government of South Australia (2016). Environment Protection (Air Quality) Policy 2016 (SA EPP)

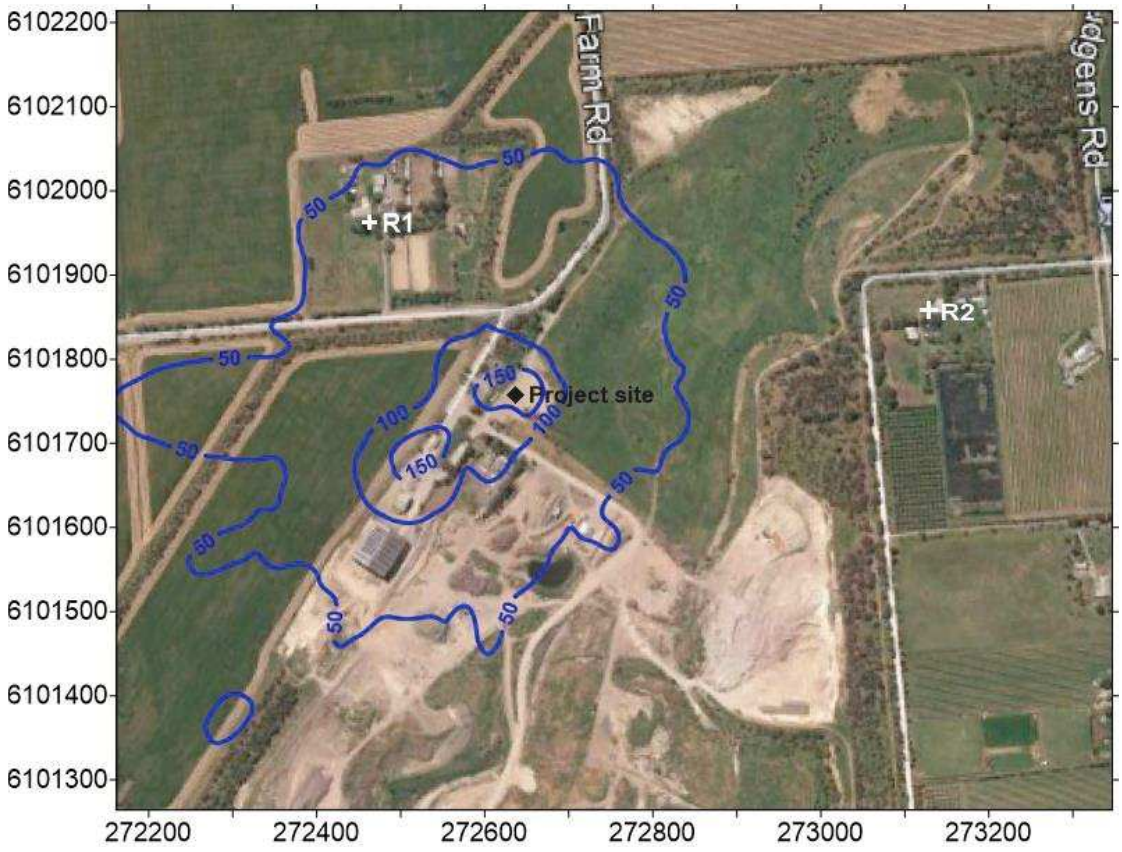

Plate 1 **Maximum 1-hour average ground-level concentration of NO_2 due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	1-hour	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Maximum contours	250 µg/m^3	Tania Haigh	July 2018

