APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Type of development:	SECTION 49 - Public Infrastructure
Development Number:	660/V008/15 V1
Applicant:	DP Energy Australia PL
Nature of Development:	Port Augusta Renewable Energy Park
Subject Land:	Various land holdings: Augusta Highway & Horrocks Pass, Port Augusta
Development Plan:	Port Augusta (City) Development Plan Mount Remarkable Council Development Plan
Zone / Policy Area:	Primary Production Zone (Mount Remarkable Development Plan); Primary Industry Zone (Port Augusta [City] Development Plan)
Contact Officer:	Simon Neldner
Phone Number:	08 7109 7058
Consultation Start Date:	22 May 2019
Consultation Close Date:	21 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, or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this document. Note – individual emails [including attachments] should not be more than 5MB.

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:
Planning and Land Use Services
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapreps@sa.gov.au

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

SECTION 49 - PUBLIC INFRASTRUCTURE

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

Notice is hereby given that an application has been made by **DP Energy Australia Pty Ltd** for consent to vary its existing development authorisation for the Port Augusta Renewable Energy Park approved under 660/V008/15. The application for a wind and solar energy project was previously sponsored as 'public infrastructure' under Section 49 of the *Development Act 1993* by the former Department of State Development.

The variation application only relates to the wind-farm component, with an increase in the maximum tip height of each wind turbine generator from 150 metres to 185 metres (with the maximum rotor diameter up to 155 metres and hub height up to 107.5 metres). The nominal generating capacity of each wind turbine would be increased to 4.5MW, with a consequential reduction in the number of wind turbines, from 59 to 50 machines. **Development Application: 660/V008/15 V1**

There is no change to the solar component, ancillary infrastructure or overall generating capacity of the windfarm, although minor changes to the approved windfarm layout have been sought to avoid recently identified microwave links.

The subject land is approximately 5400 hectares in area, comprising land on both sides of the Augusta Highway, to the south-east of Port Augusta with an 'east' site and a 'west' site (involving 39 land parcels). The project area extends from Stirling North in a south- easterly direction to the vicinity of 'Winninowie Farm' and Horrocks Creek. Refer to the application documentation for the full land parcel details.

The subject land is located within the Primary Industry Zone of the Port Augusta (City) Development Plan (Consolidated 7 July 2016) and the Primary Production Zone of the Mount Remarkable Council Development Plan (Consolidated 5 September 2013).

The application may be examined during normal office hours at the office of the State Commission Assessment Panel, Level 5, 50 Flinders Street, Adelaide and at the office of Port Augusta Council [Civic Centre, 4 Mackay Street, Port Augusta.] Application documentation may also be viewed on the SCAP website: https://www.saplanningcommission.sa.gov.au/scap/public_notices

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide 5001 **NOT LATER THAN FRIDAY 21 JUNE 2019.**

Submissions may also be made via email to scapreps@sa.gov.au (Please note individual emails and attachments should not be more than 5MB in size).

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection.

Should you wish to discuss the application and the public notification procedure please contact **Simon Neldner** on **08 7109 7058.**

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL

PN3838

www.sa.gov.au

PN3838
29x2 (63mm)
Adelaide Advertiser, Transcontinental
Wednesday 22 May 2019
APPROVAL REQUIRED BY 4PM THURSDAY 16 MAY 2019

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	DP Energy Australia PL
Development Number:	660/V008/15 V1
Nature of Development:	Port Augusta Renewable Energy Park – variation to wind turbine component (height layout and generating capacity)
Zone / Policy Area:	Primary Production Zone (Mount Remarkable Development Plan); Primary Industry Zone (Port Augusta [City] Development Plan)
Subject Land:	Various land holdings: Augusta Highway & Horrocks Pass, Port Augusta
Contact Officer:	Simon Neldner
Phone Number:	08 7109 7058
Close Date:	21 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: scapadmin@sa.gov.au [Individual emails and attachments should be limited to 5MB in size]

Your Ref:
Our Ref: PAVarDA2Apr2019

State Commission Assessment Panel
GPO Box 1815
Adelaide SA 5001

DP Energy Australia Pty Ltd
2/53 Mabel Street (PO Box 1451)
Atherton QLD 4883
T: 07 4091 2163
E: gabrielle.powell@dpenergy.com

By Email: scapadmin@sa.gov.au
Cc: Simon.Neldner@sa.gov.au, Peter.Boulton@sa.gov.au

3 April 2019

Dear State Commission Assessment Panel,

Re: Port Augusta Renewable Energy Park Variation Development Application

DP Energy Australia Pty Ltd is seeking a variation to Development 660/V008/15. The complete variation application can be downloaded from:

https://dpenergy-my.sharepoint.com:443/:f:/p/gaby_powell/En5lhBCf5l5IlGE3L8kDJW0BOiCiCb2hzmNDeSvj4onIBQ?e=K8t4uK

We await your advice regarding hard copy requirements.

I trust that the enclosed information is sufficient for your purposes, however if you require any further details please do not hesitate to contact me.

Yours sincerely,

Gabrielle Powell
Consents Manager

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: Port Augusta City Council/
District Council of Mount Remarkable

APPLICANT: DP Energy Australia Pty Ltd

ADDRESS: 2/53 Mabel Street
Atherton Queensland 4883

CROWN AGENCY: Department of State Development

FOR OFFICE USE

DEVELOPMENT No: _____

PREVIOUS DEVELOPMENT No: _____

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: David Blake

Telephone: 07 40912163 [work] 0427 085 998 [Ah]

Fax: _____ [work] _____ [Ah]

Email: gabrielle.powell@dpenergy.com

☐ Complying	Decision: _____
☐ Merit	Type: _____
☐ Public Notification	Finalised: / /
☐ Referrals	

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008*. Proposals over $4 million (excl. fit-out) will be subject to public notification and advertising fees.
(2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:				
Land Division:				
Additional:				
Minister's Approval				

EXISTING USE: Primary Industry (general farming)

DESCRIPTION OF PROPOSED DEVELOPMENT: Variation to DA # 660/V008/15 (refer attached)

LOCATION OF PROPOSED DEVELOPMENT: Refer Details Attached

House No: _____ Lot No: ____ Street: _____ Town/Suburb: _____

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

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

DEVELOPMENT COST [do not include any fit-out costs]: $ 650M (approx)

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008*, if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from the DPLG website (www.dac.sa.gov.au).

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993*.

SIGNATURE: _____ Dated: 3 / 4 / 2019

Government of South Australia

DEVELOPMENT REGULATIONS 2008
Form of Declaration (Schedule 5 clause 2A)

To: State Commission Assessment Panel

From: DP Energy Australia Pty Ltd

Date of Application: 3 / 4 / 2019

Location of Proposed Development: refer attached

House No: _____ Lot No: _____ Street: _____

Town/Suburb: _____

Section No (full/part): _____ Hundred: _____

Volume: _____ Folio: _____

Nature of Proposed Development: Variation to DA # 660/V008/15 (refer attached)

I, Gabrielle Powell, being a person acting on behalf of the applicant 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 2008.

Signed: _____ **Date:** 3 / 4 / 2019

Port Augusta Renewable Energy Park (Variation)

Development Application Variation

Development Application Report

April 2019

DP Energy Australia Pty. Ltd. ABN: 16 140 516 196
2/53 Mabel St., Atherton QLD 4883, Australia
T: +61 (0)7 4091 2163
Email: australia@dpenergy.com
Web: www.dpenergy.com

Contents

1 Introduction

This variation development application has been prepared by DP Energy Australia Pty Ltd (DPEA) and submitted to the Department of the Planning Transport and Infrastructure (DPTI), for lodgement to the State Commission Assessment Panel (SCAP) under section 49 of South Australian Development Act 1993.

1.1 Applicant

This application is made in the name of DP Energy Australia Pty Ltd although the Project will ultimately be funded, built and operated utilising one or more Special Purpose Companies (SPC's) as is standard practice for funding and constructing projects of this nature.

DP Energy Australia Pty Ltd (DPEA) is a renewable energy company operating in Australia and is one of a number of DP Energy companies under the DP Group which operates worldwide to develop renewable energy projects. The various DP Energy companies operate in the field of renewable energy and sustainable development (principally onshore wind, solar PV and tidal energy) in Ireland, the United Kingdom, Canada and Australia.

1.2 Background

In November 2015, the applicant received development approval (#660/V008/15) under section 49 of South Australian Development Act 1993 for the construction and operation of a 375MW hybrid wind and solar farm known as the Port Augusta Renewable Energy Park (the Project).

This variation application (see Appendix 1 and Appendix 2) relates only to the wind-farm element of the Project and seeks an increase of the maximum tip-height, rotor diameter, hub height and generator capacity of the wind turbines in order to accommodate a new generation of larger, more efficient wind turbines that have become available in the market.

It should be noted that no increase in the nameplate generating capacity is sought. The number of wind turbines will be reduced to maintain the existing approved generation capacity.

Further minor changes to the layout (and anticipated in the original development approval) are sought, as described in Section 2.3 below.

1.3 Site Location

The Project is located approximately 8km southeast of Port Augusta in South Australia in the coastal region bordering the southern Flinders Ranges as shown in Appendix 3 and Appendix 4. The site which lies on both sides of the A1 Augusta Highway is centred at approximately Easting 771929 and Northing 6389094 (UTM zone 53H, GDA94) or -32.595° 137.890° (GDA94).

Occupying an area of approximately 5400 hectares at an elevation of between 10m above sea level (ASL) in the north-west to 140m ASL to the east, the site is used primarily for livestock grazing and is located within the Primary Industry Zone of the Port Augusta City Council and the Primary Production Zone of the District Council of Mount Remarkable (see Appendix 5) on privately owned land (see Appendix 6).

1.4 Project Description

The main permanent components of the Project as approved were:

- up to 59 wind turbines with a maximum tip height of 150m;
- up to 59 wind turbine transformers;
- approximately 1,600,000 solar modules measuring around 1.2x0.8m each;
- up to 150 solar PV inverter/transformer stations;
- electrical export connection to Davenport Substation;
- one main substation containing switchgear, transformers, offices, welfare facilities and workshop;
- two collector substations (east and west sites);
- three solar PV interconnector substations containing switchgear and transformers;
- approximately 8km of overhead 132kV electrical connection (east site to main substation)
- up to 59 hard standing areas for wind turbine construction;
- around 45km of wind farm site tracks;
- approximately 40km of solar PV site tracks;
- approximately 100km of underground 33kV cabling (linking wind turbines);
- up to five lattice type meteorological masts of up to 92m;
- electrical cabling (linking solar arrays):
- security fencing approximately 2.4m high around the solar PV sites;
- five access locations from the public highway; and
- a viewing platform and visitor information facility,

as illustrated in Appendix 7. The main temporary components of the Project were:

- five temporary construction compounds including laydown areas;
- around five borrow pits for track material;
- two concrete batching plants; and
- four temporary meteorological masts of up to 92m,

as illustrated in Appendix 8 of this report.

1.5 Land details

The subject land remains unchanged from that of the original Development Application. Details of the involved land can be found in Appendix 9 of this report.

1.6 Project Status

In the intervening period between the original Development Approval and the present day, there has been significant progress in Project, as outlined in the following sections.

1.6.1 Contracting

In early 2017, DPEA ran a formal EPC (Engineering, Procurement and Construction) tender for the construction and operation of the Project. A preferred supplier was selected in late 2017 and DPEA continue to work in closely with the preferred EPC partner to define the detailed engineering design, and construction methodologies for the Project. These works are at an advanced state of development in anticipation of lodgement for building rules consent at an appropriate time.

1.6.2 Electricity Grid Connection

Connection to the electricity grid presents one of the key challenges for energy projects in general and renewable energy projects in particular. This process has become especially fraught since the South Australian blackout in September 2016, which resulted in significant changes to the National Electricity Rules (NER), which dictate the conditions surrounding connection to the National Electricity Market (NEM).

Despite these difficulties, DPEA has recently received approval for the connection of the Project to the NEM. This approval represents one of the key milestones in the development of any renewable energy project, and its granting clears the way for the funding and construction of the Project.

2 Proposed Variation

2.1 Overview

The original development approval was posited on a “design envelope” approach whereby the principal dimension of 150m maximum tip height was used as the overall limiting size parameter but referenced a nominal rotor diameter and hub height based on candidate turbines available at the time, and a nominal turbine generation capacity of 3.5MW for the purposes of assessment.

Subsequently, in 2017 the Project went to tender and several (then) newer wind turbines were proposed with rotor diameters ranging in size from 136m to 140m utilising towers of between 82m and 80m respectively in order to maintain overall maximum tip height of 150m. Similarly, turbine generation capacities varying between 3.4MW and 3.7MW were proposed as part of the tender process.

Consequently, in April 2017 the applicant sought explicit advice from DPTI about whether these turbines would fall within the approved design envelope, and was advised that:

> *"…the Department will consider the proposed changes – comprising 136-140m rotor diameter, 80-82m towers, to an overall maximum tip height of 150m, and the possible selection of 3.4MW or 3.7MW machines - under the conditional / reserved matters provision (Condition 3) of the development authorisation granted by the Minister for Planning on 2 August 2016."*

and further that:

> *"No separate variation application is required, being within the tolerance of the initial authorisation (noting no increase in overall turbine height, and other minor changes being a result of design development and technological improvement). It is also noted that the overall generation threshold of 375MW will continue to be met for this project stage."*

In the intervening period, wind turbine technology has seen significant advances, hence this variation application seeks to facilitate the use of the latest wind turbine technologies which offer higher yields through larger rotor diameters, higher hub heights and larger generators which deliver more energy at lower cost which ultimately translates to lower electricity cost to the consumer.

2.2 Revised Turbine Design Envelope

This variation seeks changes to turbine design envelope for the Project. Specifically, the changes to the design envelope sought are:

- An increase in the maximum tip height from 150m to 185m;
- An increase in the maximum rotor diameter from 140m to 155m;
- An increase in the nominal hub-height from 82m to 107.5m; and,
- An increase in the nominal turbine generation capacity from 3.5MW to 4.5MW.

An illustration of the revised turbine envelope is presented in Appendix 10.

2.3 Reduction in Total Number of Turbines

The use of larger, more efficient turbines facilitates a reduction in the total number of turbines required to meet the total approved generation capacity. Consequently, this variation seeks a reduction in the total number of wind turbines from the 59 to 50 machines. However, all assessments are made against a 59-turbine layout and hence represents a "beyond worst-case" scenario.

2.4 Revised Turbine Layout

As discussed in Section 1.2 above, this variation also seeks minor changes to the turbine layout. As anticipated in the original development application, these changes are necessary to accommodate:

1. An unregistered microwave link;
2. An incorrectly registered microwave link; and,
3. Changes due to the impact of 1. and 2.

Whilst the total number of turbines will be reduced from 59 to 50, the selection of the final 50 turbines will be subject to detailed design subject to full geotechnical investigations and hence it is yet to be determined which turbines will be deleted from the layout. All assessments will be made against a 59-turbine layout and hence represents a "beyond worst-case" scenario.

3 Planning Considerations

The proposed variation does not alter the nature of the original development as approved by the Minister for Planning (as described in Decision Notification Form (DNF) #660/V008/15. Further it does not involve land not included in the original DNF or changes to the approved land use.

Provision for the assessment of an application to vary an existing approval exists under Section 39(6) of the Development Act 1993. The assessment should be against the elements of the development which are being varied rather than the entire development. Similarly, the variation should be assessed in the context of the development which has been previously been approved, rather than in isolation.

In consultation with the planning authority, it was agreed that for the purposes of this variation application, the following matters should be subject to renewed impact assessment:

- Visual Amenity;
- Aviation;
- Bird Strike;
- Noise;
- Traffic and Transport;
- Telecommunications and EMI; and,
- Shadow Flicker.

It was further agreed that the following matters would remain unaffected/unchanged, and therefore require no further assessment:

- Heritage;
- Ecology (excluding bird strike);
- Vegetation clearance;
- Geotech; and,
- Hydrology.

The relevant impact assessments are presented in Section 4 below.

4 Impact Assessments

As outlined in Section 2 above, the two key changes sought in this variation application are changes to the scale of the proposed wind turbines, and changes in their location in order to mitigate against their impact on point-to-point communications links (as anticipated in the original development application).

While the scale of the proposed turbines has been specified, it is clear that changes to the layout are dependent upon an assessment of the impact on point-to-point communications and any changes to the layout required to mitigate against these impacts. Further, since knowledge of the layout is a necessary precondition for the assessment of the wider impacts, it follows that assessment of point-to-point communications impacts, and specification of the resulting layout should precede the remaining impact assessments identified in Section 3 above.

4.1 Telecommunications and EMI

An assessment of potential Telecommunications and EMI impacts of the Project was undertaken as part of the original development application (Chapter 14 – Telecommunications and EMI). This assessment determined that the only potentially significant impact of the project was associated with the physical obstruction point-to-point microwave links, hence the current assessment will be limited to site-crossing microwave links.

In undertaking the original assessment, DPEA followed best-practice by conducting an analysis of all known (by virtue of their registration with the Australian Communications and Media Authority) site-crossing microwave links. The Project was subsequently designed to avoid these links. It was subsequently discovered (during the consultation process) that one of these links (operated by the Australian Rail Track Corporation (ARTC)) was unregistered and another of these links (operated by Electranet) had been moved without a corresponding amendment to its registration.

Although under no obligation to do so, DPEA elected to mitigate the impact by relocating turbines at the detailed design stage (i.e. post-consent) as outlined in the original development application. In this variation we seek to explicitly mitigate this potential impact through minor changes to the turbine layout as anticipated in the original approval for the Project.

An updated analysis informing these changes is presented in Appendix 11. This analysis indicates that the Project (including the layout changes proposed as part of this variation) will have no impact on any site-crossing (and, by definition any non-site crossing) microwave communications links, and will result in a reduced impact as compared with the previously approved development.

The original and amended layouts are presented together in both tabular and graphical forms as Appendix 12 and Appendix 13 respectively. This amended layout forms the basis upon which all subsequent assessments are made.

4.2 Visual Amenity

DPEA engaged Convergen Pty Ltd to update the original photomontages (provided here for reference as Appendix 14) for the Project to reflect the larger scale of the proposed wind turbines (provided here as Appendix 15) as well as a comparison photomontage showing a direct comparison between the approved turbines and the proposed turbines at close range (provided here as Appendix 16).

As discussed in Section 4 above, nine turbines will be dropped from the original layout, however it remains to be determined which of the original 59 turbines locations will be utilised in the final layout. For this reason, the updated photomontages depict the full 59 turbine layout and therefore represent a "beyond worst-case" scenario.

DPEA subsequently engaged URPS Pty Ltd to undertake a planning assessment of the proposed variation, provided here as Appendix 17 and informed by the updated photomontages. The URPS assessment concluded that:

> *"The visual impact of the proposed varied wind turbines upon parts of the Rural Landscape Protection Zone is to be anticipated given that wind farms and associated development are so clearly anticipated in the Primary Production Zone.*
>
> *The proposed larger wind turbines will be more visible, depending upon where they are viewed from. From many key vantage points in the wider locality, however, the increase in turbine size will be difficult to perceive. This is particularly when they are viewed against the sky or the ranges depending upon their colour at different times of day.*
>
> *Given that large scale of the originally approved wind turbines, the change to visual impact of the proposed increase in turbine size satisfies the relevant provisions of the Development Plans."*

Hence it is contended that even neglecting the reduction in visual impact resulting from a reduced number of turbines, the proposed variation satisfies the planning scheme insofar as it relates to visual amenity.

4.3 Aviation

DPEA engaged Landrum & Brown Worldwide (Aust) Pty Ltd to undertake an updated Aeronautical Impact Assessment (provided here as Appendix 18). Again, this impact assessment was undertaken on the basis of the original 59 turbine layout, updated to reflect the larger turbines and changes to the layout discussed in Section 2.4 above, and hence

represents a "beyond worst-case" scenario. The Landrum & Brown assessment concluded that:

> *"The proposed Port Augusta REP development, south east of Port Augusta township, to a maximum height of 327.5 m AHD:*
>
> - *is located within Class G airspace;*
> - *will not infringe any OLS;*
> - *will not infringe the PANS OPS surfaces of any airport;*
> - *will not impact on contingency procedures at certified aerodromes;*
> - *is located outside the clearance zones associated with all ATC surveillance radar systems;*
> - *the cumulative effect of this wind farm and that of neighbouring wind farms will not impact upon the ATC surveillance radar systems;*
> - *will not infringe the LSALT protection surfaces for any air route;*
> - *will not infringe the relevant Grid LSALT;*
> - *is outside the clearance zones associated with any aeronautical navigation aids;*
> - *will have little or no impact upon local flying activities as the local flying club already restricts flight operations over the area; and*
> - *will provide a significant visual navigation feature in the region."*

DPEA subsequently submitted the AIA to Airservices Australia for assessment. Airservices Australia concluded that:

> *"**Airspace Procedures***
>
> *With respect to procedures promulgated by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 327.5m (1075ft) AHD, the wind farm will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Port Augusta Airport, nor will it affect any air route lowest safe altitudes.*
>
> *Note that procedures not designed by Airservices at Port Augusta Airport were not considered in this assessment.*
>
> ***Communications/Navigation/Surveillance (CNS) Facilities***
>
> *This wind farm, to a maximum height of 327.5m (1075ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links."*

The full Airservices Australia response is included here as Appendix 19.