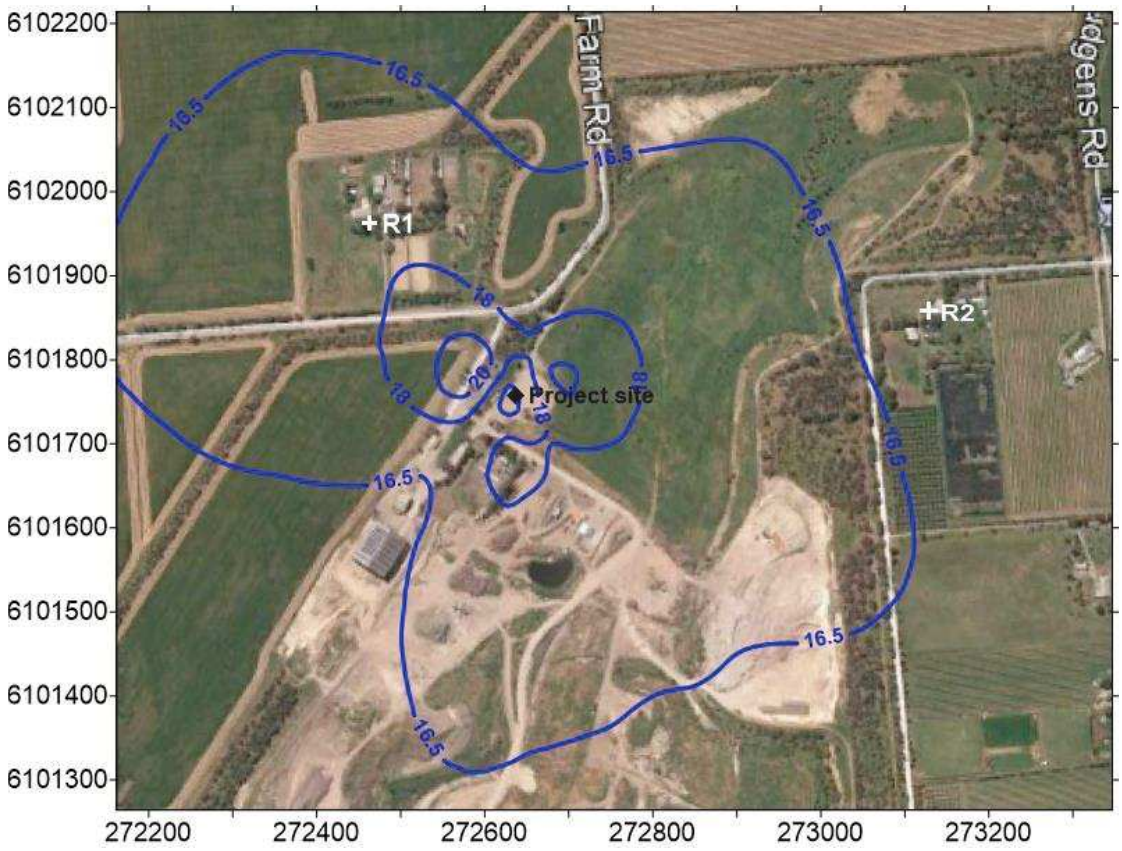

Plate 2 **Annual average ground-level concentration of NO_2 due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	1-year	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Average contours	62 µg/m^3	Tania Haigh	July 2018

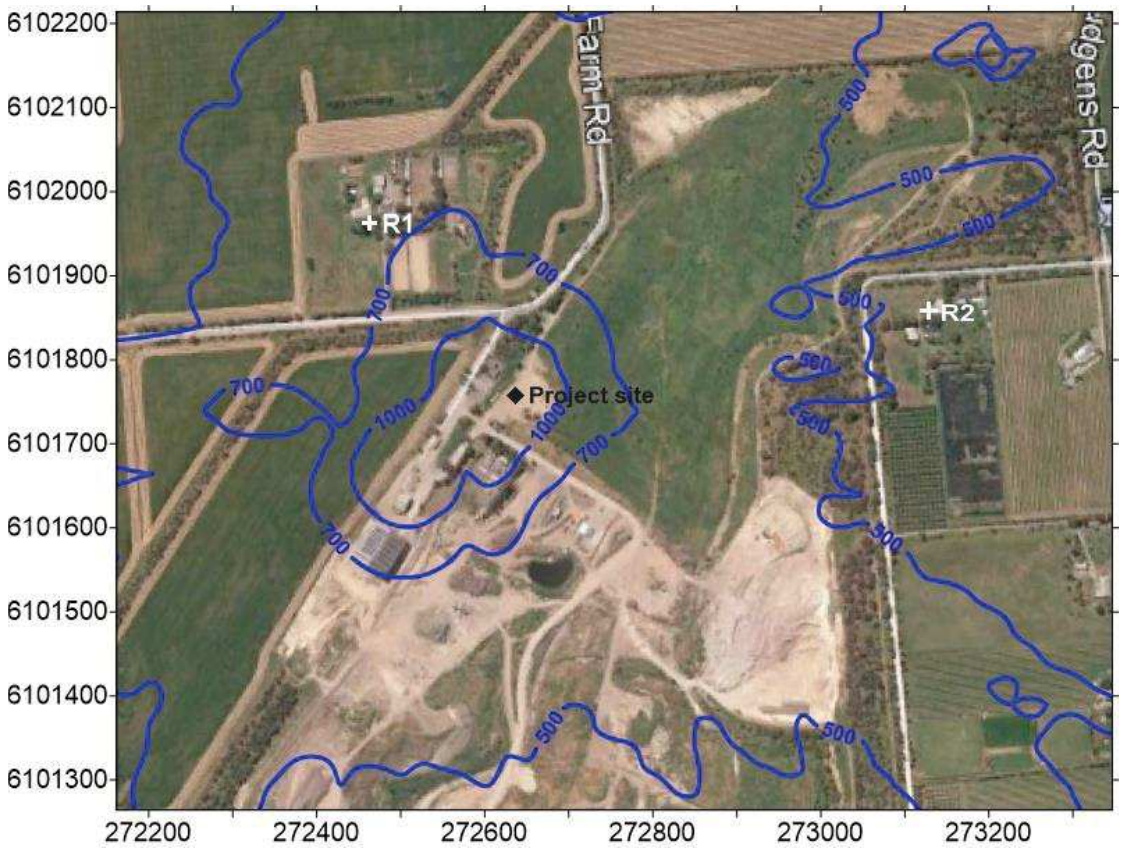

Plate 3 **Maximum 1-hour ground-level concentration of CO due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	1-hour	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Maximum contours	31,240 µg/m^3	Tania Haigh	July 2018

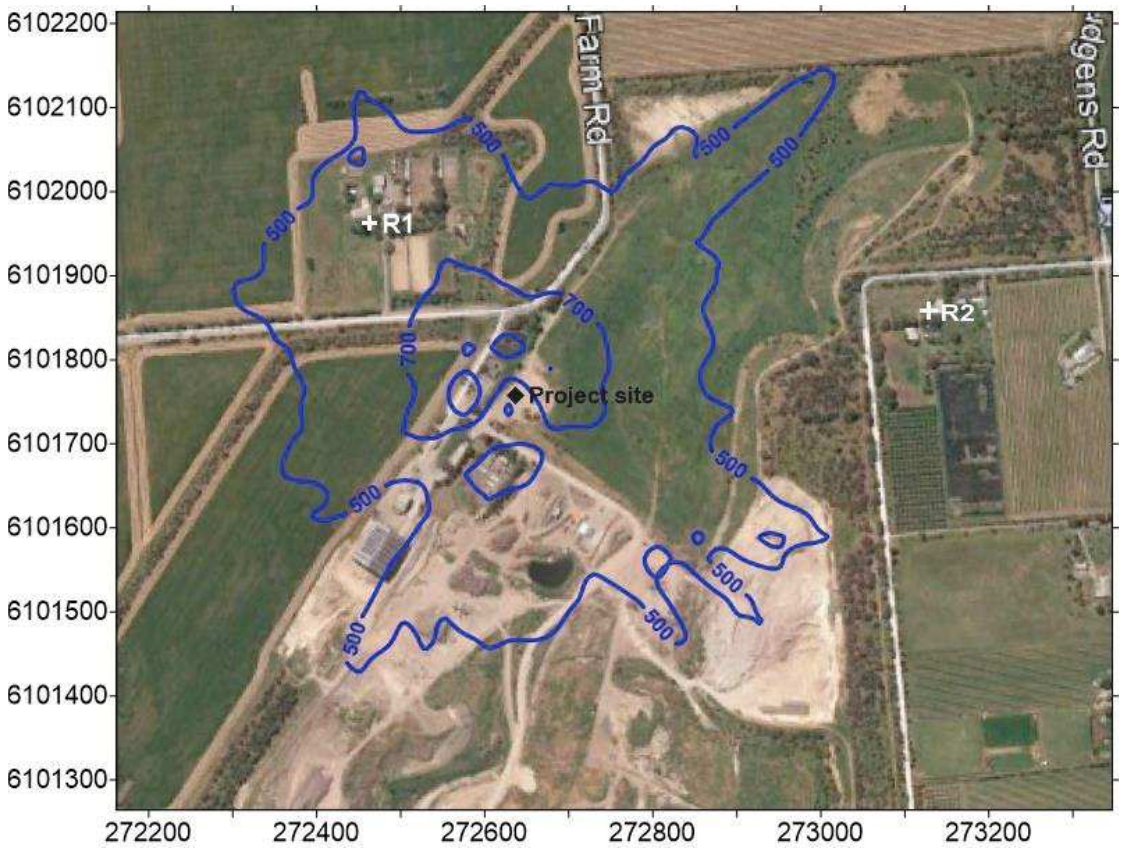

Plate 4 **Maximum 8-hour ground-level concentration of CO due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	8-hour	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Maximum contours	11,250 µg/m^3	Tania Haigh	July 2018