On the basis of the Landrum and Brown AIA and the Airservices Australia response, it is contended that even neglecting the reduction in aeronautical impact resulting from a reduced number of turbines, the proposed variation does not represent a risk to aviation.

4.4 Bird Strike

DPEA engaged Atlantic Ecology to update the Project's Ornithology Assessment, provided here as Appendix 20. Among other things, the assessment concluded that:

> *"The collision risk modelling for Eastern Curlew and Curlew Sandpiper for turbines of 150m or 155m diameter and installed with a ground clearance of 30m indicates that the risk of collision mortality would be substantially lower than for the smaller sized turbines with lower ground clearance modelled previously (DPEA, 2016; NRP, 2016). The likelihood of collision mortality for all the turbine size/ground clearance scenarios is evaluated as very low for both species. The previous conclusion that the risks to these species from the Project are negligible remains unchanged."*

and that:

> *"The potential for collision risk to other bird species that use the development site is examined qualitatively. It is concluded that the increasing ground clearance to 30m would reduce, the collision risks to most other bird species. This is particularly so for those species that tend to fly at or a little above the canopy of the scrub vegetation that occurs across parts of the development site (Group 3 species in Table 8). Compared to the smaller turbines, turbines of 150m or 155m diameter turbines could potentially lead to a modest increase (by approximately 10 – 20%) in the relative collision risk to the two species that typically fly at heights above 30m, namely wedge-tailed eagle and black kite. However the absolute risk to these species' receptor populations remains negligible."*

These reduced impacts are the cumulative result of the increased ground clearance and slower rotation speed of the proposed larger turbines. Hence it is contended that even neglecting the reduction in bird strike impact resulting from a reduced number of turbines, the proposed variation represents an overall reduced risk of bird-strike impact.

4.5 Noise

DPEA engaged Sonus Pty Ltd to update the Project's Wind Farm Environmental Noise Assessment, provided here as Appendix 21. The assessment was undertaken on the basis of one of the candidate machines under consideration, being the Vestas V150 4.2 wind turbine. The assessment concluded that:

> *"Noise predictions have been made and assessed against criteria developed in accordance with the South Australian Environment Protection Authority Wind farms environmental noise guidelines July 2009, the Environment Protection (Noise) Policy 2007, and where relevant (for beneficiaries to the project), the World Health Organisation guidelines.*
>
> *Based on the predictions, the noise from the proposed variation results in:*

- *lower noise levels compared to the Stage 1 Sonus Assessment;*
- *noise criteria being achieved at all receivers where the landowners do not have a commercial agreement with the Project (neighbours);*
- *beneficiaries being protected from unreasonable interference to their amenity with the inclusion of the recommendations of this report.*

Based on the above it is considered that the proposal can be designed and constructed to prevent adverse impact and ensure it does not detrimentally affect the amenity of the locality, thereby satisfying the relevant provisions of both the Port Augusta Council and the Mount Remarkable Council Development Plans."

These reduced impacts are the result of the decreased native sound power levels of the assessed wind turbines resulting from the reduced rotation speed and improved noise reduction measures as compared to the (currently approved) turbines originally proposed for the site. Hence it is contended that even neglecting the reduction in noise impact resulting from a reduced number of turbines, the proposed variation represents a significant reduction in the noise impact associated with the wind farm.

4.6 Traffic and Transport

The proposed variation does not involve any additional transport movements, rather only an increase in the dimension of some of the turbine components that would be transported to the site. The traffic and transport assessment was therefore limited to an updated assessment of the route feasibility assessment included as part of the original full traffic and transport assessment for the approved project.

DPEA engaged GTA consultants to undertake an updated Route Feasibility Assessment for the larger turbines, provided here as Appendix 22. Again, this impact assessment was undertaken on the basis of the original 59 turbine layout, updated to reflect the larger turbines, and hence represents a "beyond worst-case" scenario. The GTA Consultants assessment found that:

"Based on the findings and discussion presented in this report, GTA Consultants considers that the proposed over-dimensional transport route between Port Adelaide and the site (and the return route) will be suitable subject to some minor modifications being made to existing road infrastructure.

The locations of the proposed site access and egress points are considered appropriate with good sight distance available in accordance with relevant design standards and guidelines. The access points will be constructed to accommodate the largest design vehicles expected to enter and exit the site.

It has been demonstrated that wind turbine components have successfully been transported along sections of the proposed routes. All over-dimensional movements will be accompanied by pilot vehicles and include appropriate traffic management measures."

and further concluded that:

> *"On the above basis, GTA considers it feasible to transport the project components along both of the proposed routes subject to minor mitigation works and adherence to any requirements to cross rail infrastructure."*

Hence it is contended that the changes required to accommodate the increased turbine dimensions proposed for this variation are entirely feasible and not inconsistent with past practices adopted for existing wind farm projects.

4.7 Shadow Flicker

4.7.1 Evaluation Method

In line with the National Wind Farm Development Guidelines (Draft July 2010)[1], DPEA has carried out a shadow flicker assessment using WindFarm. This software takes into account the relative position of the wind turbine, the observer, and the sun over the course of a full year. A number of inputs were provided to complete the assessment including surface topology from a digital terrain map and wind turbine specifications, dimensions, and positions.

4.7.2 Non-beneficiary Dwellings

Application of the criteria provided in the National Guidelines yields a consultation range of approximately 1192m (265 x blade chord (typically 4.5m). Since no wind turbines are within 2.0km of any non-beneficiary dwelling, no shadow flicker effects are expected at any non-beneficiary dwelling as shown in Appendix 23.

4.7.3 Beneficiary Dwellings

In terms of beneficiary dwellings, the results indicate that Houses 2, 12 and 13 will be exposed to less than 10 hours of shadow flicker per year. House 2 is unoccupied, and houses 12 and 13 are both unoccupied and derelict. House 11 will be exposed to between 10 and 40 hours per year, however as a beneficiary dwelling, the occupants will be offered appropriate treatments (screening, plantings) as required.

Houses 4, 10 and 14 will be exposed to greater than 40 hours per year of shadow flicker per year. House 4 is derelict and unoccupied and must be demolished under the conditions of the original development application. Houses 10 and 14 both sit in heavily vegetated areas of the site and are therefore likely to be screened from any shadow flicker. However, as with house 11, as beneficiary dwellings, the occupants will be offered appropriate treatments as and if required.

[1] Environment Protection and Heritage Council (EPHC) (2010) National Wind Farm Development Guidelines – Draft July 2010, p. 148.

4.7.4 Road Users

Whilst there will be shadowing effects on public roads including the A1, as stated within the National Wind Farm Development Guidelines (2010) there is a negligible risk associated with distraction of vehicle drivers who experience shadowing, therefore impacts from shadowing effects on public roads users are considered negligible, as was determined through the consultation process for the original application.

4.7.5 Overall Impact

In conclusion it is contended that whilst shadow flicker effects will marginally increase beyond those determined for the original application, no non-beneficiaries are impacted and the impact on beneficiaries is easily mitigated.

5 Consultation

DPEA has engaged with the following parties in advance of the lodgement of this Variation application:

- Port Augusta City Council;
- District Council of Mount Remarkable;
- Port Augusta Flying Club;
- Port Augusta Coastal Homes Association; and
- Minister for Energy.

DPEA has committed to further engagement with each of these parties throughout the public consultation process.

6 Conclusions

This application seeks to vary the existing development approval #660/V008/15 for the Port Augusta Renewable Energy Park. Specifically, this variation application seeks:

- An increase in the maximum tip height from 150m to 185m;
- An increase in the maximum rotor diameter from 140m to 155m;
- An increase in the maximum hub-height from 82m to 107.5m; and,
- An increase in the nominal turbine generation capacity from 3.5MW to 4.5MW;
- A decrease in the number of turbines from 59 to 50
- Minor changes to the turbine layout as anticipated in the original development application.

In order to determine the impact of these changes, the following matters have been assessed:

- Visual Amenity;
- Aviation;
- Bird Strike;

- Noise;
- Traffic and Transport;
- Telecommunications and EMI; and,
- Shadow Flicker

These assessments have shown that (compared to the currently approved development):

- The larger and taller turbines represent a modest increase to the visual impact of the Project
- The reduced number of turbines will result in a modest decrease to the visual impact of the Project
- The impact on aviation remains unchanged
- There is a reduced impact on birds due to the increased ground-tip clearance and the slower rotation speed of the larger turbines proposed for the Project
- There is a reduced noise impact due to both the reduced noise levels of the larger turbines, and the reduced number of turbines proposed for the project
- There is a moderately increased impact associated with the transport of the larger turbine components proposed for the project
- There is a moderately reduced traffic impact due to the reduced number of turbines proposed for the project
- There is a significantly reduced impact on point-to-point telecommunications services due to adjustments of the turbine layout
- There is a moderately increased shadow flicker impact for Project beneficiaries
- There is no change in the shadow flicker impact on non-beneficiary dwellings

On balance, the results of the various impact assessment demonstrate the overall impact of the development is similar, or perhaps lower than that of the currently approved development. It is therefore contended that the development warrants approval.

Port Augusta Renewable Energy Park

Figure A3

Project Location

Project Site

Davenport Substation

Ver	Date	Drawn by	Checked	Approved
V1.0	23/03/2019	FK	DB	GP

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:200,000 Printed @ A3

Filename:

App_03_PA DA_Proj Loc (Final)

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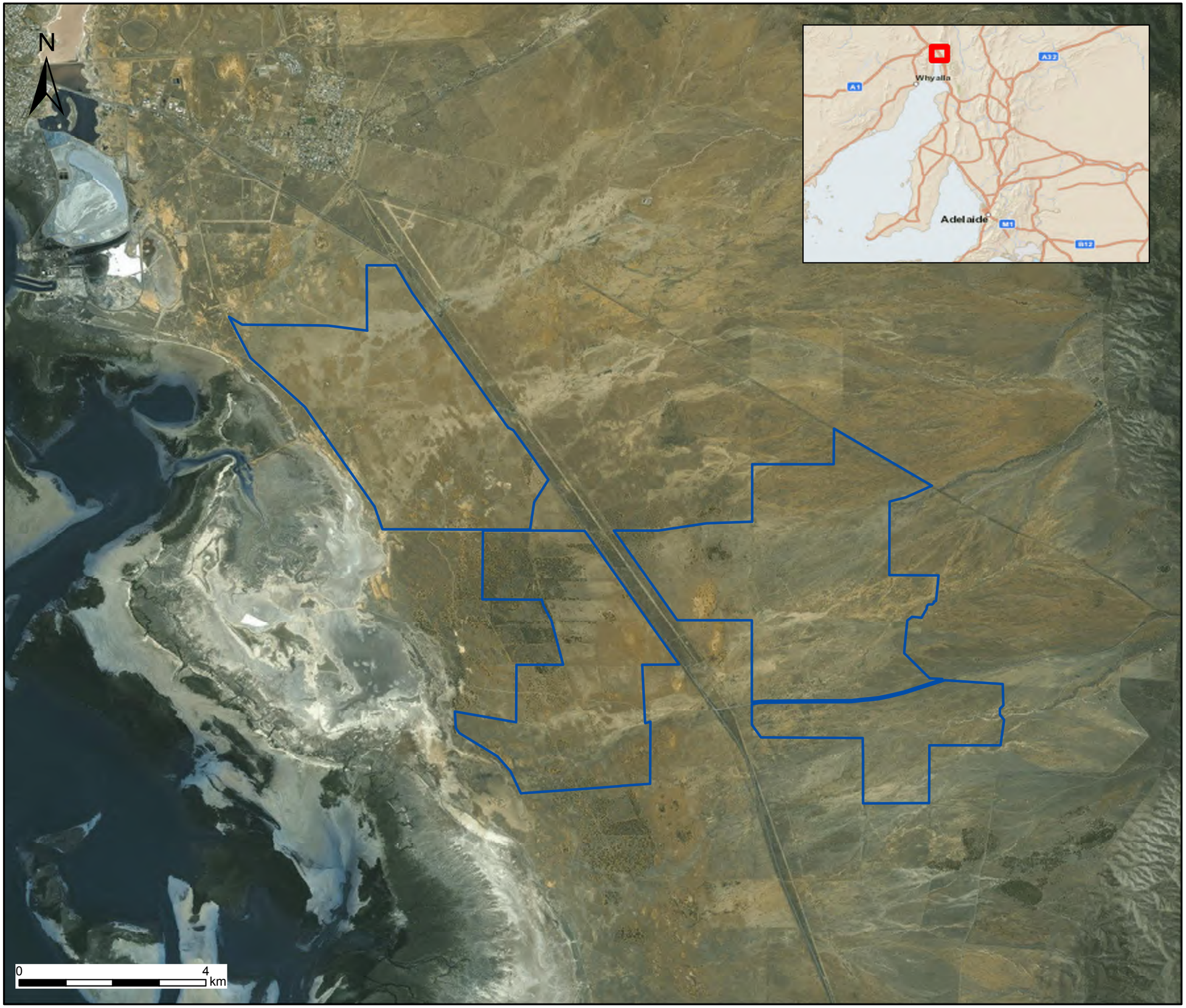

Port Augusta Renewable Energy Park

Figure A4

Project Site

Project Site

Ver	Date	Drawn by	Checked	Approved
V1.0	23/03/2019	FK	DB	GP

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:80,000 Printed @ A3

Filename:

App_04_PA DA_Proj Site (Final)

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Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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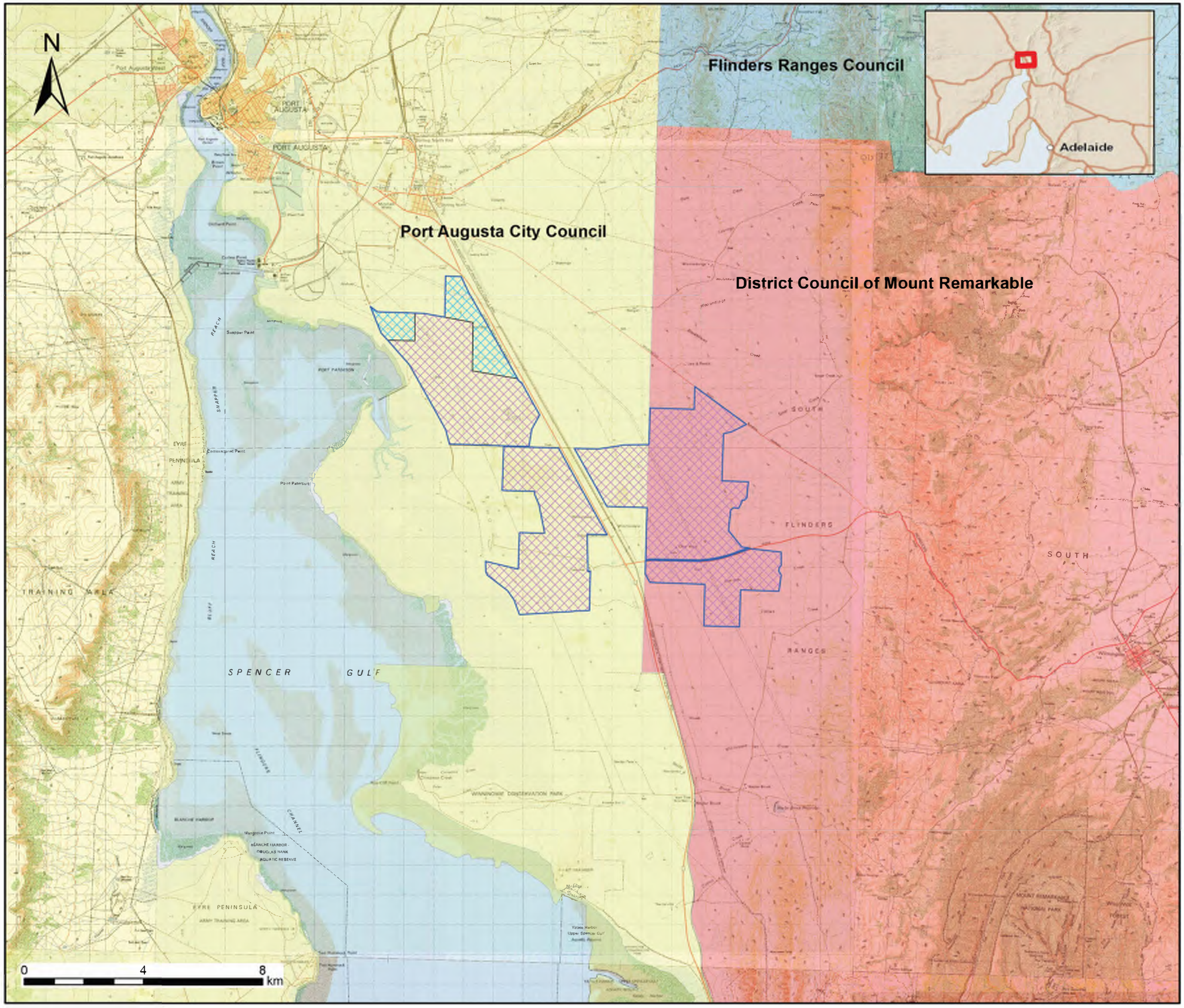
Port Augusta Renewable Energy Park

Figure A5

Local Government Areas



Project Boundary
Wind Site
Solar Site
District Council of Mount Remarkable
Flinders Ranges Council
Port Augusta City Council

Ver	Date	Drawn by	Checked	Approved
V1.0	04/11/2015	FK	DB	GP

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:125,000 Printed @ A3

Filename:

App_05_PA DA_LGA (Final)

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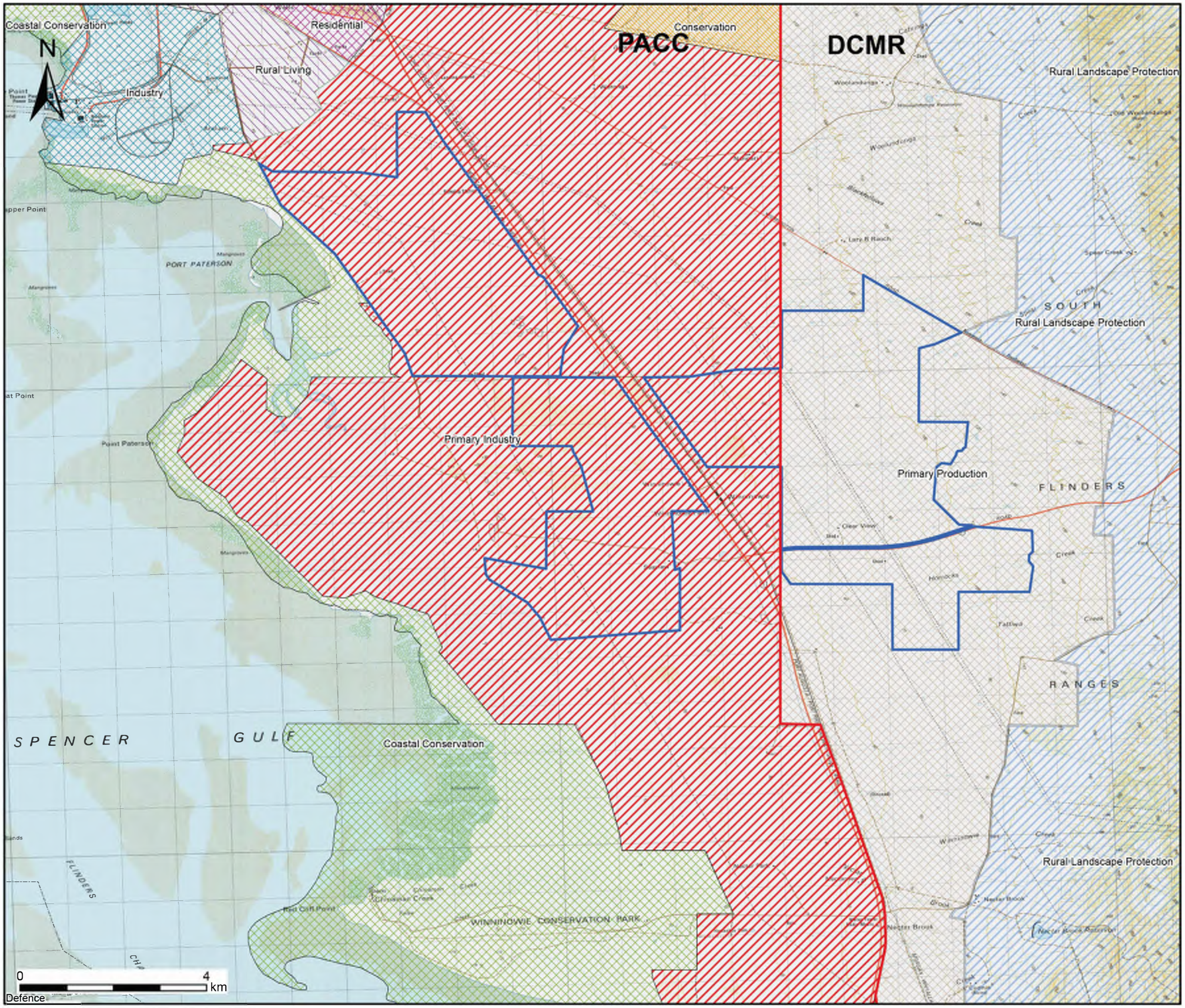
Port Augusta Renewable Energy Park

Figure A6

Council Zones



- Project Boundary
- Primary Production
- Rural Landscape Protection
- Primary Industry
- Conservation
- Coastal Conservation
- Industry
- Residential
- Rural Living

PACC - Port Augusta City Council
DCMR - District Council of Mount Remarkable

Ver	Date	Drawn by	Checked	Approved
V1.1	04/11/2015	FK	DB	GP

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:80,000 Printed @ A3

Filename:
App_06_PA DA_CouncilZones (Final)

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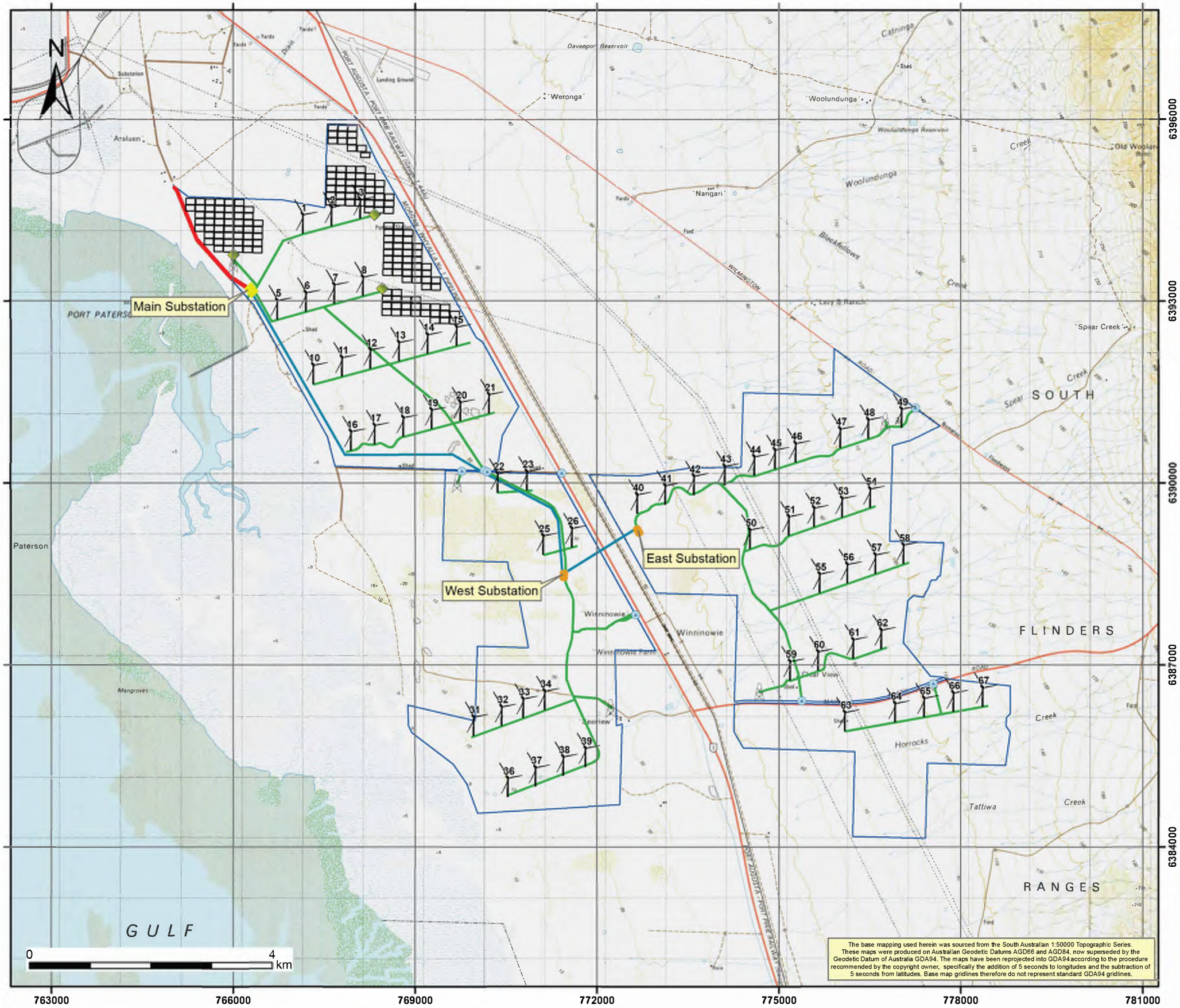
Port Augusta Renewable Energy Park

Figure A7

Project Design Layout



- Project Boundary
- Turbines
- Solar PV Modules
- PV Interconnection Substations (not to scale)
- Site Access/Exit Points
- MainSubstation/Offices (not to scale)
- Substations (not to scale)
- Export Line (Shown to Project Boundary only)
- 132kV Overhead Line
- Permanent Met Masts
- Tracks

Ver	Date	Drawn by	Checked	Approved
V1.0	23/03/2019	FK	D B	G P

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:60,000 Printed @ A3

Filename:
App_07_PA DA_Proj Des (Final)

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Port Augusta Renewable Energy Park

Figure A8

Project Design Layout - Including Temporary Infrastructures -

Main Substation

West Substation

East Substation

Construction Compound

Batching Plant

Batching Plant

Construction Compound

Project Boundary

Turbines

Solar PV Modules

Water abstraction tapping

PV Interconnection Substations (not to scale)

Site Access/Exit Points

MainSubstation/Offices (not to scale)

Substations (not to scale)

Borrow Pit Search Area

Batching Plant

Construction Compound

Export Line (Shown to Project Boundary only)

132kV Overhead Line

Permanent Met Masts

Temporary Met Masts

Tracks

Ver	Date	Drawn by	Checked	Approved
V1.0	23/03/2019	FK	DB	GP

Coordinate System
GCS GDA 1994

Size
A3

Scale 1:60,000 Printed @ A3

Filename:
App_08_PA DA_Proj Des incl Temp (Final)

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The base mapping used herein was sourced from the South Australian 1:50000 Topographic Series. These maps were produced on Australian Geodetic Datums AGD66 and AGD84, now superseded by the Geodetic Datum of Australia GDA94. The maps have been reprojected into GDA94 according to the procedure recommended by the copyright owner, specifically the addition of 5 seconds to longitudes and the subtraction of 5 seconds from latitudes. Base map gridlines therefore do not represent standard GDA94 gridlines.

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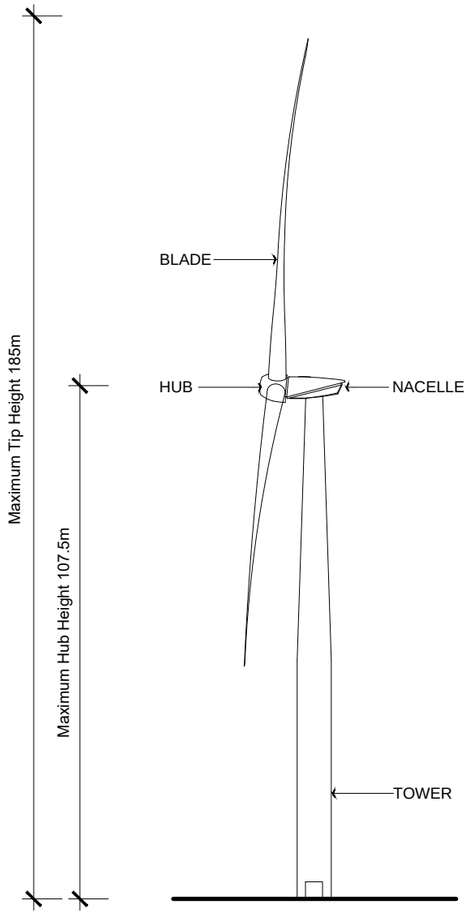
N

0 4 km

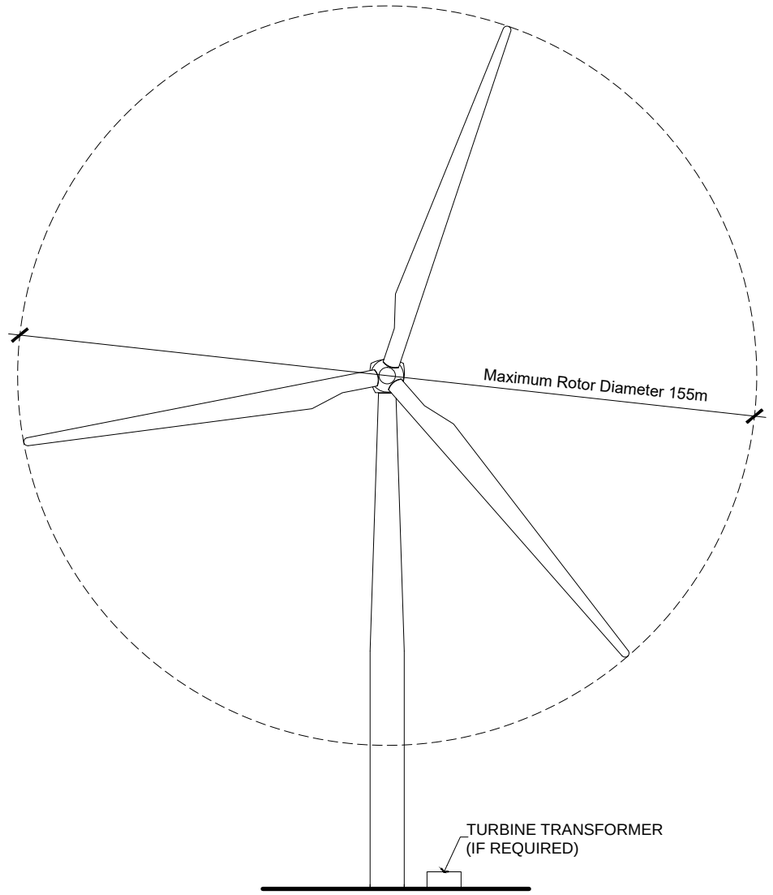
763000 766000 769000 772000 775000 778000 781000

6396000 6393000 6390000 6387000 6384000

Sec/Allot	PlanType	Road	Locality	CT Reference
s696	H330600	Port Paterson Rd	Port Paterson	CT 6151/864
s697	H330600	Port Paterson Rd	Port Paterson	CT 6151/864
s698	H330600	Port Paterson Rd	Port Paterson	CT 6151/864
S699	H330600	Augusta Highway	Port Paterson	CT 6151/864
S700	H330600	Augusta Highway	Port Paterson	CT 6151/864
S708	H330600	Augusta Highway	Port Paterson	CT 6151/864
S682	H330600	Port Paterson Rd	Port Paterson	CT 5480/196
5695	H330600	Port Paterson Rd	Port Paterson	CT 5480/196
S694	H330600	Augusta Highway	Port Paterson	CT 5229/724
5684	H330600	Augusta Highway	Port Paterson	CT 5229/726
5683	H330600	Gade Road	Port Paterson	CT 5229/727
S688	H330600	Farm Access	Winninowie	CT 5463/300
5920	H331400	Farm access	Winninowie	CT 5463/314
S921	H331400	Farm access	Winninowie	CT 5463/314
S922	H331400	Farm access	Winninowie	CT 5463/314
5923	H331400	Farm access	Winninowie	CT 5463/314
S687	H330600	Pillion Road	Winninowie	CT 5641/229
S662	H330600	Farm Access	Winninowie	CT 5676/249
S663	H330600	Farm Access	Winninowie	CT 5676/249
S12	H331400	Horrocks Pass Rd	Winninowie	CT 5936/973
S19	H331400	Horrocks Pass Rd	Winninowie	CT 5936/973
S357	H331400	Horrocks Pass Rd	Winninowie	CT 5936/973
A400	D71015	Farm Access	Winninowie	CT 6015/882
S16	H331400	Horrocks Pass Rd	Winninowie	CT 6015/882
S17	H331400	Horrocks Pass Rd	Winninowie	CT 6015/882
531	H331400	Farm Access	Winninowie	CT 6015/882
S32	H331400	Farm Access	Winninowie	CT 6015/882
S33	H331400	Farm Access	Winninowie	CT 6015/882
S34	H331400	Farm Access	Woolundunga	CT 6015/882
S35	H331400	Spear Creek Rd	Woolundunga	CT 6015/882
S360	H331400	Horrocks Pass Rd	Winninowie	CT 6015/882
S661	H330600	Port Paterson Rd	Winninowie	CT 6015/882
S669	H330600	Farm Access	Winninowie	CT 6015/882
S670	H330600	Farm Access	Winninowie	CT 6015/882
S674	H330600	Augusta Highway	Winninowie	CT 6015/882
S676	H330600	Pillion Road	Winninowie	CT 6015/882
S677	H330600	Augusta Highway	Winninowie	CT 6015/882
S678	H330600	Gade Road	Winninowie	CT 6015/882
S686	H330600	Augusta Highway	Winninowie	CT 6015/882



SIDE ELEVATION



FRONT ELEVATION

NOTES:

1. THIS DRAWING IS FOR DEVELOPMENT PURPOSES ONLY AND NOT FOR CONSTRUCTION
2. DIMENSIONS NOT TO BE SCALED
3. COMPONENTS SHOWN ARE INDICATIVE ONLY
4. DESIGN ENVELOPE NOT TO EXCEED 185 m HEIGHT ABOVE GROUND LEVEL

PROJECT TITLE

PORT AUGUSTA
RENEWABLE ENERGY PARK

DRAWING TITLE

TYPICAL WIND TURBINE

DRAWN BY	CHECKED BY	DATE	FINAL ISSUE
AS	DB	23/03/19	23/03/19

DRAWING N0.
V1.0

PAPER SIZE
A3

SCALE
1:1000

REVISION
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Appendix 11: Updated Point-to-Point Link Impact Assessment

Contents

Introduction:

This analysis has been undertaken to support an application to vary the development approval (the Variation) for the Port Augusta Renewable Energy Park – Stage 1 (the Project). The Variation seeks to increase the approved maximum turbine tip height for the Project from the current 150m above ground level (agl) to a new maximum of 185m agl and an increase in the approval for a maximum rotor diameter of 140m to a new maximum rotor diameter of 155m.

In addition to the abovementioned increases in tip height and rotor diameter, minor changes to the turbine layout are proposed in order to mitigate impacts to one unregistered and one incorrectly registered point-to-point link. These changes were anticipated in the original development application[1] and are explicitly incorporated into this Variation application.

This analysis serves two purposes, firstly it is used as a tool to inform the revised layout in order to demonstrate that the proposed changes implement the mitigation measures proposed in the original development application. Secondly it is used to demonstrate that the proposed layout changes *in conjunction with* the increased turbine rotor diameter and tip height does not impact any site-crossing point-to-point links.

Methodology

The methodology employed herein is largely identical to that employed in the original assessment, namely:

1. Map turbines and potentially impacted radio links identified in original application;
2. Measure distance from radio link transmitters and receivers to the closest interference point along link for each identified turbine;
3. Measure vertical displacement between turbines nearest identified radio links;
4. Eliminate turbines with no potential to interfere with radio links on the basis of vertical displacement;
5. Measure the height above sea level for the interference point and the ground height of the turbine base for the remaining turbines;
6. Calculate the 2nd Fresnel zone[2] for each interference point; and,
7. Calculate the separation distance between the 2nd Fresnel zone and the outermost dimension of the turbine swept area;

[1] Volume 2, Chapter 14
[2] Ref. Section 14.7.4. of the Project's original development application

The results of this analysis are then used to adjust the original layout, taking into account minimum cross-wind turbine spacings.

Analysis and Results

As outlined in the Project's original development application only 3 point to point links were significantly affected by turbine placement. Two of these links are operated by Electranet and the third by the Australian Rail Track Corporation (ARTC). The northern endpoint of both Electranet links at Davenport substation is incorrectly registered[3] and the ARTC link is unregistered[4]. These links are illustrated in Figure 1 below[5], with potentially problematic turbines identified in yellow.

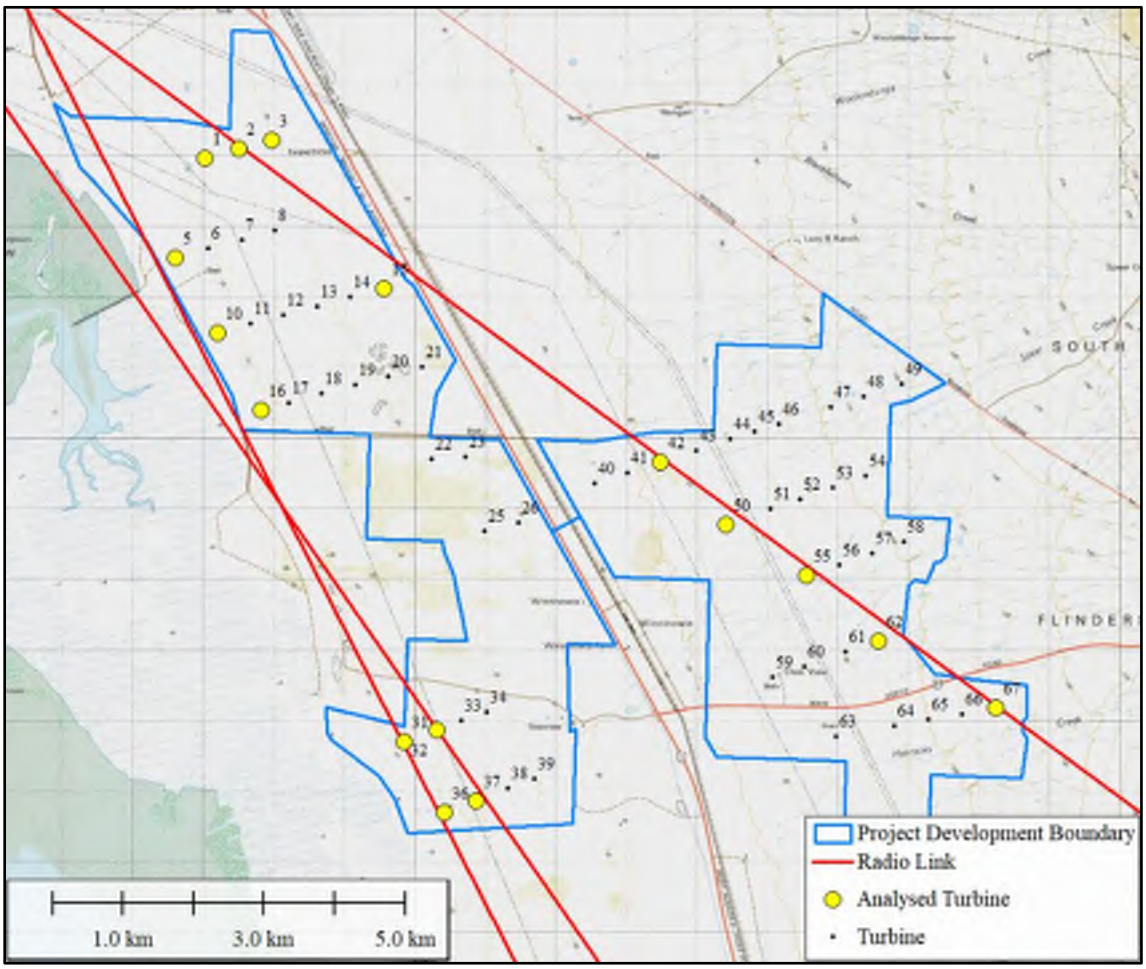


Figure 1 Potentially Impacted Point-to-Point Radio Telecommunications Links

[3] Pers comms, Hoang Nguyen, Principal Land Management Advisor, Regulation and Land Management, Electranet, 14/9/2015
[4] Pers comms, Paul Hunt, Team Manager, Control & Wayside Systems, ARTC 10/9/2015
[5] Based on link coordinates provided by link operators

Details of each of these links are provided in Table 1 below, together with the specific turbines which have potential to impact these links.

Table 1 Identified radio links and conflicting turbines

Licence Number	Link ID	Site Locations	Licensee	Identified Turbines
1568979	328860	Davenport Substation - Mt Karia	ElectraNet	1, 2, 3, 15, 42, 50, 62, 67
1911893	365314	Davenport Substation - Nectar Brook	ElectraNet	5, 10, 16, 31, 36
NA	NA	Port Augusta - Nectar Brook	ARTC	32, 37

DPEA subsequently undertook a line-of-sight analysis against the original layout for each of the links listed in Table 1. In order to conduct this analysis, DPEA employed a GIS software package known as Global Mapper. Global Mapper includes a line-of-sight tool which allows the vertical clearance between any turbine and the path of the microwave link to be calculated, taking into account both atmospheric corrections[6] and Earth curvature. Figure 2 below illustrates the graphical output of Global Mapper's line-of-sight tool.