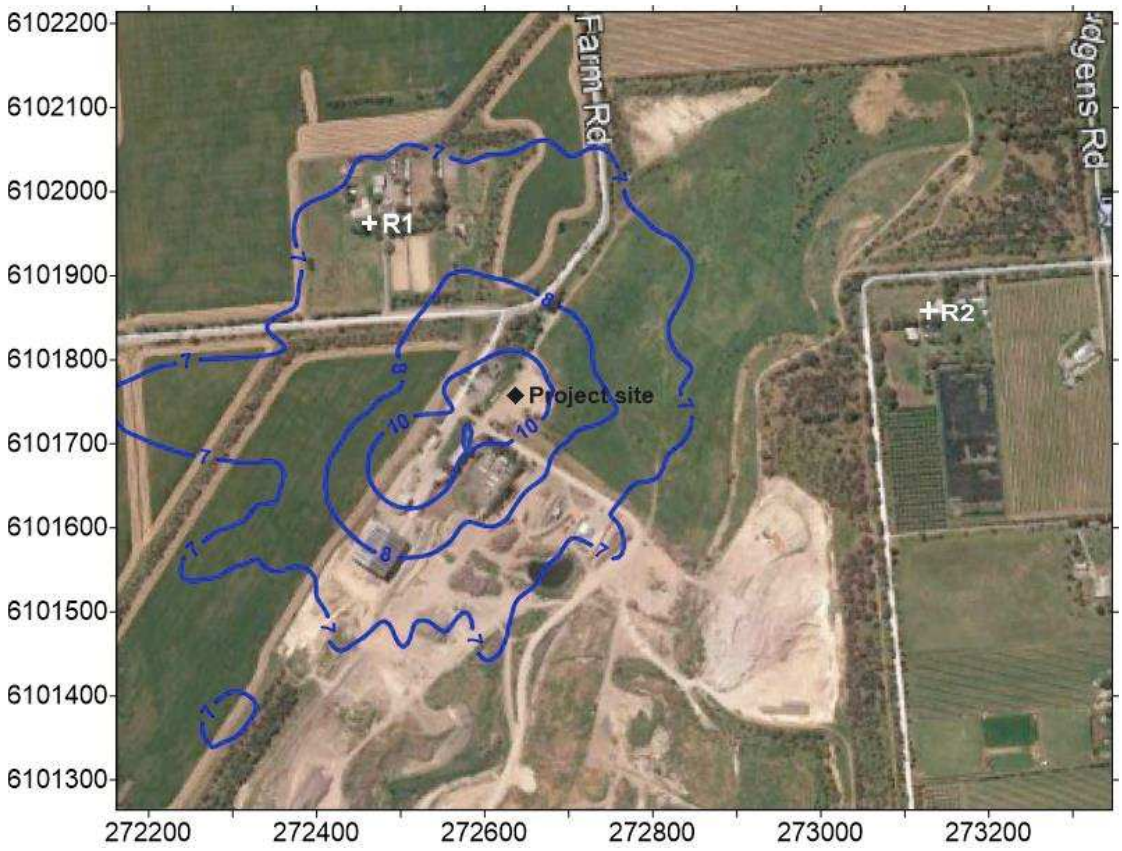

Plate 5 **Maximum 1-hour ground-level concentration of SO_2 due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	1-hour	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Maximum contours	570 µg/m^3	Tania Haigh	July 2018

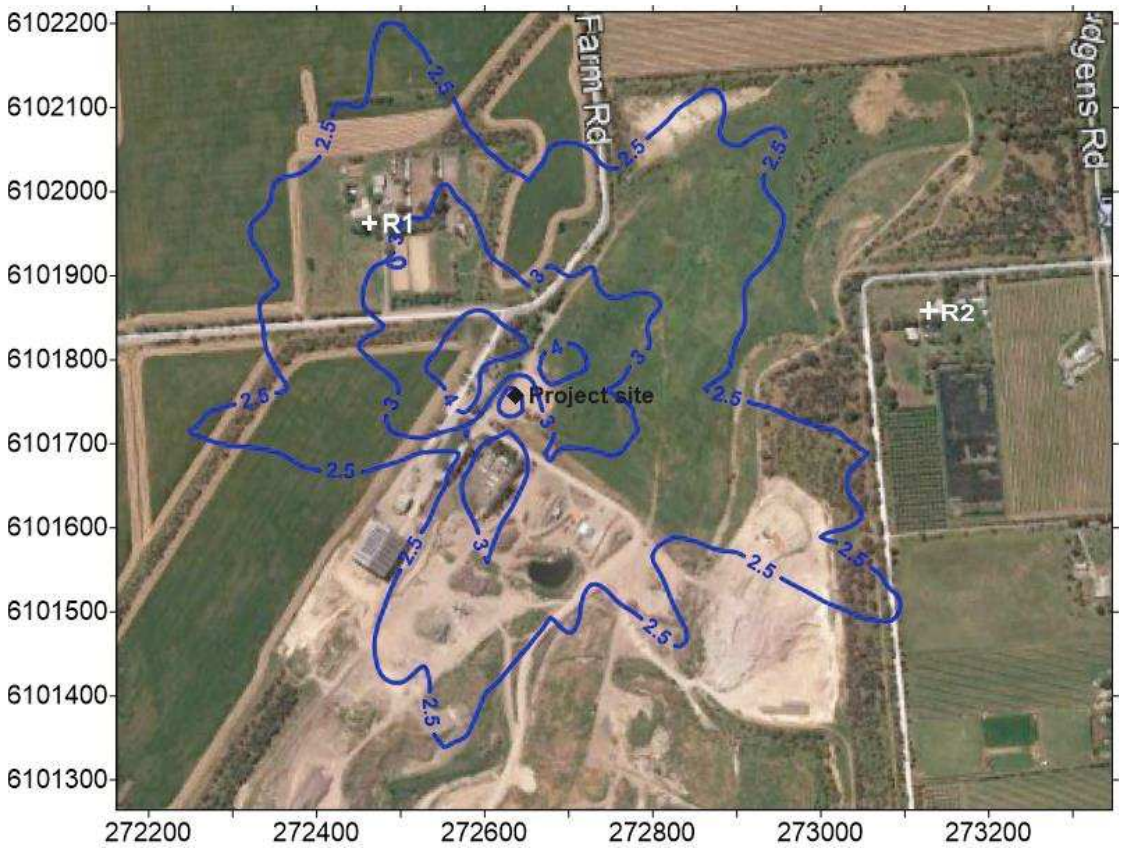

Plate 6 **Maximum 24-hour ground-level concentration of SO_2 due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	24-hour	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Maximum contours	230 µg/m^3	Tania Haigh	July 2018

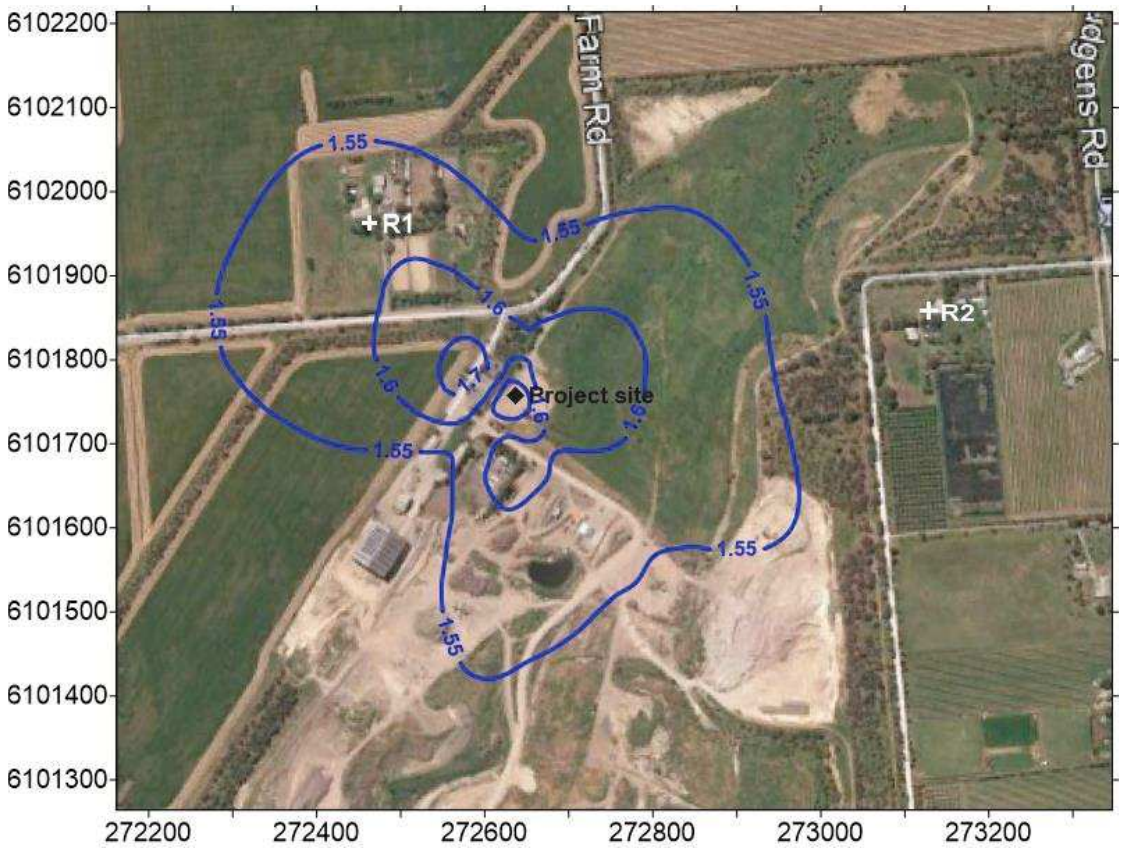

Plate 7 **Annual average ground-level concentration of SO_2 due to the Project plus ambient background**