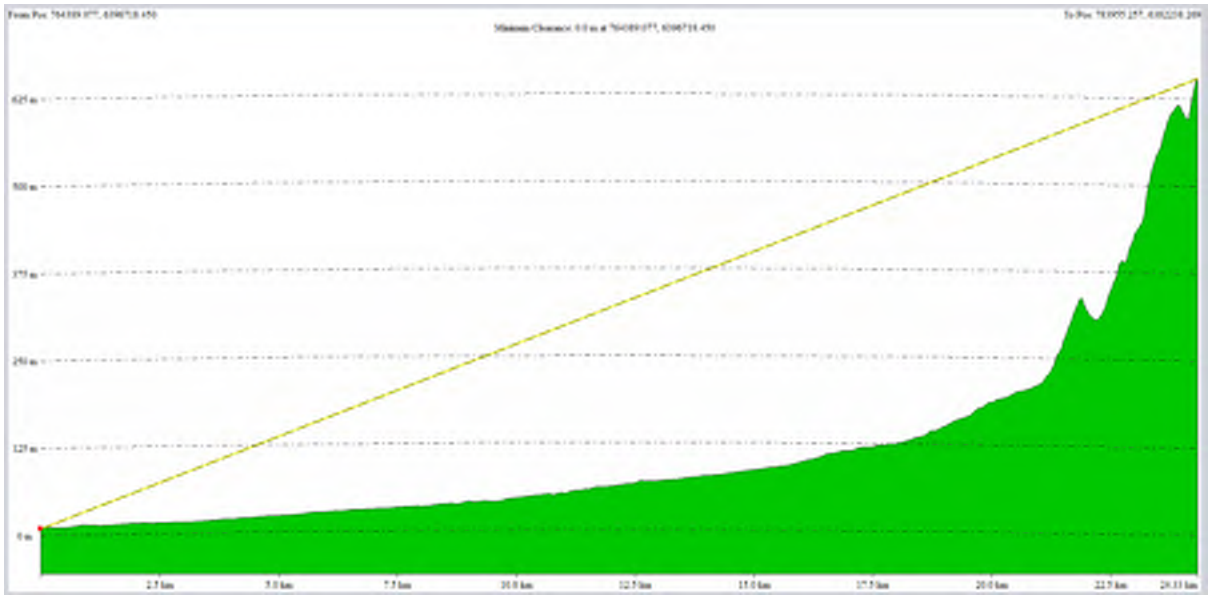


Figure 2 Line of site path profile

[6] An atmospheric correction factor of 1.333 was used for the purpose of this analysis

A line-of-sight analysis using the preferred candidate turbine (Vestas V150, 150m rotor and 105m hub height) was conducted for each of the turbines identified in Table 1 above. This analysis indicated that only four of the turbines, being turbines 2, 31, 32 and 36 had the potential (as indicated by negative Fresnel-Blade disc clearances) to impact site-crossing links. These results are in complete agreement with those of the original analysis and anticipated in the original development application (Volume 2, Chapter 14, Section 14.7.4), and are provided in Table 2 below.

Table 2 Clearances Based on the Original Layout, 150m rotor and 105m hub height

Turbine	Beam-Hub Clearance (m)	Beam-Blade Disc Clearance (m)	2nd Fresnel Zone Radius (m)	Fresnel Zone-Blade Disc Clearance (m)
2	48.01	-26.99	9.26	-36.25
31	55.40	-19.60	12.74	-32.34
32	76.69	1.69	12.88	-11.18
36	80.52	5.52	12.87	-7.36

The locations of the turbines identified in Table 2 above were subsequently adjusted, as outlined in Table 3 below to remove any potential impact on the identified links.

Table 3: Turbine Location Adjustments in Order to Eliminate Point-to-Point Link Impacts

Turbine	Action
2	Moved 85m west along row.
31	Moved 124m west along row
32	Moved 190m west along row
36	Moved 60m east along row

Again, these changes are very close to those anticipated in the original development application. The layout adjustments outlined in Table 3 above necessitated further adjustments in adjacent turbines in order to maintain appropriate cross-wind spacing between turbines as shown in Table 4 below.

Table 4 Turbine Location Adjustments in Order to Ensure Sufficient Cross-Wind Spacing

Turbine	Action
33	Moved 98m west along row
38	Moved 47m west along row

Finally, the analysis was repeated to ensure that the adjusted layout did not impact any of the identified point-to-point links, with the results provided in Table 5 below, demonstrating that the adjusted layout does not impact on any site crossing link.

Table 5: Analysis Results for Adjusted Layout

Turbine	Beam-Hub Clearance (m)	Beam-Blade Disc Clearance (m)	2nd Fresnel Zone Radius (m)	Fresnel Zone-Blade Disc Clearance (m)
2	114.54	39.54	9.26	30.28
31	114.43	39.43	12.74	26.69
32	133.17	58.17	12.88	45.30
36	134.00	59.00	12.87	46.13

Given that the clearances found in Table 5 above are all greater than 5m, then it is obvious that sufficient clearance also exists for the maximum turbine rotor diameter of 155m sought under this Variation.

Conclusions

The analysis contained herein, considered alongside the analysis presented in the original development application clearly show that the adjusted layout will have no impact on any point-to pint communications links, be they site crossing or otherwise. The impact is therefore considered to be *lower* than that assessed for the original development application, and achieves the mitigations proposed in that application.

Appendix 12: Turbine Coordinate Comparison

Turbine Identifier	Original Layout		Amended Layout	
	Easting	Northing	Easting	Northing
1	767174.805	6394122.831	767174.805	6394122.831
2	767563.76	6394226.747	767646.122	6394248.775
3	768117.642	6394374.726	768117.642	6394374.726
5	766751.678	6392713.624	766751.678	6392713.624
6	767221.954	6392841.319	767221.954	6392841.319
7	767692.697	6392969.145	767692.697	6392969.145
8	768164.561	6393097.27	768164.561	6393097.27
10	767344.366	6391647.152	767344.366	6391647.152
11	767816.652	6391772.8	767816.652	6391772.8
12	768287.586	6391898.084	768287.586	6391898.084
13	768759.009	6392023.499	768759.009	6392023.499
14	769230.947	6392149.054	769230.947	6392149.054
15	769706.951	6392275.677	769706.951	6392275.677
16	767965.152	6390551.161	767965.152	6390551.161
17	768356.975	6390656.329	768356.975	6390656.329
18	768828.273	6390782.606	768828.273	6390782.606
19	769299.663	6390908.675	769299.663	6390908.675
20	769771.17	6391034.771	769771.17	6391034.771
21	770242.594	6391160.826	770242.594	6391160.826
22	770382.391	6389859.076	770382.391	6389859.076
23	770868.234	6389893.256	770868.234	6389893.256
25	771136.527	6388833.775	771136.527	6388833.775
26	771607.704	6388960.048	771607.704	6388960.048
31	769868.978	6385806.573	769985.863	6385848.85
32	770270.829	6385952.764	770449.16	6386017.578
33	770715.448	6386114.484	770807.14	6386147.781
34	771164.104	6386277.687	771164.104	6386277.687
36	770610.083	6384862.607	770554.404	6384841.102
37	771009.694	6385016.956	771009.694	6385016.956
38	771420.379	6385175.611	771464.606	6385192.699
39	771831.615	6385334.465	771831.615	6385334.465
40	772686.312	6389509.809	772686.312	6389509.809
41	773150.459	6389660.564	773150.459	6389660.564
42	773622.088	6389814.152	773622.088	6389814.152
43	774129.207	6389979.346	774129.207	6389979.346
44	774618.371	6390136.325	774618.371	6390136.325
45	774956.04	6390246.125	774956.04	6390246.125
46	775297.168	6390356.945	775297.168	6390356.945
47	776034.844	6390595.265	776034.844	6390595.265
48	776498.545	6390747.104	776498.545	6390747.104

DP Energy Australia Pty. Ltd. ABN: 16 140 516 196
2/53 Mabel Street (PO Box 1451)
Atherton QLD 4883
T: 07 4091 2163

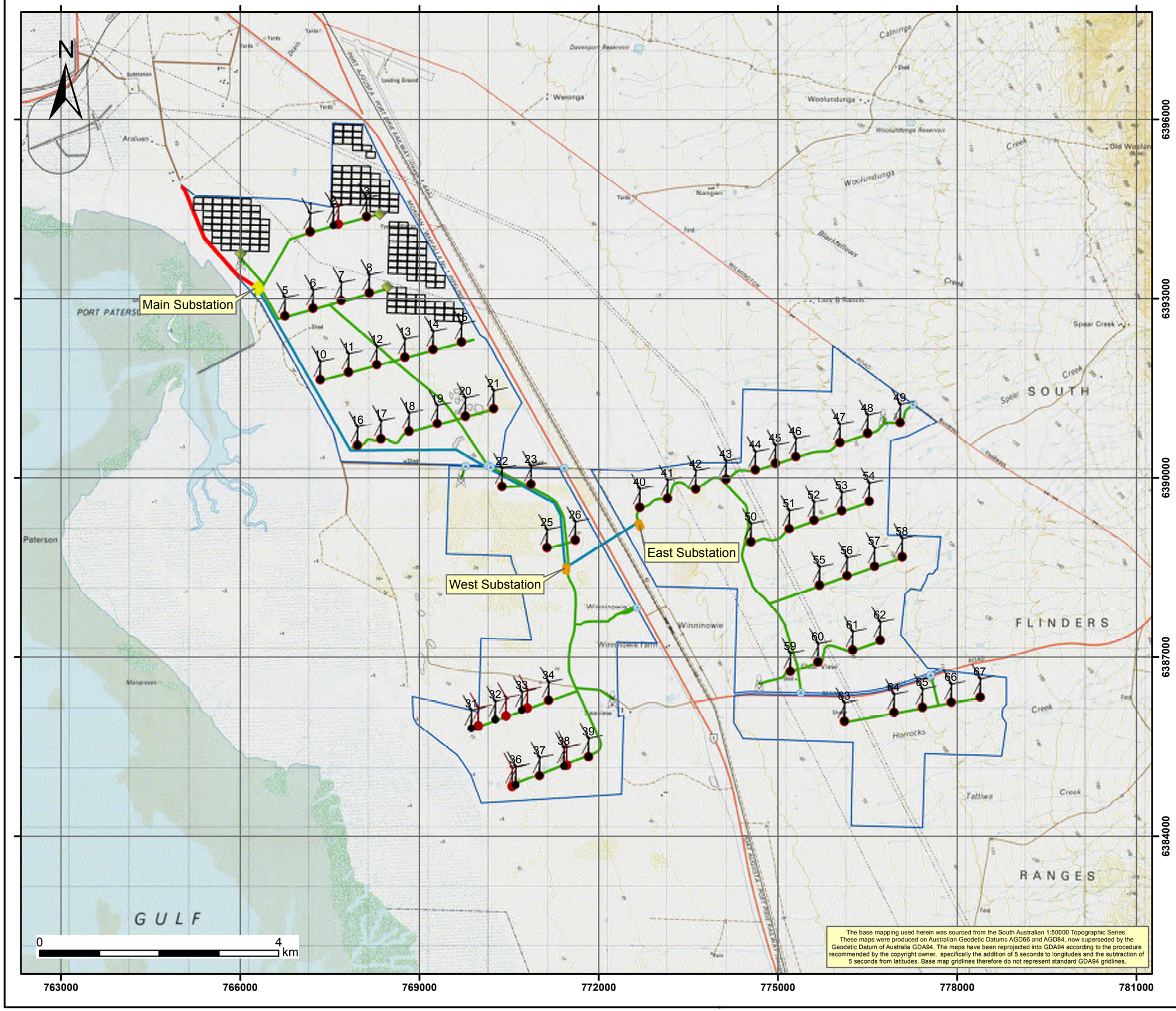
49	777043.266	6390923.448	777043.266	6390923.448
50	774545.628	6388930.967	774545.628	6388930.967
51	775185.504	6389150.43	775185.504	6389150.43
52	775601.96	6389293.255	775601.96	6389293.255
53	776063.658	6389451.992	776063.658	6389451.992
54	776525.148	6389610.408	776525.148	6389610.408
55	775692.484	6388205.562	775692.484	6388205.562
56	776152.846	6388364.49	776152.846	6388364.49
57	776614.361	6388523.29	776614.361	6388523.29
58	777075.62	6388682.398	777075.62	6388682.398
59	775206.037	6386763.936	775206.037	6386763.936
60	775667.296	6386923.505	775667.296	6386923.505
61	776246.994	6387124.189	776246.994	6387124.189
62	776708.022	6387283.758	776708.022	6387283.758
63	776110.374	6385926.894	776110.374	6385926.894
64	776938.503	6386074.599	776938.503	6386074.599
65	777416.677	6386159.998	777416.677	6386159.998
66	777897.498	6386245.765	777897.498	6386245.765
67	778380.159	6386331.86	778380.159	6386331.86

Appendix 13: Original and Amended Layout Comparison

Port Augusta Renewable Energy Park

Figure A13

Original and Amended Project Design Layout



The base mapping used herein was sourced from the South Australian 1:50000 Topographic Series. These maps were produced on Australian Geodetic Datums AGD66 and AGD84, now superseded by the Geodetic Datum of Australia GDA94. The maps have been reprojected into GDA94 according to the procedure recommended by the copyright owner, specifically the addition of 5 seconds to longitudes and the subtraction of 5 seconds from latitudes. Base map gridlines therefore do not represent standard GDA94 gridlines.

- Original Layout
- Amended Layout
- Project Boundary
- Solar PV Modules
- PV Interconnection Substations (not to scale)
- Site Access/Exit Points
- MainSubstation/Offices (not to scale)
- Substations (not to scale)
- Export Line (Shown to Project Boundary only)
- 132kV Overhead Line
- Permanent Met Masts
- Tracks

Ver	Date	Drawn by	Checked	Approved
V1.1	28/03/2019	FK/AM	BM	DB

Coordinate System
WGS 1984 UTM Zone 53S

Size
A3

Scale 1:60,000 Printed @ A3

Filename:
App_13_PA Variation DA_Layout Comparison

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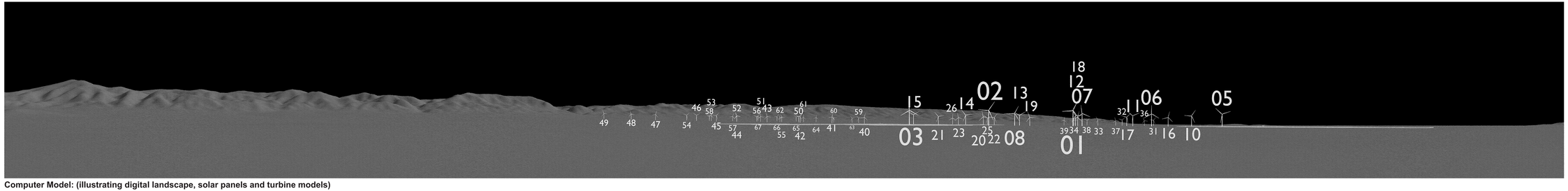
Appendix 14: Original Photomontages

Viewpoint 1

Viewpoint 1: A1 Flyover, Port Augusta Princes Highway looking south

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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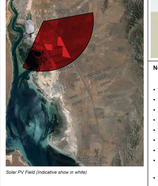
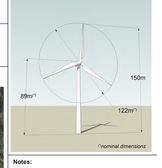
Viewpoint Location Plan:



Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



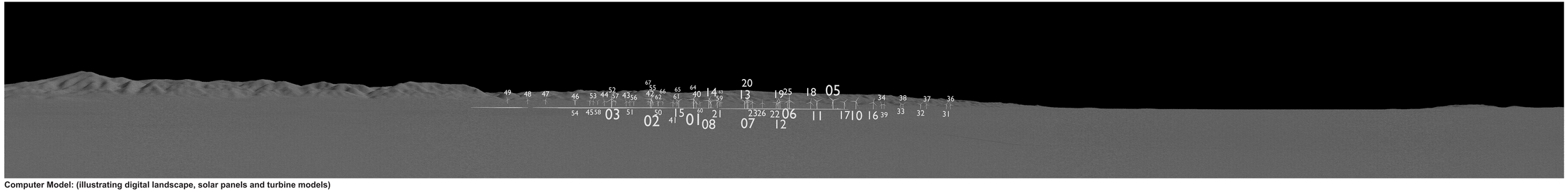
Notes:

- distance to nearest turbine: 4.74 km
- latitude position: 6398718.712
- longitude position: 764544.0436
- elevation of viewpoint (m): 93m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:35
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 140°
- horizontal field of view: 120°

Viewpoint 2

Viewpoint 2: Larkin Crescent – Cudmore Hill looking southeast (near Monument)

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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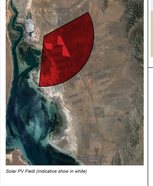
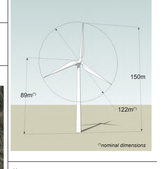
Viewpoint Location Plan:



Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :

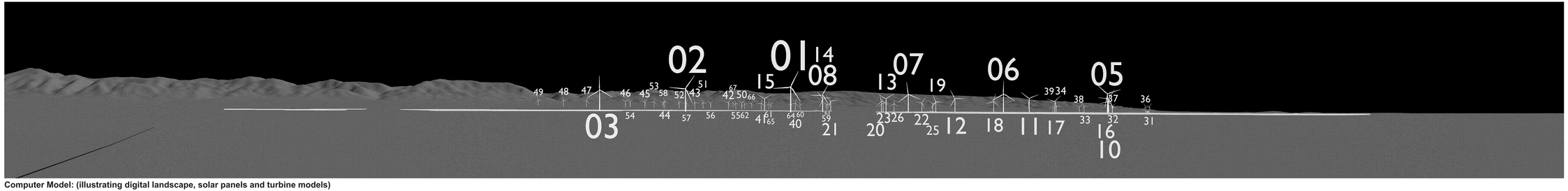


Notes:

- distance to nearest turbine: 7.72 km
- latitude position: 6399039.243
- longitude position: 761223.8247
- elevation of viewpoint (m): 77m
- height of camera above ground: 1.75m
- date photograph was taken: 13/04/15
- time of photo 12:22
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 140°
- horizontal field of view: 120°

Viewpoint 3: Flinders View Estate, Warner Road looking east

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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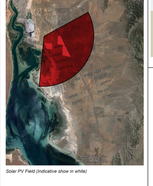
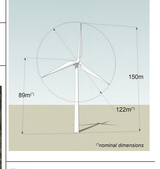
Viewpoint Location Plan:



Solar PV Field (indicative shoe in white)

Maximum Wind Turbine Size :



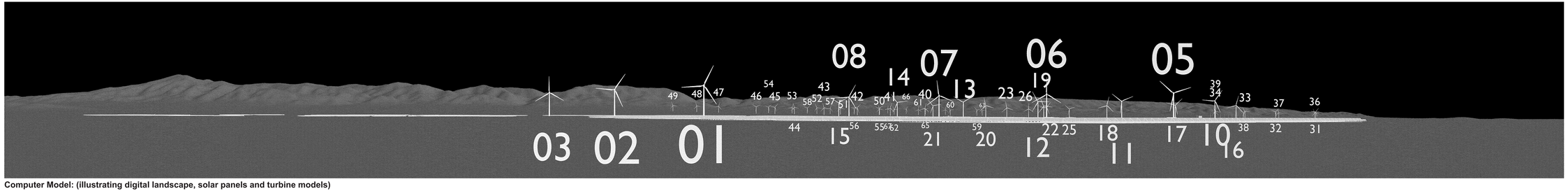
Notes:

- distance to nearest turbine: 2.78 km
- latitude position: 6395995.031
- longitude position: 764903.1251
- elevation of viewpoint (m): 43m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:09
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 133°
- horizontal field of view: 120°

Viewpoint 4

Viewpoint 4: Point Paterson Road looking east

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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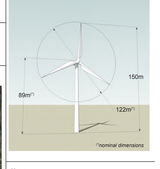
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



**nominal dimensions*

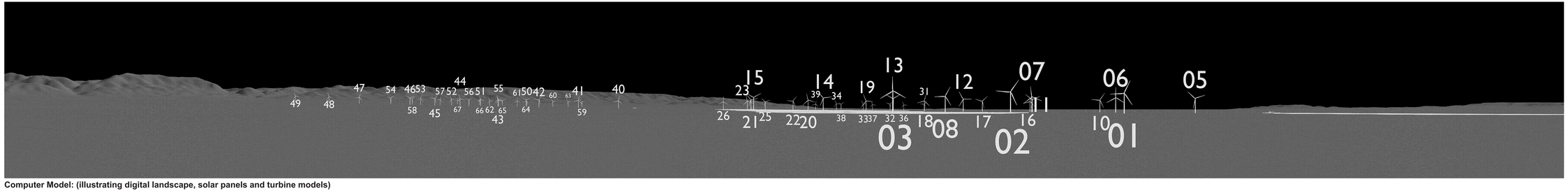
Notes:

• distance to nearest turbine:	2.32 km
• latitude position:	6394933.871
• longitude position:	765004.0584
• elevation of viewpoint (m):	74m
• height of camera above ground:	1.75m
• date photograph was taken:	12/04/15
• time of photo	17:28
• focal length of camera: (equivalent to 50㎜ analogue)	35㎜ DSLR
• direction of camera to centre of view:	126°
• horizontal field of view:	120°

Viewpoint 5

Viewpoint 5: McConnal Road, Stirling North looking southeast

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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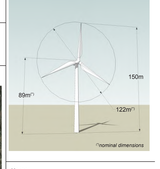
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