Location:	**Averaging period:**	**Data source:**	**Units:**
Seaford Heights, South Australia	1-year	CALPUFF	µg/m^3
Type:	**Air EPP max glc:**	**Prepared by:**	**Date:**
Average contours	60 µg/m^3	Tania Haigh	July 2018

APPENDIX A METEOROLOGICAL AND DISPERSION MODELLING METHODOLOGY

A1 METEOROLOGY

A1.1 TAPM meteorology

The meteorological model TAPM has been validated by the CSIRO, Katestone Environmental and others for many locations in Australia, in southeast Asia and in North America (CSIRO, 2008). Katestone has used the TAPM model throughout Australia as well as in parts of America, Bangladesh, New Caledonia and Vietnam. This model has performed well for simulating regional winds patterns. TAPM has proven to be a useful model for simulating meteorology in locations where monitoring data is unavailable.

TAPM is a prognostic meteorological model which predicts the flows important to regional and local scale meteorology, such as sea breezes and terrain-induced flows from the larger-scale meteorology provided by the synoptic analyses. TAPM solves the fundamental fluid dynamics equations to predict meteorology at a mesoscale (20 km to 200 km) and at a local scale (down to a few hundred metres [m]). TAPM includes parameterisations for cloud/rain micro-physical processes, urban/vegetation canopy and soil, and radiative fluxes.

TAPM requires synoptic meteorological information for the region. This information is generated by a global model similar to the large-scale models used to forecast the weather. The data were supplied on a grid resolution of approximately 75 km, and at elevations of 100 m to 5 km above the ground. TAPM uses this synoptic information, along with specific details of the location such as surrounding terrain, land-use, soil moisture content and soil type to simulate the meteorology of a region as well as at a specific location.

The year 2009 was used for meteorological modelling, based on advice from SA EPA.

TAPM was configured as follows:

- Modelling period for one year from 1 January to 2009 December 2009;
- 41 x 41 grid point domain with an outer grid of 30 km and nesting grids of 10 km, 3 km and 1 km;
- 25 vertical levels;
- Grid centred near the QPS project site (latitude –35° 12.0', longitude 138° 30.0');
- Geoscience Australia 9 second DEM terrain data;
- Land cover data based on TAPM's default land use database and edits based on a comparison against aerial imagery;
- Default options selected for advanced meteorological inputs; and
- Data from the Bureau of Meteorology's monitoring station at Noarlunga assimilated over three vertical levels with a radius of influence of 5.5km.

A1.2 CALMET meteorological modelling

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output

from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET (version 6.5.0) was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the innermost nest. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

Key features of CALMET used to generate the wind fields are as follows:

- Domain area of 101 by 101 grid points at 100 m spacing;
- Twelve vertical levels set at 20 m, 60 m, 100 m, 150 m, 200 m, 250 m, 350 m, 500 m, 800 m, 1600 m, 2600 m and 4600 m;
- 365 days (1 January to 31 December 2009);
- No observations mode, with prognostic wind fields generated by TAPM input as MM5/3D.dat at surface and upper air for "initial guess" field;
- No extrapolation of surface winds observations;
- All other wind field options set as default;
- Terrain radius of influence set at 3 km;
- 3D Relative humidity and temperature from prognostic data;
- Mixing height parameters all set as default except for maximum search radius in averaging process (set to 10 grid cells);
- No data assimilation; and
- All other options set to default.

A1.3 Comparison of TAPM output with observational data

The model validation in the following sections compares observational meteorological data with data derived from running TAPM.

Table A1 presents statistical comparisons of TAPM output with data assimilation (wind speed and temperature) to meteorological data recorded at the automatic weather station located at Noarlunga. Figure A4 shows probability density functions that graphically compare statistical distributions of meteorological parameters between the TAPM output and observational data. The TAPM output was extracted from the closest inner grid point to the location of the weather station.

The following statistical measures of model accuracy are presented in the tables.

The mean bias, which is the mean model prediction minus the mean observed value. Values of the mean bias close to zero show good prediction accuracy.

The root mean square error (RMSE), which is the standard deviation of the differences between predicted values and observed values. The RMSE is non-negative and values of the RMSE close to zero show good prediction accuracy. The RMSE is given by

$$\mathrm{RMSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(P_i - O_i)^2}$$

where N is the number of observations, P_i are the hourly model predictions and O_i are the hourly observations

The index of agreement (IOA), which takes a value between 0 and 1, with 1 indicating perfect agreement between predictions and observations. The IOA is calculated following a method described in Willmott (1982), using the equation

$$\mathrm{IOA} = 1 - \frac{\sum_{i=1}^{N}(P_i - O_i)^2}{\sum_{i=1}^{N}(|P_i - O_{mean}| + |O_i - O_{mean}|)^2}$$

where N is the number of observations, P_i are the hourly model predictions, O_i are the hourly observations and O_{mean} is the observed observation mean.