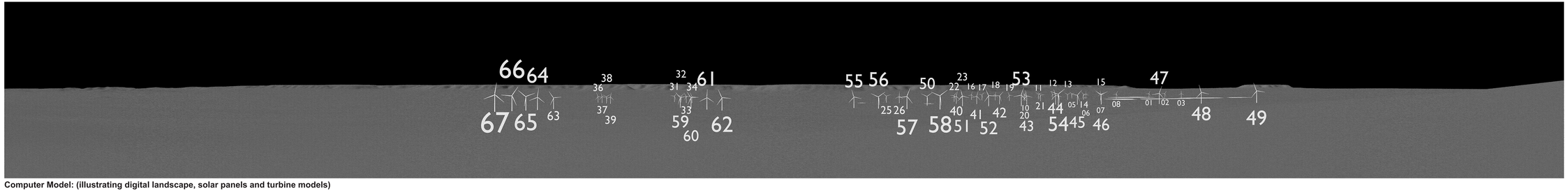
Notes:

- distance to nearest turbine: 3.54 km
- latitude position: 6397791.911
- longitude position: 767180.9912
- elevation of viewpoint (m): 125m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 13:05
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 198°
- horizontal field of view: 120°

Viewpoint 6

Viewpoint 6: Layby at end of Horrocks Pass, Main North Road looking west

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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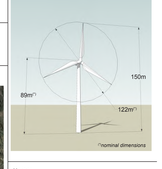
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :

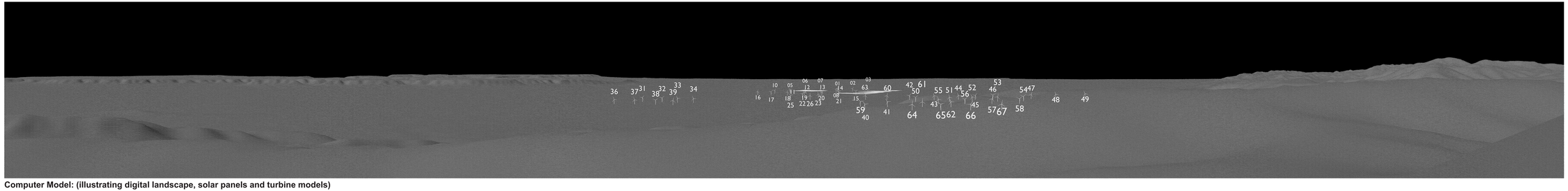


Notes:

• distance to nearest turbine:	4.32 km
• latitude position:	6387906.827
• longitude position:	782399.8907
• elevation of viewpoint (m):	820m
• height of camera above ground:	1.75m
• date photograph was taken:	12/04/15
• time of photo	11:55
• focal length of camera: (equivalent to 50㎜ analogue)	35㎜ DSLR
• direction of camera to centre of view:	280°
• horizontal field of view:	120°

Viewpoint 7: The Battery looking northwest

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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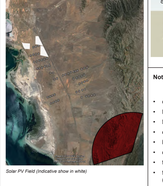
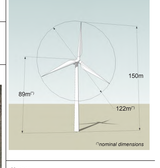
Viewpoint Location Plan:



Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :

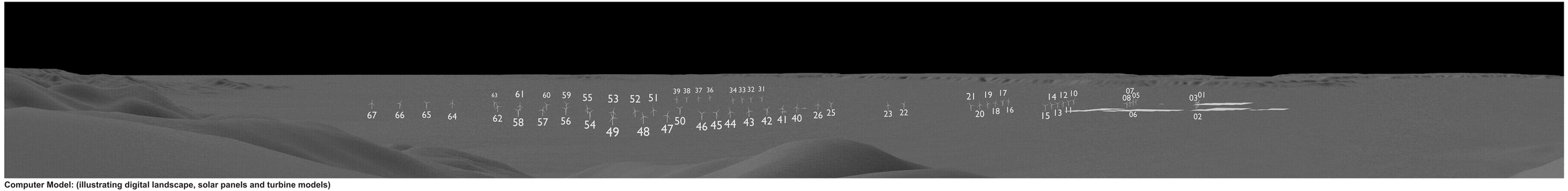


Notes:

- distance to nearest turbine: 13.19 km
- latitude position: 6375597.998
- longitude position: 786026.9962
- elevation of viewpoint (m):
- height of camera above ground: 1.75m
- date photograph was taken: 9/12/2014
- time of photo 09:52
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 315°
- horizontal field of view: 120°

Viewpoint 8: Mount Brown looking southwest

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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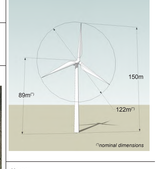
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



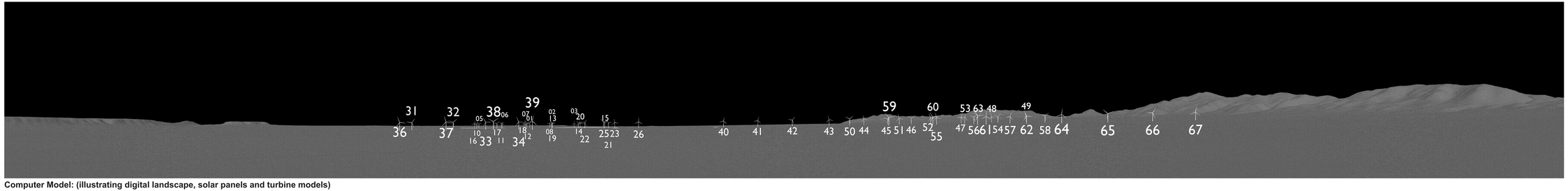
Notes:

- distance to nearest turbine: 9.57 km
- latitude position: 6398912.997
- longitude position: 782308.0021
- elevation of viewpoint (m): -
- height of camera above ground: 1.75m
- date photograph was taken: 9/12/2014
- time of photo 11:24
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 127°
- horizontal field of view: 120°

Viewpoint 9

Viewpoint 9: A1 Southern Approach looking north

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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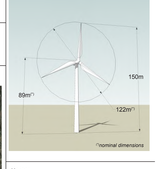
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



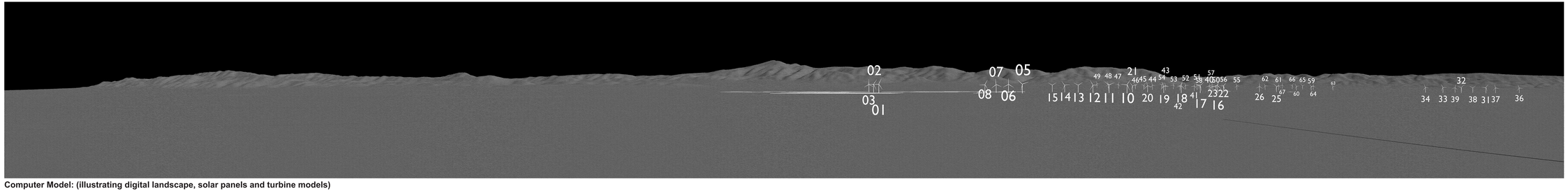
Notes:

- distance to nearest turbine: 8.21 km
- latitude position: 637719.927
- longitude position: 775808.6793
- elevation of viewpoint (m): 210m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 11:29
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 350°
- horizontal field of view: 120°

Viewpoint 10

Viewpoint 10: Shack Road north of Commissariat Point looking east

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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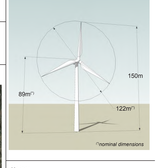
Viewpoint Location Plan:

Solar PV Field (indicative show in white)

Maximum Wind Turbine Size :



**nominal dimensions*

Notes:

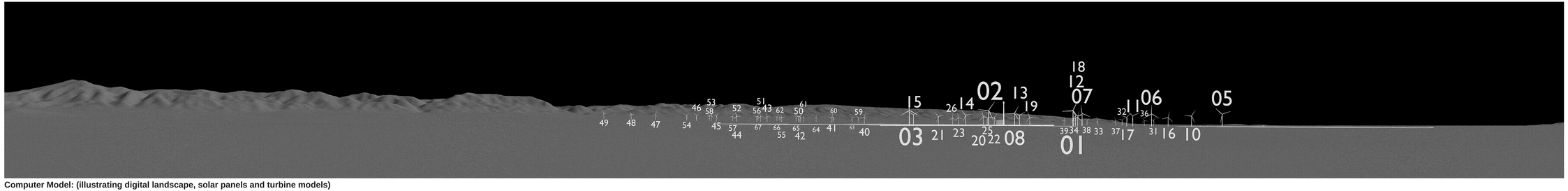
- distance to nearest turbine: 8.01 km
- latitude position: 6392864.683
- longitude position: 758743.7493
- elevation of viewpoint (m): 53m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:25
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 100°
- horizontal field of view: 120°

Appendix 15: Updated Photomontages

Viewpoint 1

Viewpoint 1: A1 Flyover, Port Augusta Princes Highway looking south

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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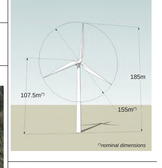
Viewpoint Location Plan:

Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :

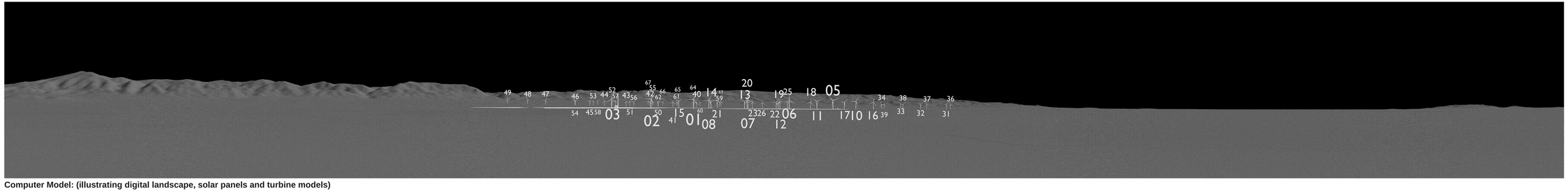


Notes:

- distance to nearest turbine: 4.74 km
- latitude position: 6398718.712
- longitude position: 764544.0436
- elevation of viewpoint (m): 93m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:35
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 140°
- horizontal field of view: 120°

Viewpoint 2: Larkin Crescent – Cudmore Hill looking southeast (near Monument

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

DP ENERGY
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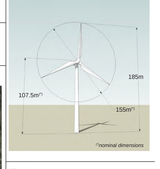
Viewpoint Location Plan:

Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :

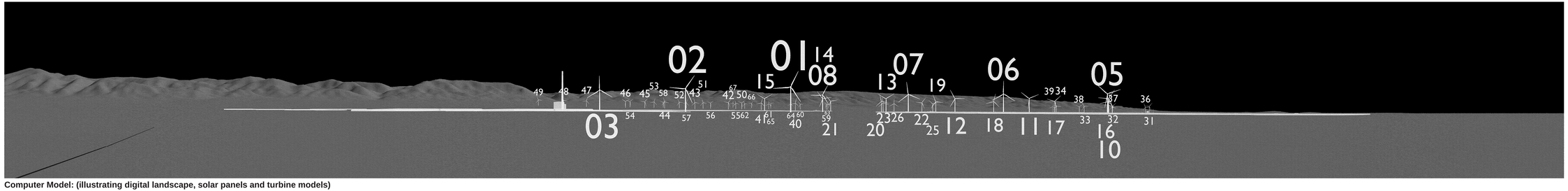


Notes:

- distance to nearest turbine: 7.72 km
- latitude position: 6399039.243
- longitude position: 761223.8247
- elevation of viewpoint (m): 77m
- height of camera above ground: 1.75m
- date photograph was taken: 13/04/15
- time of photo 12:22
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 140°
- horizontal field of view: 120°

Viewpoint 3: Flinders View Estate, Warner Road looking east

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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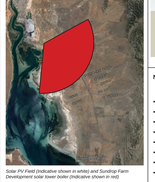
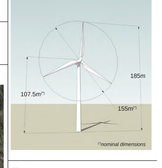
Viewpoint Location Plan:



Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :



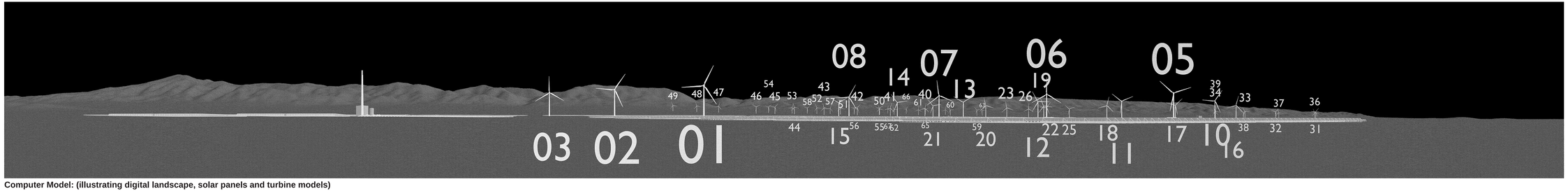
Notes:

- distance to nearest turbine: 2.78 km
- latitude position: 6395995.031
- longitude position: 764903.1251
- elevation of viewpoint (m): 43m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:09
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 133˚
- horizontal field of view: 120˚

Viewpoint 4

Viewpoint 4: Point Paterson Road looking east

Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

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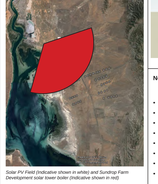
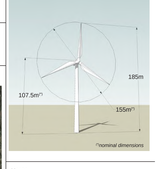
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:



Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :



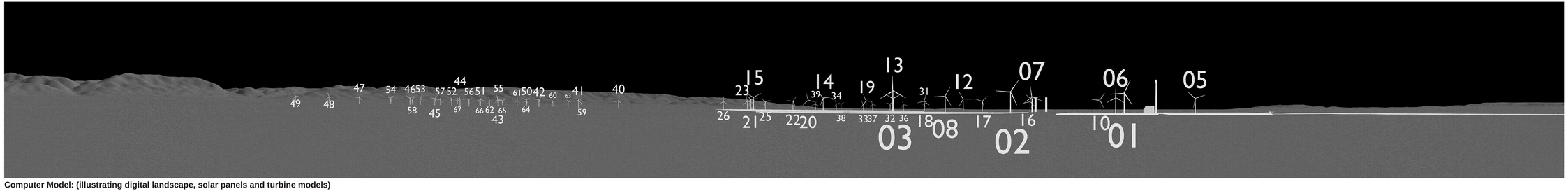
Notes:

- distance to nearest turbine: 2.32 km
- latitude position: 6394933.871
- longitude position: 765004.0584
- elevation of viewpoint (m): 74m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:28
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 126°
- horizontal field of view: 120°

Viewpoint 5

Viewpoint 5: McConnal Road, Stirling North looking southeast

Existing View:



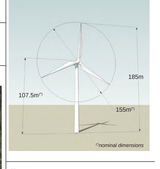
Computer Model: (illustrating digital landscape, solar panels and turbine models)

DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:

Solar PV Field (Indicative shown in white) and Sundrop Farm Development solar tower boiler (Indicative shown in red)

Maximum Wind Turbine Size :



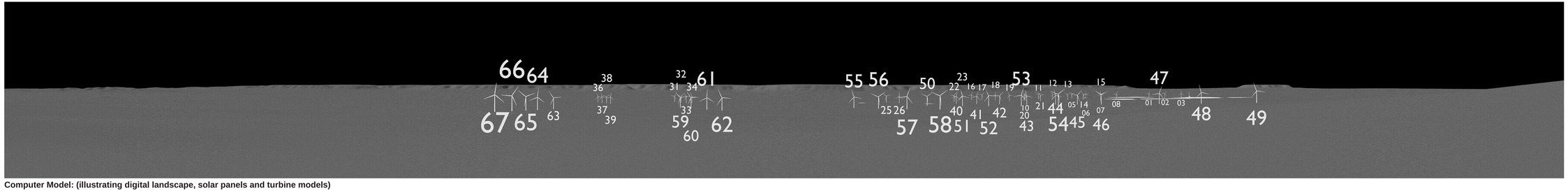
Notes:

- distance to nearest turbine: 3.54 km
- latitude position: 6397791.911
- longitude position: 767180.9912
- elevation of viewpoint (m): 125m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 13:05
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 198°
- horizontal field of view: 120°

Viewpoint 6

Viewpoint 6: Layby at end of Horrocks Pass, Main North Road looking west

Existing View:



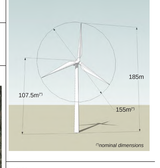
Computer Model: (illustrating digital landscape, solar panels and turbine models)

DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:

Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :

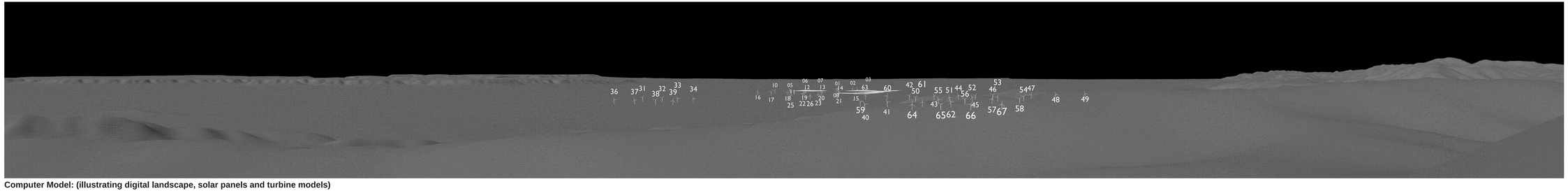


Notes:

- distance to nearest turbine: 4.32 km
- latitude position: 6387906.827
- longitude position: 782399.8907
- elevation of viewpoint (m): 820m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 11:55
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 280°
- horizontal field of view: 120°

Viewpoint 7: The Battery looking northwest

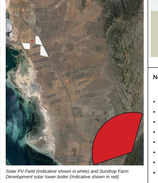
Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

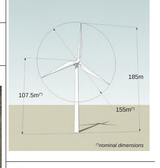
DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:



Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :

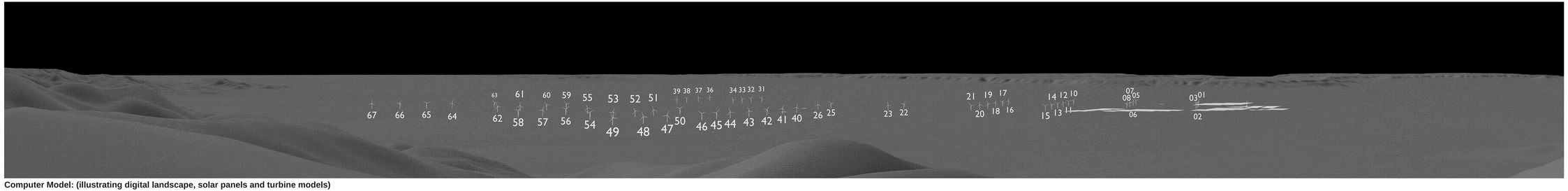


Notes:

- distance to nearest turbine: 13.19 km
- latitude position: 6375597.998
- longitude position: 786026.9962
- elevation of viewpoint (m):
- height of camera above ground: 1.75m
- date photograph was taken: 9/12/2014
- time of photo 09:52
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 315°
- horizontal field of view: 120°

Viewpoint 8: Mount Brown looking southwest

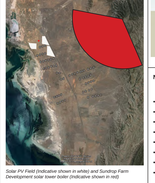
Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

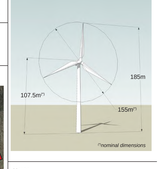
DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:



Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :



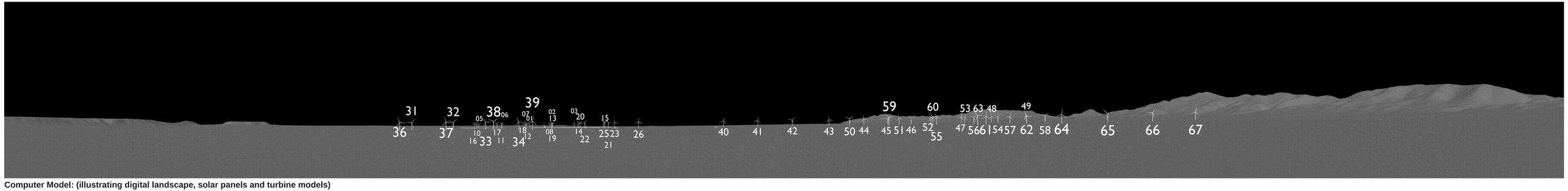
Notes:

- distance to nearest turbine: 9.57 km
- latitude position: 6398912.997
- longitude position: 782308.0021
- elevation of viewpoint (m): -
- height of camera above ground: 1.75m
- date photograph was taken: 9/12/2014
- time of photo 11:24
- focal length of camera: (equivalent to 50... analogue) 35— DSLR
- direction of camera to centre of view: 127°
- horizontal field of view: 120°

Viewpoint 9

Viewpoint 9: A1 Southern Approach looking north

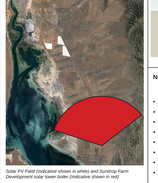
Existing View:



Computer Model: (illustrating digital landscape, solar panels and turbine models)

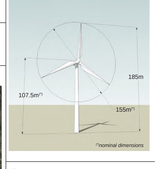
DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:



Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :



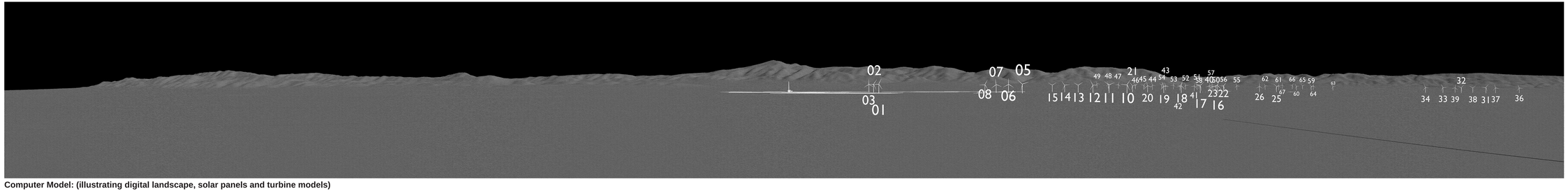
Notes:

- distance to nearest turbine: 8.21 km
- latitude position: 6377719.927
- longitude position: 775808.6793
- elevation of viewpoint (m): 210m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 11:29
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 350°
- horizontal field of view: 120°

Viewpoint 10

Viewpoint 10: Shack Road north of Commissariat Point looking east

Existing View:



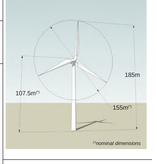
Computer Model: (illustrating digital landscape, solar panels and turbine models)

DP ENERGY
ENERGY IS IN OUR NATURE

Viewpoint Location Plan:

Solar PV Field (indicative shown in white) and Sundrop Farm Development solar tower boiler (indicative shown in red)

Maximum Wind Turbine Size :



Notes:

- distance to nearest turbine: 8.01 km
- latitude position: 6392864.683
- longitude position: 758743.7493
- elevation of viewpoint (m): 53m
- height of camera above ground: 1.75m
- date photograph was taken: 12/04/15
- time of photo 17:25
- focal length of camera: (equivalent to 50㎜ analogue) 35㎜ DSLR
- direction of camera to centre of view: 100°
- horizontal field of view: 120°

Appendix 16: Comparison Photomontage

PORT AUGUSTA **RENEWABLE ENERGY PARK**

DP ENERGY

OLD TURBINE DIMENSIONS

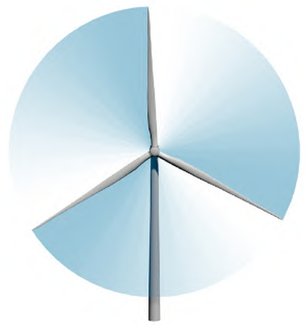
TIP HEIGHT: 150m | HUB HEIGHT: 89m | ROTOR DIAMETER: 122m

NEW TURBINE DIMENSIONS

TIP HEIGHT: 185m | HUB HEIGHT: 107.5m | ROTOR DIAMETER: 155m

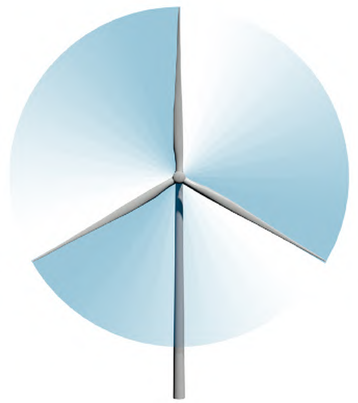
BEFORE

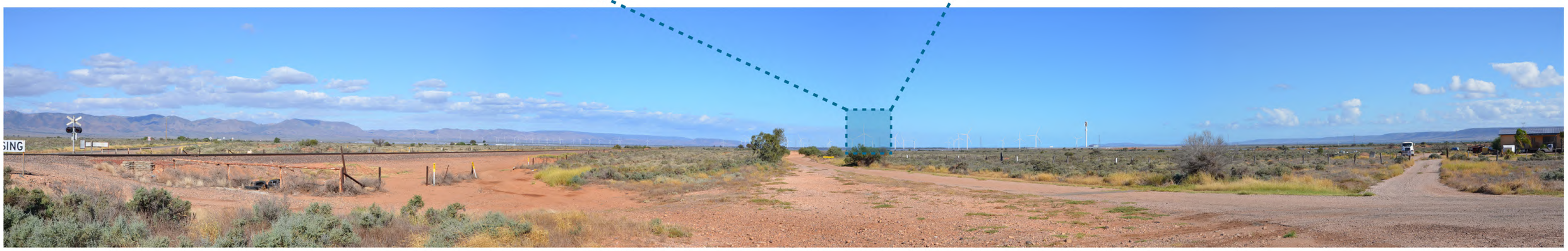
DIAMETER: 122m



AFTER

DIAMETER: 155m





DP ENERGY

PHOTOMONTAGES OF TURBINES FOR
PORT AUGUSTA RENEWABLE ENERGY PARK

Appendix 17: Visual Amenity Planning Assessment

URPS

DP Energy Australia Pty Ltd
19ADL-0019
28 March 2019

PORT AUGUSTA RENEWABLE ENERGY PARK

STAGE 1 DEVELOPMENT APPLICATION - VARIATION

Development Plan Visual Impact Assessment

Port Augusta Renewable Energy Park Stage 1 Development Application - Variation

Development Plan Visual Impact Assessment

28 March 2019

Lead consultant	URPS
Prepared for	DP Energy Australia
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URPS Ref	R001_v2_190328.docx

Document history and status

Revision	Date	Reviewed	Approved	Details
1	7.3.19	MR	MR	Draft
2	28.3.19	MR	MR	Final

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H:\Synergy\Projects\19ADL\19ADL-0019 Port Augusta Renewable Energy Park - Variation\Development Application\Draft Documents\R001_v2_190328.docx

Contents

1.0 Background

URPS has been engaged by DP Energy Australia (DPEA) to undertake an assessment of visual impact of the proposed variation application to increase the rotor diameter and tip height of 59 previously approved wind turbines against the provisions of the relevant Development Plans.

We have undertaken an inspection of the site and locality, reviewed the photo montages prepared by Convergen and have reviewed the provisions of the City of Port Augusta Development Plan and the District Council of Mount Remarkable Development Plan.

Following our review of the supporting documentation and our assessment against the relevant planning provisions we consider that the proposed development satisfies those provisions and therefore warrants Approval in terms of visual impact

2.0 Proposal, Subject Land and Locality

2.1 Proposal

The initially Approved development includes 59 wind turbines. Each of these turbines had a rotor diameter and tip height 136 metres and 150 metres respectively.

This variation application proposes an increase in the rotor diameter and tip height of each turbine to 155 metres and 185 metres respectively.

Six of the proposed turbines also need to be moved to accommodate Electranet's microwave link (which, as outlined in the original development application, was incorrectly registered on the SCMA database), as well as ARTC's unregistered microwave link. This has also resulted in some other minor changes to maintain appropriate inter-turbine spacing. The turbine location amendments are summarised as follows:

Turbine	Action	Reason
T2	Moved 85m west along row	Avoid Link
T31	Moved 124m west along row	Avoid Link
T32	Moved 190m west along row	Avoid Link
T33	Moved 98m west along row	Maintain Inter-turbine spacing
T36	Moved 60m east along row	Avoid Link
T38	Moved 47m west along row	Maintain Inter-turbine spacing

2.2 Subject Land

The subject land comprises 39 sections/allotments across 11 land titles and 5 separate landowners. It is bisected by the Augusta Highway with approximately half of the subject land on each side of the highway.

The subject land has a total area in the order of 5,400 hectares. The land is generally used for low-intensity livestock grazing. It is generally flat, rising gently in the eastern portion to the base of the Southern Flinders Ranges.

2.3 Locality

Given the large size of the subject land, and that the proposed development will be visible from some distance, the locality is quite broad.

The locality extends generally to the southern edge of the Port Augusta Township, the Stirling North Township, along the ridge of the Southern Flinders Ranges (roughly between Mount Brown and the northern edge of the Mount Remarkable National Park), to the Winninowie Conservation Park in the south and along the western edge of the Spencer Gulf.

Land within the locality is put to a range of uses, but typically low intensity pastoral use, particularly on the lower lying land directly surrounding the subject land.

The Sundrop Farms glasshouse facility is a notable element in this landscape. This development comprises approximately 20 hectares of glasshouses and a solar thermal farm consisting of a series of low-level mirrors and a central solar tower of 115 metres in height.

The eastern edge of the locality extends toward the Flinders Ranges from where there are expansive views toward and across the Spencer Gulf. Land to the east at the lower edge of the Flinders Ranges is also typically put to pastoral use.

The hills and ridges to the east of the site varies in height with the escapement itself largely devoid of vegetation. Native vegetation is generally confined to the valleys and watercourses. There is little built form development across the escarpment except for some scattered agricultural buildings and a small number of dwellings.

3.0 Planning Assessment of Visual Impact

3.1 The Approach to Assessing Visual Impact of the Variation

Section 39(6) of the Development Act 1993 provides for the assessment of an application to vary an existing approval. The correct approach is to only assess the elements of the development being varied and not the entire development. At the same time, the extent of the variation cannot be assessed in the abstract – it must be assessed in the context of the development which has been previously been approved.

3.2 Relevant Development Plan

The subject land is located within two Council areas; the City of Port Augusta and the District Council of Mount Remarkable.

The portion of the subject land within the City of Port Augusta is located wholly within the Primary Industry Zone (consolidated 7 July 2016).

The portion of the subject land within the District Council of Mount Remarkable is located wholly within the Primary Production Zone (consolidated 5 September 2013).

The land is not located in any Policy Areas or Precincts.

The provisions relating to wind farms and other renewable energy facilities in each of these Development Plans are largely identical and are referred to in the assessment that follows.

3.3 Background/Supporting Documentation

Convergen has prepared 10 photomontages of the proposed varied wind turbines from similar vantage points to the original Development Application. These have been used to inform the assessment of the visual impact on the proposed variation application. These photomontages are included with the Development Application documentation.

3.4 Performance Against Development Plan Provisions

The performance of the already approved wind turbines against the relevant provisions of the Development Plan assists in establishing the context for consideration of the proposed varied turbine design as discussed below.

3.4.1 Wind Farms are Anticipated in Certain Locations

Objective 120 in the Council Wide section of the Port Augusta Development Plan and Objective 2 of the Mount Remarkable Development Plan state:

Objective 120/2 **The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity. (underlining added)**

The Primary Industry Zone of the Port Augusta Development Plan and the Primary Production Zone of the Mount Remarkable Development Plan are some of the areas where wind farms are explicitly envisaged, as referred to in the similarly worded Objectives 4 and Principles of Development Control 1 of the respective zones:

Objective 4 **Accommodation of wind farms and ancillary development.**

Principle 1 **The following forms of development are envisaged in the zone:…**

Wind farm and ancillary development. (underlining added)

The approved wind turbines sit entirely within the Primary Industry and Primary Production Zones where this type of development is expressly envisaged. The proposed variation application does not alter this.

3.4.2 The Visual Impact of Wind Farms and Solar Farms is Anticipated

Principle of Development Control 2 in the Primary Industry Zone of the Port Augusta Development Plan and Principle of Development Control 3 in the Primary Production Zone of the Mount Remarkable Development Plan state that:

Principle 2/3 **Wind farms and ancillary development should be located in areas which provide opportunity for harvesting of wind and efficient generation of electricity and may therefore be sited:**

(a) in visually prominent locations

(b) closer to roads than envisaged by generic setback policy. (underlining added)

The Desired Character statements for the Primary Industry Zone and the Primary Production Zone also state:

…Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character. These facilities will need to be located in areas where they can take advantage of the natural resource upon which they rely and, as a consequence, components (particularly turbines) may need to be:

(a) located in visually prominent locations such as ridgelines;

(b) visible from scenic routes and valuable scenic and environmental areas; and

(c) located closer to roads than envisaged by generic setback policy.

This, coupled with the large scale of these facilities (in terms of both height and spread of components), renders it difficult to mitigate the visual impacts of wind farms to the degree expected of other types of development. Subject to implementation of management techniques set out by general council wide policy regarding renewable energy facilities, these visual impacts are to be accepted in pursuit of benefits derived from increased generation of renewable energy. (underlining added)

In short, wind farms are expected in the Primary Industry Zone and Primary Production Zone, as well as the potential for visual impact that goes with this large infrastructure.

Principle of Development Control 393 and 2 under "Renewable Energy Facilities" in the respective Development Plans seek to manage visual impact of wind farms and ancillary development via the following measures:

Principle 2 **The visual impacts of wind farms and ancillary development (such as substations, maintenance sheds, access roads and wind monitoring masts) should be managed through:**

(a) wind turbine generators being:

(i) setback at least 1000 metres from non-associated (non-stakeholder) dwellings and tourist accommodation

(ii) setback at least 2000 metres from defined and zoned township, settlement or urban areas (including deferred urban areas)

(iii) regularly spaced

(iv) uniform in colour, size and shape and blade rotation direction

(v) mounted on tubular towers (as opposed to lattice towers)

(b) provision of vegetated buffers around substations, maintenance sheds and other ancillary structures. (underlining added)

The approved wind turbines satisfied these prescriptive guidelines, ensuring that:

- each turbine is setback at least 1000m from all non-associated dwellings and tourist accommodation. The closest non-associated dwelling is in fact located over 2,000m from the nearest wind turbine
- each turbine is setback at least 2,000 metres from defined and zoned township, settlement or urban areas. The nearest turbine is located approximately 2,100 metres from the Port Augusta Rural Living Zone, 2,900 metres from the Residential Zone at Stirling North and 4,200 metres from the Stirling North Urban Centre
- to the maximum extent possible, turbines are regularly spaced; the layout is based on a regular 4 x 9 rotor diameter grid (9 rotor diameter separation between turbine row and 4 rotor diameter separation between turbines within any row), which has been modified in places in response to environmental, telecommunications and other constraints, and
- all turbines are of a uniform colour (off white/light grey), height (maximum tip height of 150m), have the same slender conical/tubular shape and blade rotation direction.

The variation application is unchanged in respect of all of these prescriptive guidelines relating to managing visual impact.

3.4.3 Balancing the Assessment with Other Provisions of the Development Plan

There are a number of Council Wide provisions in both Development Plans that seek/anticipate the more general minimisation of adverse impacts (which can include visual impact), not impairing the amenity of localities (which can also include visual impact) and preserving areas of high scenic value, as follows:

Renewal Energy Facilities (Both Development Plans)

Objective 121/3 **Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.**

Appearance of Land and Buildings (Port Augusta Development Plan)

Objective 18 **The amenity of localities not impaired by the appearance of land, buildings and objects.**

In areas of high scenic value, electric supply and telecommunications structures should be so sited and designed to preserve the attractiveness of such areas.

Principle 44 **Prominent slopes and land visible from tourist roads should be kept free of urban development and be protected against unsightly development.**

Design and Appearance (Mount Remarkable Development Plan)

Objective 1 **Development of a high architectural standard that responds to and reinforces positive aspects of the local environment and built form.**

Principle 1 **The design of a building may be of a contemporary nature and exhibit an innovative style provided the overall form is sympathetic to the scale of development in the locality and with the context of its setting with regard to shape, size, materials and colour.**

Principle 17 **The setback of buildings from public roads should:**

- **(a) be similar to, or compatible with, setbacks of buildings on adjoining land and other buildings in the locality**
- **(b) contribute positively to the streetscape character of the locality**
- **(c) not result in or contribute to a detrimental impact upon the function, appearance or character of the locality.**

Principle 21 **No building should be erected on land outside of a township nearer than 30 metres to the boundary of a primary, secondary or scenic road shown on Concept Plan Map MtR/1 – Scenic Roads unless:**

- **(a) the set-back is consistent with existing buildings**
- **(b) site conditions provide effective screening**
- **(c) no suitable alternative site exists**
- **(d) to facilitate the development of wind farms and ancillary development.**

Environment Protection (Port Augusta Development Plan)

Objective 21 **The conservation, preservation and enhancement, of scenically attractive areas, including land adjoining water or scenic routes.**

The landscape of the Flinders Ranges and the shores of Spencer Gulf are examples of areas of visual significance worthy of protection against unsightly development and mismanagement.

Natural Resources (Both Development Plans)

Objective 43/13 **Protection of the scenic qualities of natural and rural landscapes.**

Principle 80/1 **Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas. (underlining added)**

In considering the approved turbines against these provisions, it was emphasised that:

- there are no tourist roads designated in the Development Plans running through the subject site
- wind turbines and solar PV modules are neither inherently “urban” or “rural” in character/nature, but it is very common for development of this type to be located in rural/non-urban areas
- the subject site, and the Primary Industry and Primary Production Zones covering the subject site, is not identified as an area of “high scenic value” in the Development Plans, and
- the Project is sited on a coastal plain rather than an elevated ridgeline where the visual prominence of the wind farm may extend over a greater area.

It is also widely accepted in development assessment that, in instances where there may be apparent inconsistencies between Council Wide/General Section provisions and Zone provisions, the latter should take precedence, particularly the Desired Character statement/s[1].

It is also emphasised that the more recently inserted Council Wide/General Section provisions relating specifically to the potential visual impact of renewable energy facilities should take precedence over older Council Wide/General Section provisions relating more generally to protection of visual amenity[2].

In the context of the respective Zones' Desired Character statements, it was considered that any variation by the original wind turbines from the Council-Wide/General Section provisions quoted above regarding general amenity negligible and acceptable. The proposed variation to the turbines does not alter this interpretation of the interaction between the relevant Development Plan provisions.

Finally, it is noted that there is a Rural Landscape Protection Zone located to the east of the subject site covering the southern Flinders Ranges. The Desired Character statement for this separate Zone states that:

…the conservation of the scenic, scientific and heritage features of the South Flinders Ranges environment is intended as the paramount objective when assessing future development proposals in the zone...

Where two zones adjoin and have incompatible objectives, it would be unreasonable to expect that the amenity consequences at the boundary would be neutral. In other words, the visual impact of the initially proposed wind turbines upon parts of the Rural Landscape Protection Zone is to be anticipated given that wind farms and associated development are so clearly anticipated in the Primary Production Zone. It is also considered that the proposed variation to the wind turbines do not alter this interpretation of the Development Plan.

3.4.4 Overall Visual Impact of the Varied Turbine Size

From a development assessment perspective, it is important to note that the relevant Development Plan provisions do not limit the size of wind turbines. Rather, as indicated previously, the Desired Character statements for the Primary Industry Zone and the Primary Production Zone state:

…Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character. These facilities will need to be located in areas where they can take advantage of the natural resource upon which they rely and, as a consequence, components (particularly turbines) may need to be:

(a) located in visually prominent locations such as ridgelines;

(b) visible from scenic routes and valuable scenic and environmental areas; and

(c) located closer to roads than envisaged by generic setback policy.

This, coupled with the large scale of these facilities (in terms of both height and spread of components), renders it difficult to mitigate the visual impacts of wind farms to the degree expected of other types of development. Subject to implementation of management techniques set out by general council wide policy regarding renewable energy facilities, these visual impacts are to be accepted in pursuit of benefits derived from increased generation of renewable energy. (underlining added)

[1] City of Mitcham v Freckman [(1999) SASC 234, (1999) 74 SASR 56]
[2] Telstra Corp Ltd v City of Holdfast Bay [2008] SAERDC 47

The proposed larger wind turbines will be more visible, depending upon where they are viewed from. It is contended, however, that from many key vantage points in the wider locality, the increase in turbine size will be difficult to perceive. This is particularly when they are viewed against the sky or the ranges behind depending upon their colour at different times of day.

Given that large scale of the originally approved wind turbines, it is contended that the change to visual impact from the proposed increase in turbine size satisfies the relevant provisions of the Development Plans.

3.4.5 Summary

Wind farms are expected in the Primary Industry Zone and Primary Production Zone. There are no tourist roads running through the subject site designated in the Development Plans. The subject site and the Primary Industry and Primary Production Zones covering the subject site are not identified as an area of "high scenic value" in the Development Plans.

The visual impact of wind turbines is anticipated in these Zones, subject to specific measures having been taken to manage this visual impact. The proposed variation to the approved wind turbines incorporates these measures, as follows:

- Each turbine is setback at least 1,000m from all non-associated dwellings and tourist accommodation
- Each turbine is setback at least 2,000m from defined and zoned township, settlement or urban areas
- The turbines are regularly spaced
- The turbines are uniform in colour, size, shape and blade rotation, and
- Each turbine is mounted on a tubular tower.

There are a number of Council Wide provisions in both Development Plans that seek/anticipate the minimisation of adverse impacts (which can include visual impact), not impairing the amenity of localities (which can include visual impact) and preserving areas of high scenic value. It is accepted development assessment practice that these Council-Wide/General Section provisions have significantly less weight than the wind-farm specific provisions at Council-Wide/General Section and Zone levels of the Development Plans in the assessment of this variation application.

The visual impact of the proposed varied wind turbines upon parts of the Rural Landscape Protection Zone is to be anticipated given that wind farms and associated development are so clearly anticipated in the Primary Production Zone.

The proposed larger wind turbines will be more visible, depending upon where they are viewed from. From many key vantage points in the wider locality, however, the increase in turbine size will be difficult to perceive. This is particularly when they are viewed against the sky or the ranges depending upon their colour at different times of day.