Whilst the bias shows that TAPM has a tendency to slightly underpredict both wind speed and temperature, the predicted wind speeds and temperature are within the other benchmarks for performance and are therefore representative of the area. The probability density functions illustrate reasonable agreement between predicted and observed meteorological data.

For comparison, Figure A1 presents the distribution of winds measured at BoM's Noarlunga station during 2009. Figure A2 and Figure A3 present the TAPM generated wind distribution without, and with data assimilation. As expected, the data assimilation has resulted in a wind distribution from TAPM that better matches that measured at the BoM Noarlunga station.

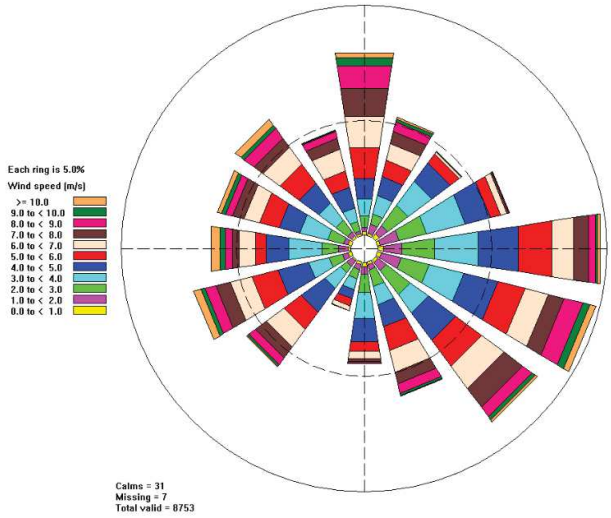

Figure A1 Annual distribution of winds measured at BoM's Noarlunga station during 2009

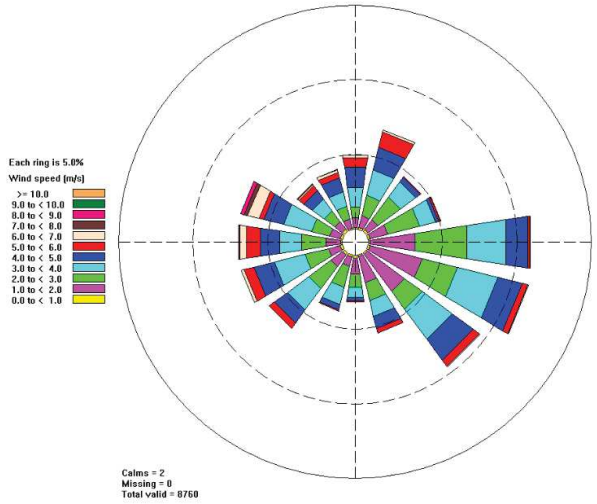

Figure A2 **Annual distribution of winds predicted by TAPM at the location of BoM's Noarlunga station during 2009**

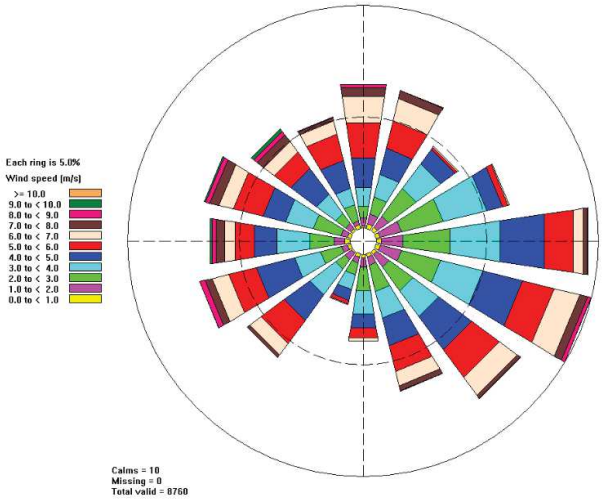

Figure A3 **Annual distribution of winds predicted by TAPM with data assimilation at the location of BoM's Noarlunga station during 2009**

Table A1 A comparison of the observed meteorological data with the first-level TAPM output

Statistic	"Good" value	Wind speed			Temperature		
		Benchmark	Observational data	TAPM	Benchmark	Observational data	TAPM
Mean	-	-	4.87	4.05	-	17.13	16.48
Standard deviation	-	-	2.27	1.73	-	6.30	5.79
Minimum	-	-	0.00	0.00	-	4.90	5.20
Maximum	-	-	13.69	9.90	-	43.80	40.90
Bias	0	<±0.5 m/s	-0.82		<±0.5 °C	-0.65	
Root mean square error (RMSE)	Close to 0	<2 m/s	1.02		-	2.03	
Index of agreement	Close to 1	>0.6	0.94		≥0.8	0.97	

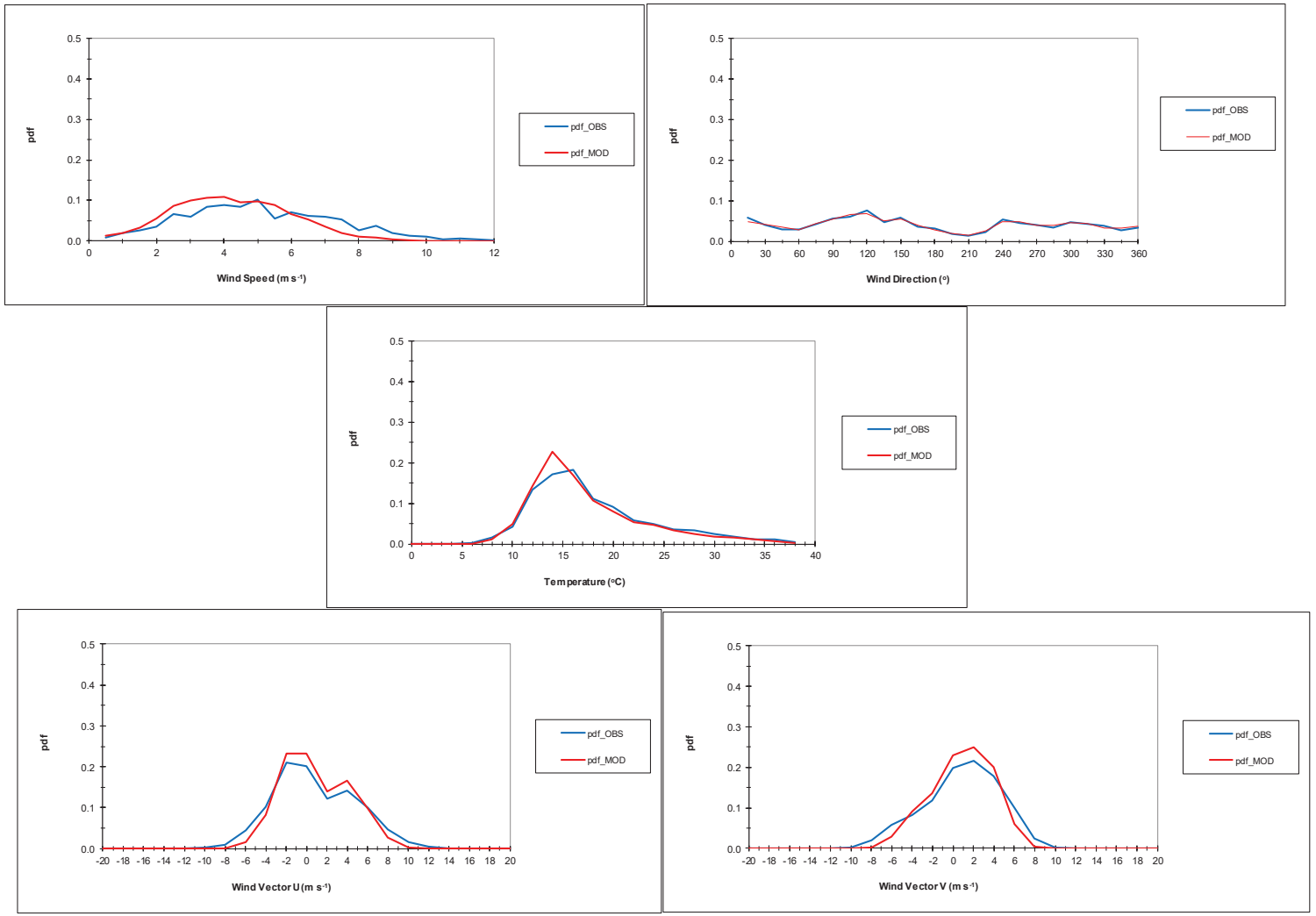

Figure A4 **Probability density functions (pdfs) comparing observational data (blue) with TAPM data (red) at the location of the BoM Noarlunga monitoring station**

A2 CALPUFF DISPERSION MODELLING

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. CALPUFF takes into account the geophysical features of the study area that affects dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily-varying point, area, volume and lines or any combination of those sources within the modelling domain.

Key features of CALPUFF used to simulate dispersion:

- Computational and sampling grids of 30 by 30 grids at 100m spacing, with a nesting factor of 4
- 365 days modelled (1 January 2009 to 31 December 2009)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- No chemical transformation
- Partial plume path adjustment for terrain modelled
- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables
- Minimum turbulence velocities sigma-v set to 0.2
- Stack tip downwash, transitional plume rise and PDF used for dispersion under convective conditions

All other options set to default.