Given that large scale of the originally approved wind turbines, the change to visual impact of the proposed increase in turbine size satisfies the relevant provisions of the Development Plans.

Appendix 18: Updated Aeronautical Impact Assessment

Aeronautical Impact Assessment

Port Augusta Renewable Energy Park, South Australia

Client

DP Energy

LB00266

Final Version 1
11 December 2018

Version No.	Basis of issue	Author	Date	Reviewers
001	Draft report for submission to Client	PW	7 November 2018	JW & CA
002	Draft report following Client feedback	PW	6 December 2018	JW
Final V1	Final Report	PW	11 December 2018	JW

Contents

1 Introduction

1.1 The Development

DP Energy (the proponent), has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) for the proposed Port Augusta Renewable Energy Park (REP) development located approximately 7km south-east of Port Augusta, South Australia, in the coastal region of the northern part of the Spencer Gulf and bordering the southern Flinders Ranges.

The wind farm component of the Port Augusta REP will contain 59 Wind Turbine Generators (WTGs) with a height of 185 m Above Ground Level (AGL) to the tip of a WTG blade. The location of each WTG is indicative only and may change. Final layout may vary within the boundary. The boundary is depicted in Appendix A.

The highest terrain within the boundary of the REP is reported as 142.45 m AHD. The highest elevation of any possible WTG will therefore be 327.45 m (1074.5 ft) AHD to the tip of a vertical blade. The most recent WTG layout shows the highest point on which a WTG is located—WTG number 49—to be just west of the highest point of terrain within the REP. WTG 49 has a maximum height of 313.2 m / 1027.8 ft AHD.

However, for conservatism and to allow the proponent the opportunity to adjust the WTG layout in the future, this report will consider the highest possible WTG tip to be 327.5m/1075 ft AHD. This maximum height is approximately 14 metres above the highest listed WTG and will allow WTG locations within the REP to be adjusted if required, and remain below the maximum elevation of 327.5 m AHD.

Figure 1 shows the location of the Port Augusta REP in relation to Port Augusta, Port Augusta Airport and Stirling North airfield.

Figure 1: Port Augusta Renewable Energy Park. (Google Earth)

1.2 Managing the Risk to Aviation Safety of Wind Farms

In order to comply with State and Commonwealth planning requirements, as well as those of the aviation authorities—the Civil Aviation Safety Authority (CASA) and Airservices Australia—this report provides an assessment of the Port Augusta REP development from an aviation safety perspective.

National Airports Safeguarding Framework Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations* provides guidance to address the risk to civil aviation activities near wind farms and acknowledges the importance of airports to national, state/local infrastructure networks and economies as well as their social value.

Wind farms can be hazardous to aviation activity due to the tall structures that could present a conflict with low flying aircraft. They can also interfere with the performance of Air Traffic Control (ATC) communications, navigation and surveillance equipment.

This report assesses the likely impact of the Port Augusta REP WTGs upon aviation activity in the area as well as the ATC facilities by examining the heights and locations of the turbines and their anticipated effect on aviation activity and airspace within 30 nm (55 km) of the development.

2 Airspace Protection

2.1 Overview

Protected airspace for an airport is the airspace above any part of either an Obstacle Limitation Surface (OLS), a PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surface, and any Radar Terrain Clearance Chart (RTCC) protection surfaces in the area.

The International Civil Aviation Organisation (ICAO) Annex 14 – *Aerodrome Design and Operations*, describes the minimum specifications for the OLS to be provided at aerodromes. CASA prescribes the use of Annex 14 OLS and any differences that Australia has initiated to cater for unique situations that may exist.

The OLS are conceptual surfaces associated with an airport's runways that are designed to protect aircraft operations at the airport from unrestricted obstacle growth. Depending on the type of instrument flight procedures provided at the airport, the OLS can extend to a maximum of 15 km from the airport. For the airports considered in this report, the OLS extend to a maximum distance of 4 km from the airport.

PANS OPS surfaces are described in ICAO Doc 8168, *Procedures for Air Navigation – Aircraft Operations*. They are designed around instrument approach and departure flight paths with a prescribed minimum obstacle clearance from terrain and structures. They designate an obstacle-free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC), where the pilot is not guaranteed to be able to see the ground, water or obstacles on or near their flight path. The largest of these protection surfaces exist out to a distance of 55 km (30 nm) from the airport.

Airspace within the lateral navigation tolerances of an air route, and the vertical allowance is also protected from terrain or obstacle intrusion to ensure safe flight operations during IFR flight on those routes. The tolerance for the air routes in the vicinity of the Port Augusta REP is 9.2 km (5 nm).

Infringement by an infrastructure development or crane into protected airspace requires the approval of the aerodrome operator or Airservices Australia, and CASA.

Whilst infringements of the OLS and the air route protection surfaces may be considered, infringement of PANS OPS protection surfaces are not supported by the aviation authorities.

2.2 Obstacle Limitation Surfaces

Port Augusta Airport has an OLS that extends to 4 km from the aerodrome. As the proposed wind farm is greater than 4 km from the airport, the OLS is not infringed.

Stirling North airfield's OLS consist of an approach and a takeoff surface each with a 5% gradient that extends to 1600 m from the end of the southern-most runway threshold. The closest WTG is further than 6 km from that threshold.

The OLS at Stirling North airfield is not infringed by the Port Augusta REP WTGs.

The wind farm does not infringe the OLS of any other airport or airfield.

2.3 PANS OPS Surfaces

Port Augusta Airport is located approximately 12 km from the nearest WTG. It has one instrument flight procedure (IFP) published in the Australian Aeronautical Information Publication (AIP) – RNAV (GNSS) RWY 15.

An assessment of the impact of the WTGs on the PANS OPS surfaces was carried out. The results are detailed in Table 1.

The wind farm is located outside of the lateral PANS OPS protection surfaces for the missed approach segment. The lowest PANS OPS protection surface above any element of the wind farm is at an elevation of 1036 m (3400 ft) AHD.

As the highest possible WTG blade tip elevation could be 327.5 m (1075 ft), this assessment concludes that the proposed development of the Port Augusta REP does not infringe the PANS OPS surfaces for Port Augusta Airport.

Port Augusta Instrument Flight Procedure Title	PANS OPS Protection Surface Elevation (m AHD)	Clearance of development at 327.5 m AHD (in metres)
25 nm and 10 nm MSA	1036	708.5
RNAV-Z (GNSS) RWY 15	UWF located outside of missed approach tolerance area	Clear

Table 1: Port Augusta PANS OPS Assessment Details

2.4 Air Routes

AIP Enroute Charts L7 and H3, effective 8 November 2018, were assessed in order to discover if any air routes exist within the navigation tolerances of the wind farm. The navigation tolerance is a 5 nm buffer either side of the centerline of the air route.

There are no IFR Air Routes within 5 nm of the Port Augusta REP. The nearest one is W723, 5.7 nm west of the nearest WTG.

Should the Port Augusta REP expand to the west, and place WTGs within the 5 nm buffer for W723, the WTGs would need to be below a maximum elevation of 731 m AHD to remain clear of the protection surface.

The wind farm is within a Grid LSALT area of 1280 m (4200 ft), as shown in green in Figure 2. The clearance above the highest possible WTG is 952.5 m.

The grid is based on a whole 1-degree longitude x 1-degree latitude square. The Grid LSALT provides pilots not flying on a published air route with a LSALT if they have chosen not to determine their own for the particular route being flown. The LSALT is the lowest altitude that an IFR aircraft can fly on that route, without visual reference to the ground or water.

The WTGs will not infringe the LSALT protection surface for the relevant Grid LSALT.

The Port Augusta REP will not infringe the LSALT protection surface for any air routes.

Should a new air route be proposed in the future, the Port Augusta REP elevations will be taken into account in the calculation of the appropriate LSALT.

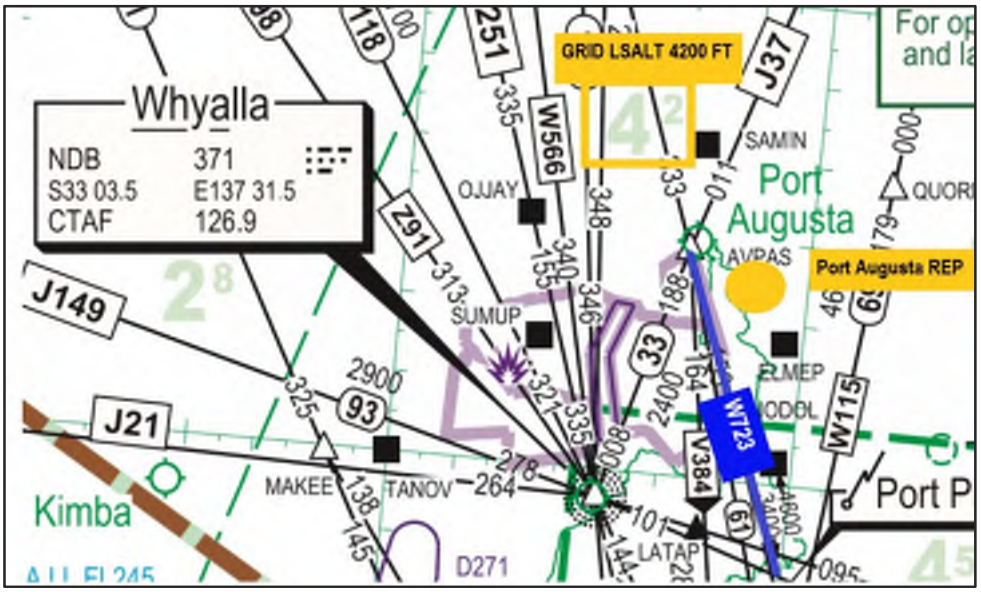


Figure 2: Air Routes and Port Augusta REP (AIP ERC L7 – 8 November 2018)

3 ATC Surveillance Systems and Navigation Aids

3.1 Overview

Wind farms have the potential to cause interference to ATC radar surveillance systems and to the accuracy of aeronautical navigation aids resulting in physical obstructions, the generation of 'radar clutter' and signal propagation.

Research has occurred around the world to determine the effect of WTGs on radar systems[1]. Primary radars (PSR) transmit a pulse of energy that is reflected back to the radar receiver by an object that is within its line of sight. The closer a WTG is to a radar site, the greater the likelihood its reflected energy will be detected by the radar receiver. Secondary surveillance radar (SSR) systems differ from PSRs as rather than measuring the range and bearing of targets through detecting radar signals, an SSR transmits an interrogation requesting a dedicated response. Upon receiving an interrogation, the aircraft then transmits a coded reply which the SSR can use to ascertain the aircraft's position as well as decode other information contained within the response.

Wind turbine effects on SSR are traditionally less than those on PSRs but can be caused due to the physical blanking and diffracting effects of the turbine towers, depending on the size of the turbines and the wind farm. These effects are typically only a consideration when the turbines are located very close to the SSR, i.e. less than 10 km.

3.2 Surveillance Systems

The nearest ATC surveillance radar systems are located at Adelaide Airport and Summertown in the Adelaide Hills, approximately 260 km south of the wind farm, beyond line of sight and located outside of the clearance zones associated with this facility.

Wind farms that are located near to other wind farms were considered to have an impact on ATC surveillance systems due to the cumulative effects of the many WTGs above those of an individual wind farm. Modern ATC surveillance systems such as Automatic Dependent Surveillance – Broadcast (ADS-B) are not impacted to the same extent as Primary Radar systems. As the nearest surveillance

[1] UK CAA, *CAA Policy and Guidelines on Wind Turbines*. CAP764. Issue 6, February 2016.

radars are located more than 200 km from the boundary of the Port Augusta REP therefore our assessment is that their signals will not be affected by the many WTGs in the area.

Airservices Australia has installed ADS-B receivers throughout Australia that provide a much greater ATC surveillance service to aircraft in and around controlled airspace than the current radar systems do. The locations of these receivers is not public knowledge. Due to the nature of the signals between aircraft and the ADS-B receivers, it is unlikely that the WTGs will cause any interference to those signals but the details of the Port Augusta REP should be provided to Airservices Australia to enable them to determine if there is any interference from WTGs.

To date there have been no reported incidents of interference from WTGs with ADS-B signal reception.

3.3 Navigation Aids

The nearest aeronautical navigation aid is located at Whyalla Airport, 56km from the development. The wind farm is located outside the clearance zones associated with this and all other aviation navigation aids.

Details of the wind farm should be provided to Airservices Australia to enable their engineers to confirm that the WTGs do not interfere with ATC communications, surveillance or navigations systems.

4 Aviation Activity in the Vicinity of the Wind Farm

4.1 Aerodromes in the Vicinity

Table 2 shows the distances to the airports and aerodromes within 55.56km (30 nm) of the Port Augusta REP boundary.

Figure 1, in Section 1, maps the development in relation to these airfields.

Airport	Direction and distance from site
Port Augusta Airport (Certified)	12 km north west
Stirling North ALA (Uncertified)	1 km north east

Table 2: Airports within 30 nm of the Port Augusta REP

Of these airports, Port Augusta is the only one with instrument approach procedures.

Stirling North Aeroplane Landing Area (ALA) caters for Visual Flight Rules (VFR) operations including joy flights, recreation flights and pilot training. A gliding club may operate from there as well.

The Port Augusta Flying Club operates light aircraft from the Stirling North ALA which is across the Princess Highway from the REP. The OLS is not infringed by the WTGs. Locally imposed operating requirements restrict aircraft operations to the east and south of the ALA, on the opposite side of the ALA to the REP. It is apparent that the flying club is aware of the REP and avoid flying over the area. They also advise visiting pilots of the operational restrictions at the ALA. Although the REP is in very close proximity to the ALA, it is apparent that aircraft can operate safely there. There are no night time flight operations at the ALA.

There may be other privately-owned airstrips in the area that are not published in the Aeronautical Information Publication (AIP). The owners of these airstrips and the pilots that use them are responsible for ensuring that the condition of the airstrip and the surrounding terrain and obstacle environment are suitable for the safe operation of the aircraft using them.

Ongoing consultation by the developer, together with details of the construction of the wind farm, will have created a community awareness of any impact the WTGs may have on these airstrips. The Port Augusta Flying Club and the local gliding club, should be provided with these details, if they haven't already, to help them determine their best course of action to keep their flying activities safe.

4.2 Other VFR operations

It is difficult to assess the level of aviation activity in the vicinity of the Port Augusta REP due to the lack of reporting requirements for VFR flights in this area.

VFR flights between airports normally operate at a comfortable altitude above terrain for their transit over the rugged terrain in the region, to their destinations. They are required to maintain visual reference to the ground or water at all times so they should have ample opportunity to see any wind farm at a suitable distance to be able to avoid it if they need to.

VFR scenic and local flights might operate at lower altitudes in calm conditions, but the prominent wind turbines will be readily identifiable and avoidable and also serve as a navigation feature. The existence of other wind farms in Australia will have influenced pilot behavior due to an increased level of awareness of their presence.

Glider flying training and cross-country soaring activity occurs around Australia. Glider flights are conducted by day only and in good weather conditions using either thermal or mountain wave type updrafts to conduct cross-country flights away from the airfield. Gliding operations in mountainous areas require careful consideration of the weather conditions for the entire period of the planned flight and constant awareness of available landing areas should the conditions change adversely. The glider flights will either be at an altitude well above the energy park or be landing in paddocks if they cannot get back to an airfield. Either way, the WTGs are a prominent navigation feature that will enable pilots to avoid the wind farm if they need to land nearby.

4.3 Low level operations

Pilots undertaking authorised low level operations such as crop dusting (aerial application of fertilisers), aerial firefighting, aerial cattle mustering, search and rescue, power line survey, gas pipe line monitoring and military low level flying that may occasionally occur in the area undergo specialised training and are required to take account of obstacles when planning and conducting low level operations.

Depiction of the Port Augusta REP on aeronautical charts will provide sufficient information for pilots planning to operate in the vicinity of the Port Augusta REP. This will allow pilots to be aware of the wind farm's presence and to plan their flights in order to either avoid the location altogether or to consider any likely impact upon their proposed flight operations.

Aerial surveillance of power lines in the area is undertaken by helicopter operations. In some cases, where power lines are in close proximity to a wind farm, arrangements are made between the wind farm operator and the power line authority to shut down certain turbines.

4.4 IFR Operations

IFR pilots operating in the area are required to maintain minimum altitudes published on aeronautical charts and instrument approach charts.

As shown in Section 2, the Port Augusta REP will not infringe any of the LSALTs for air routes in the area nor any PANS OPS protection surfaces for any aerodrome with published IFPs.

4.5 Contingency Procedures – Engine Inoperative Flight Paths

In the context of the aircraft and airport operations in the vicinity of the proposed development of the Port Augusta REP and the physical environment, it is considered to be sufficiently distant from Port Augusta airport to have no impact on contingency procedures and engine inoperative flight paths in the area.

In the unlikely event of a twin engine aircraft operating at Stirling North ALA, the WTGs will be a prominent feature that will enable pilots to understand that the area to the west and south west of the Princess Hwy will need to be considered in their contingency planning if they suffer an engine failure shortly after take-off.

5 Obstacle Marking and Lighting

Previous experience suggests that obstacle marking of the wind turbines will not be required. CASA is likely to impose a condition that the WTGs are painted in a colour that is visually conspicuous against the prevailing background, usually white. CASA considers that WTGs are sufficiently conspicuous by day due to their shape, size and colour.

If CASA or the Department of Defence (DoD) require obstacle lighting for Port Augusta REP, shielding of the lights to avoid distraction to residents may be installed, however the lights must remain visible above a horizontal plane. CASA and DIRD are reviewing the requirements for lighting of wind farms.

Discussion notes regarding the lighting of wind farms can be found in Appendix C.

As Port Augusta REP's WTG tip heights will exceed the height of 110m AGL, formal notification to CASA and DoD is required in accordance with:

- CASA Advisory Circular AC 139-08(0) "Reporting of Tall Structures" to enable inclusion of the wind farm location and height of turbines in relevant aeronautical information publications; and
- CASA Form 406 – "Operational Assessment of Existing and Proposed Structures".

This aeronautical impact assessment and review of obstacle marking and lighting requirements supports this formal notification requirement.

Formal notification of the intention to develop the Port Augusta REP should also be provided to local aviation parties and relevant aviation stakeholders.

6 Turbulence

Turbulence is caused by the wake of the turbine which extends downwind behind the blades and the tower, from a near to a far field. The dissipation of the wake and the reduction of its intensity depend on the convection, the turbulence diffusion, the topography (obstacles, terrain, etc.) and the atmospheric conditions.

There is evidence of considerable research activity on modelling and studying the wake characteristics within wind developments, using computational fluid dynamics (CFD) techniques, wind tunnel tests and on-site LIDAR measurements[2]. The advice contained in the NASF Guideline D remains the current advice in Australia, noting that wind farm operators should be conscious of their duty of care to communicate with aviation operators within the vicinity of the wind farm.

7 Conclusion

The proposed Port Augusta REP development, south east of Port Augusta township, to a maximum height of 327.5 m AHD:

- is located within Class G airspace;
- will not infringe any OLS;
- will not infringe the PANS OPS surfaces of any airport;
- will not impact on contingency procedures at certified aerodromes;
- is located outside the clearance zones associated with all ATC surveillance radar systems;
- the cumulative effect of this wind farm and that of neighbouring wind farms will not impact upon the ATC surveillance radar systems;
- will not infringe the LSALT protection surfaces for any air route;
- will not infringe the relevant Grid LSALT;
- is outside the clearance zones associated with any aeronautical navigation aids;
- will have little or no impact upon local flying activities as the local flying club already restricts flight operations over the area; and
- will provide a significant visual navigation feature in the region.

Details of the wind farm should be provided to CASA and the Department of Defence, for assessment of the need for obstacle lighting.

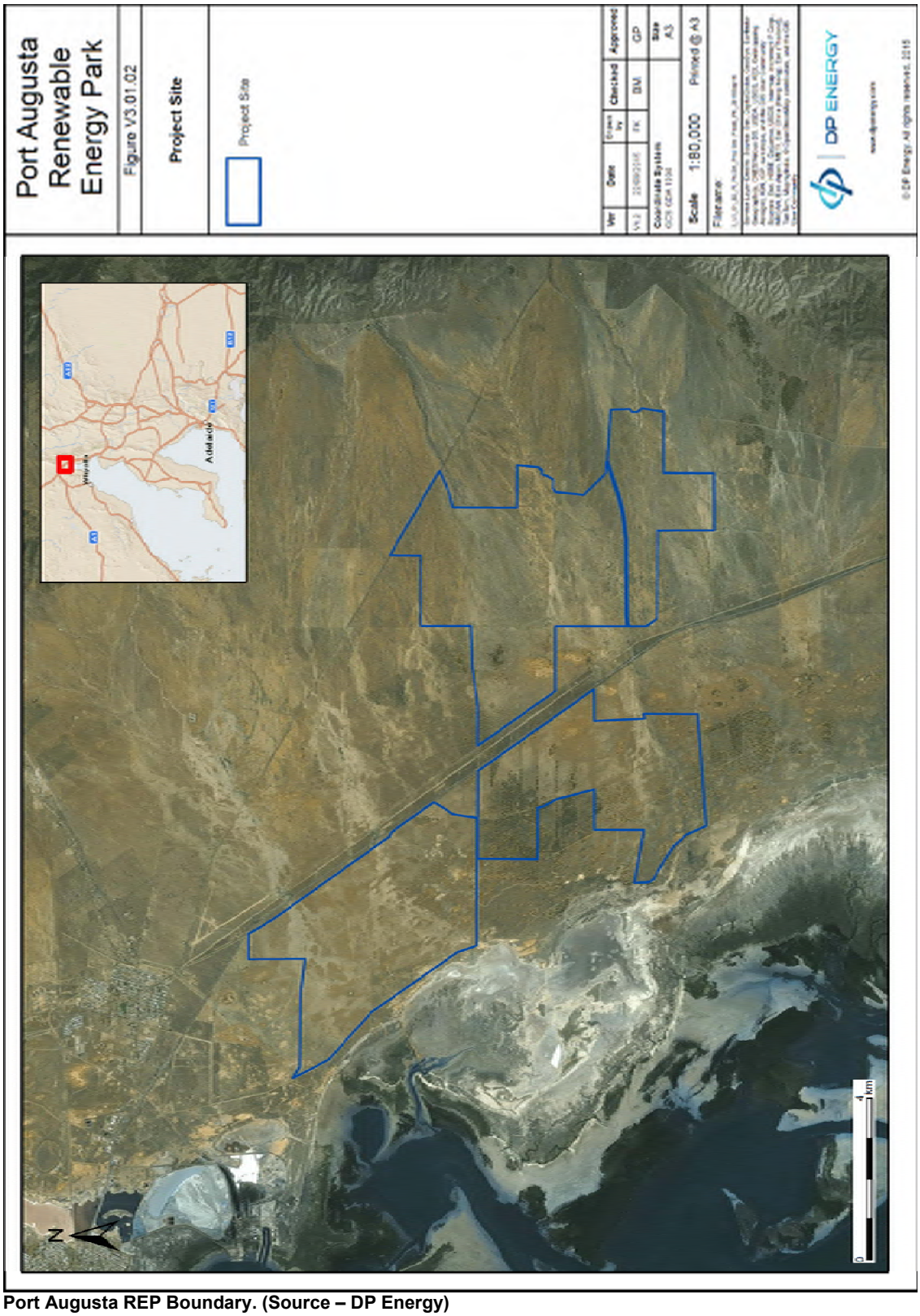
This report will need to be referred to Airservices Australia for inclusion on aeronautical charts.

[2] https://www.liverpool.ac.uk/flight-science/cfd/wake-encounter-aircraft/

Appendix A: Indicative Site Coordinates and Elevations

WTG No	LATITUDE	LONGITUDE	WTG Height AGL (m)	Ground Elevation [m] AHD	WTG Tip Elevation (m) AHD
1	32° 33' 29.3381" S	137° 50' 43.6649" E	185	15.9	200.9
2	32° 33' 25.6299" S	137° 50' 58.4552" E	185	18.4	203.4
3	32° 33' 20.3484" S	137° 51' 19.5164" E	185	23.0	208.0
5	32° 34' 15.4134" S	137° 50' 28.9010" E	185	10.5	195.5
6	32° 34' 10.8636" S	137° 50' 46.7842" E	185	13.5	198.5
7	32° 34' 06.3085" S	137° 51' 04.6846" E	185	16.2	201.2
8	32° 34' 01.7421" S	137° 51' 22.6271" E	185	18.7	203.7
10	32° 34' 49.4905" S	137° 50' 52.6983" E	185	11.0	196.0
11	32° 34' 45.0044" S	137° 51' 10.6621" E	185	13.4	198.4
12	32° 34' 40.5305" S	137° 51' 28.5738" E	185	16.6	201.6
13	32° 34' 36.0513" S	137° 51' 46.5037" E	185	19.5	204.5
14	32° 34' 31.5665" S	137° 52' 04.4525" E	185	23.8	208.8
15	32° 34' 27.0427" S	137° 52' 22.5554" E	185	28.9	213.9
16	32° 35' 24.4990" S	137° 51' 17.6078" E	185	10.5	195.5
17	32° 35' 20.7463" S	137° 51' 32.5113" E	185	13.1	198.1
18	32° 35' 16.2390" S	137° 51' 50.4376" E	185	14.7	199.7
19	32° 35' 11.7377" S	137° 52' 08.3670" E	185	15.8	200.8
20	32° 35' 07.2347" S	137° 52' 26.3004" E	185	22.6	207.6
21	32° 35' 02.7324" S	137° 52' 44.2300" E	185	26.1	211.1
22	32° 35' 44.8309" S	137° 52' 50.9374" E	185	25.2	210.2
23	32° 35' 43.2948" S	137° 53' 09.5167" E	185	27.7	212.7
25	32° 36' 17.4215" S	137° 53' 20.8999" E	185	28.0	213.0
26	32° 36' 12.9101" S	137° 53' 38.8228" E	185	32.0	217.0
31	32° 37' 56.7221" S	137° 52' 35.4711" E	185	12.2	197.2
32	32° 37' 51.6271" S	137° 52' 50.7222" E	185	14.5	199.5
33	32° 37' 45.9903" S	137° 53' 07.5958" E	185	17.1	202.1
34	32° 37' 40.3012" S	137° 53' 24.6220" E	185	20.6	205.6
36	32° 38' 26.6865" S	137° 53' 04.8612" E	185	11.8	196.8
37	32° 38' 21.3278" S	137° 53' 20.0187" E	185	15.7	200.7
38	32° 38' 15.8192" S	137° 53' 35.5957" E	185	19.2	204.2
39	32° 38' 10.3032" S	137° 53' 51.1930" E	185	22.3	207.3
40	32° 35' 54.1245" S	137° 54' 19.5761" E	185	44.1	229.1
41	32° 35' 48.8230" S	137° 54' 37.2017" E	185	49.7	234.7
42	32° 35' 43.4224" S	137° 54' 55.1103" E	185	58.1	243.1
43	32° 35' 37.6130" S	137° 55' 14.3657" E	185	63.4	248.4
44	32° 35' 32.0853" S	137° 55' 32.9412" E	185	74.0	259.0
45	32° 35' 28.2224" S	137° 55' 45.7619" E	185	78.4	263.4
46	32° 35' 24.3231" S	137° 55' 58.7137" E	185	86.7	271.7
47	32° 35' 15.9326" S	137° 56' 26.7217" E	185	104.0	289.0
48	32° 35' 10.5917" S	137° 56' 44.3245" E	185	114.5	299.5
49	32° 35' 04.3823" S	137° 57' 05.0043" E	185	128.2	313.2
50	32° 36' 11.2436" S	137° 55' 31.4256" E	185	66.9	251.9
51	32° 36' 03.5537" S	137° 55' 55.7112" E	185	76.8	261.8
52	32° 35' 58.5485" S	137° 56' 11.5165" E	185	85.4	270.4
53	32° 35' 52.9860" S	137° 56' 29.0378" E	185	94.3	279.3
54	32° 35' 47.4336" S	137° 56' 46.5508" E	185	104.4	289.4
55	32° 36' 33.7440" S	137° 56' 16.1373" E	185	77.1	262.1
56	32° 36' 28.1763" S	137° 56' 33.6090" E	185	84.0	269.0
57	32° 36' 22.6111" S	137° 56' 51.1243" E	185	92.9	277.9
58	32° 36' 17.0354" S	137° 57' 08.6289" E	185	102.4	287.4
59	32° 37' 20.9358" S	137° 55' 59.0229" E	185	64.4	249.4
60	32° 37' 15.3470" S	137° 56' 16.5311" E	185	69.7	254.7
61	32° 37' 08.3176" S	137° 56' 38.5339" E	185	78.7	263.7
62	32° 37' 02.7276" S	137° 56' 56.0317" E	185	85.5	270.5
63	32° 37' 47.2715" S	137° 56' 34.5700" E	185	72.0	257.0
64	32° 37' 41.7355" S	137° 57' 06.1522" E	185	88.0	273.0
65	32° 37' 38.5343" S	137° 57' 24.3876" E	185	98.2	283.2
66	32° 37' 35.3181" S	137° 57' 42.7236" E	185	108.6	293.6
67	32° 37' 32.0888" S	137° 58' 01.1293" E	185	119.6	304.6

Indicative WTG Coordinates and Terrain Elevations (Data Source: DP Energy)
(Highest WTG is highlighted in yellow)



Port Augusta REP Boundary. (Source – DP Energy)

Appendix B: Assessment Methodology

In preparing aeronautical impact assessments associated with airport safeguarding and protection, it is necessary to observe the requirements of the relevant aviation authorities including:

- The Department of Infrastructure, Regional Development and Cities (DIRDC);
- The Civil Aviation Safety Authority of Australia (CASA);
- Airservices Australia (ASA);
- Airport Operators; and
- Department of Defence where appropriate.

Relevant Acts and Regulations applicable to developments near airports and air traffic routes were referenced during this assessment.

The major relevant documents include:

- National Airports Safeguarding Framework Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations*
- The Airports Act 1996, Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards – Aerodromes;
- Aeronautical Information Publication (AIP);
- Airservices Australia's Airways Engineering Instruction – Navigation Aid Building Restricted Areas and Siting Guidance (BRA);
- International Civil Aviation Organisation (ICAO) Doc 8168 *Procedures for Air Navigation – Aircraft Operations* (PANS OPS); and
- International Civil Aviation Organisation (ICAO) Annex 14 – *Aerodrome Design and Operations*.

A Glossary of Aeronautical Terms and Abbreviations is shown at Appendix D.

Appendix C: Discussion of Obstacle Lighting

The aeronautical requirements for marking and lighting of wind farms are currently undergoing review by the International Civil Aviation Organization (ICAO), the Department of Infrastructure, Regional Development and Cities (DIRDC) and CASA.

It is understood that ICAO will be issuing an amendment to ICAO Annex 14 (Aerodromes) later this year that addresses, inter alia, wind farms.

DIRDC recently issued a Discussion Paper “Safeguards for Airports and The Communities Around Them” that implies an amendment to the criteria for wind turbine heights from 110m to 152m AGL as being applicable to wind farms in the vicinity of aerodromes. In addition, CASA is currently reviewing its withdrawn Advisory Circular AC139-181 “Obstacle Marking and Lighting of Wind Farms”. The outcomes of these various reviews may result in:

- Revised criteria for wind farms; and
- Wind farms that are in remote locations, away from aerodromes, not requiring obstacle lighting, depending on the findings of a qualitative risk assessment to be undertaken by the proponent.

While the DIRDC Discussion Paper applies specifically to wind farms within the vicinity (generally accepted as 30km) of aerodromes, CASA is also currently reviewing the requirements for marking and lighting of obstacles and hazards remote from aerodromes. CASA has informally advised the wind farm industry that a qualitative risk assessment approach to the potential hazards, as presented by wind farms, may be considered.

CASA’s current position on obstacle lighting of wind farms that are remote from an aerodrome (which is the situation for Port Augusta REP apart from the ALA which is not used for night operations) is summarised as:

- CASA cannot mandate obstacle lighting for wind farms that are not within the vicinity of an aerodrome;
- provision of obstacle lighting is the responsibility of the proponent;
- any associated requirements placed on proponents by planning authorities, insurers or financiers are beyond CASA’s scope;
- a wind farm proponent may have a duty of care to the aviation industry and local operators in terms of ensuring obstacles are made conspicuous; and
- obstacle marking and lighting requirements as specified in the CASA Manual of Standards Part 139, Chapters 8 and 9 applies.

CASA Manual of Standards (MOS) 139, Chapter 9, Section 9.4 indicates that for structures more than 110m AGL, the proponent should expect that obstacle lighting will be required unless there are unusual circumstances. The turbines to be installed at Port Augusta REP will have a maximum height of 250 m AGL. However, there have been situations where CASA has acknowledged non-provision of obstacle lighting of wind farms in Australia where the turbine height exceeds 110m AGL. Such installations have been the subject of a hazard risk assessment that takes into account such factors as location of the wind farm with respect to nearby airfields and air routes, potential impact on navigable airspace, surrounding terrain, local aviation activity in the area, and environmental considerations.

As indicated above, Australian policy, standards and recommended practices for obstacle marking and lighting of wind farms are currently under review. A current proposal includes a change to the criterion height of 110m (361ft) to 152m (500ft) AGL for wind farms within the vicinity of a certified or registered aerodrome.

Appendix D: Glossary of Aeronautical Terms and Abbreviations

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

Advisory Circulars (AC) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical Information Publication (AIP) is a publication promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. It contains details of regulations, procedures and other information pertinent to flying and operation of aircraft within the applicable country. AIP Australia is produced by Airservices Australia under contract to CASA.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

Air routes exist between navigation aids or waypoints to facilitate the regular and safe flow of aircraft operating under the IFR.

Airservices Australia (ASA) is the Australian government-owned corporation Air Navigation Service Provider (ANSP) providing safe, secure, efficient and environmentally sound air traffic management and related airside services including telecommunications, aeronautical data, navigation services and aviation rescue and firefighting services to the aviation industry within the Australian flight information region.

Air Traffic Control (ATC) service is a service provided in controlled airspace for the purpose of preventing collisions between aircraft and between aircraft and obstructions on the manoeuvring area of controlled aerodromes whilst maintaining an expeditious and orderly flow of air traffic.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

Area navigation (RNAV) A method of navigation which permits aircraft operation on any desired flight path within the coverage of the station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Circling approach An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Civil Aviation Safety Authority (CASA) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

Civil Aviation Safety Regulations (CASR) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

Decision altitude (DA) or decision height (DH) A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. *Note— Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.*

Elevation The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

Height The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

Instrument Flight Rules (IFR) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not available due to cloud cover or restricted visibility. IFR flight depends upon a qualified instrument rated pilot flying by reference to instruments located in the flight deck. Navigation is accomplished by reference to electronic signals. It is also referred to as, “a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,” such as an IFR or VFR flight plan. IFR flights can and do regularly operate in VMC but remain an IFR flight for rule and ATC requirements. Regular Public Transport flights are required to file an IFR flight plan, irrespective of the weather conditions.

Instrument Meteorological Conditions (IMC) are meteorological conditions that are less than the minimum specified for visual meteorological conditions.

International Civil Aviation Organization (ICAO) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

Lowest Safe Altitude (LSALT) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

Manual of Standards (MOS) comprises specifications (Standards) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation in relation to a particular segment of the aviation regulations. For example, MOS 139 relates to CASR Part 139 – Aerodromes.

Minimum descent altitude (MDA) or minimum descent height (MDH) A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference. Note: Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Minimum Obstacle Clearance (MOC) is the minimum distance above an obstacle or terrain that aircraft conducting instrument approach or departure procedures are not allowed to fly below in IMC. The MOC varies depending on the distance from the runway or in mountainous areas.

Notices to Airmen (NOTAMs) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

Obstacle assessment surface (OAS) is a defined surface intended for the purpose of determining those obstacles to be considered in the calculation of obstacle clearance altitude/height for a specific APV or precision approach procedure.

Obstacle Limitation Surfaces (OLS) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) is an ICAO term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) using the Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space, below the nominal flight path of the aircraft, which guarantee a certain minimum obstacle clearance above the ground or man-made obstacles. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating in IMC an obstacle free descent or climb path for a given approach, holding procedure or departure.

Regulations (Civil Aviation Safety Regulations)

Threshold (THR). The beginning of that portion of the runway usable for landing.

Visual Flight Rules (VFR) are rules applicable to the conduct of flights that are only permitted in VMC due to aircraft equipment and pilot qualifications. The visual flight rules allow a pilot to operate an aircraft in weather conditions that allow the pilot to navigate by visual reference to the ground or water by maintaining visual contact with the terrain and obstacle environment in order to be able to see and avoid other aircraft, terrain, obstacles or other hazards. Specifically, the weather must be equal to or better than basic VFR weather minima. If the weather is worse than VFR minima, IFR qualified pilots operating an IFR qualified aircraft are able to operate under the IFR.

Visual Meteorological Conditions (VMC) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

Visual Segment Surface (VSS) A PANS-OPS design segment of a straight-in instrument approach procedure, which needs to be monitored and kept clear of any penetrations by obstacles.

Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table.

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance - Broadcast
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALT	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BARO-VNAV	Barometric Vertical Navigation
BRA	Building Restricted Area
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix

Abbreviation	Meaning
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LNAV	Lateral Navigation criteria
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NDB	Non Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North North East
NOTAM	NOtice to AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface

Abbreviation	Meaning
OLS	Obstacle Limitation Surface
PANS OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	STandard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VNAV	Vertical Navigation criteria
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart

Appendix 19: Updated Airservices Australia Response

David Blake

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Monday, 11 February 2019 1:53 PM
To: David Blake
Cc: 'Airspace Protection (Airspace.Protection@casa.gov.au)'
Subject: AIRSERVICES RESPONSE: SA-WF-015 P4 - Port Augusta Renewable Energy Park [SEC=UNCLASSIFIED]

Hi David,

I refer to your request for an Airservices assessment of the wind farm for the Port Augusta Renewable Energy Park.

Airspace Procedures
With respect to procedures promulgated by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 327.5m (1075ft) AHD, the wind farm will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Port Augusta Airport, nor will it affect any air route lowest safe altitudes.

Note that procedures not designed by Airservices at Port Augusta Airport were not considered in this assessment.

Communications/Navigation/Surveillance (CNS) Facilities
This wind farm, to a maximum height of 327.5m (1075ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Vertical Obstacle Notification
As soon as construction commences, the proponent must complete the Vertical Obstacle Notification Form for tall structures and submit the completed form to VOD@airservicesaustralia.com. For further information regarding the reporting of tall structures, please contact (02) 6268 5622, email VOD@airservicesaustralia.com or refer to the web link below:
http://www.airservicesaustralia.com/services/aeronautical-information-and-management-services/part-175/

Kind regards,

William Zhao
Advisor Airport Development | Operations Standards & Assurance
Airservices Australia

Phone: +61 3 9339 2504
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Appendix 20: Updated Ornithology Assessment

Port Augusta Renewable Energy Park

Ornithology Assessment Update

January 2019

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List of Tables

Introduction

1. In light of advances in wind turbine design, DP Energy Australia Pty Ltd (DPEA) are considering the use of larger sized wind turbines (up to 155 m in diameter) with greater rotor ground clearance for the consented Port Augusta Renewable Energy Park (the Project). DPEA have commissioned Atlantic Ecology to evaluate how these wind farm design changes would affect the ornithology impacts assessment conclusions for the Project. DPEA have also asked Atlantic Ecology to identify recent changes to national and state-specific threatened species lists and other context information that are relevant to the Project's impact assessment.
2. In previous studies, the potential numbers of lethal collisions involving Eastern Curlew and Curlew Sandpiper were calculated using collision rate modelling (CRM) for turbines of 130m and 137m diameter and operating with a ground clearance (the distance between the lowest part of the rotor sweep and the ground) of 20m and 13m respectively (DPEA, 2016; NRP, 2016). This report evaluates the implications for bird collision risk of increasing the rotor diameter to 150m or 155m, and increasing ground clearance to 30m. The evaluation of larger turbines is underpinned by new CRM. The potential for larger sized turbines to affect collision risk to other bird species that use the vicinity of the development sites is examined qualitatively.
3. National and South Australia-specific threatened species lists and threat category are regularly reviewed and updated in light of new information on species' conservation status. The report also examines if there have been any recent changes to the threatened bird species lists that are relevant to the Project and if so whether this could have implications for the Project impact assessment conclusions and compliance with nature conservation legislation, including the Environmental Protection and Biodiversity Conservation (EPBC) Act.

Background

4. In their response to the Project's Flora and Fauna assessment (EBS, 2013; DPEA, 2015) the federal Department of Environment (DoE) expressed concern that there could be potential for adverse impacts on Eastern Curlew and Curlew Sandpiper. These species were placed on the EPBC Critically Endangered list in 2015 due to their rapid population decline.
5. Baseline surveys showed that small numbers of Eastern Curlew regularly use the intertidal wetlands adjacent to the western edge of the development site. Curlew Sandpiper was not recorded in baseline surveys (or subsequent surveys), however, based on literature review and expert judgement of habitat suitability, it is considered likely that this species occasionally uses the wetlands adjacent to the western edge of the development site.
6. An additional field study and further impact assessment was undertaken in 2016 to inform the concern raised by DoE, in particular the potential for the Project to lead to mortality of Eastern Curlew and Curlew Sandpiper through collision with turbines. This work included CRM studies based on wind turbines of 130m rotor diameter and with a ground clearance of 20m. This work concluded that the potential for adverse impacts on Eastern Curlew and Curlew Sandpiper was negligible (DPEA, 2016). A report of the field study, CRM predictions and impact assessment results (DPEA, 2016: '*Supplementary Studies on Shorebirds'*) was submitted to DOE, who subsequently indicate their approval of the work and its conclusions. A follow-up report (NRP, 2016) presenting CRM mortality predictions for turbines of 137m in diameter and the implications of using turbines of this size for impacts on birds was sent to DOE in November 2016. DOE also approved the findings of this report (email from DOE to DPE 15th December 2016).
7. The potential for the Project to affect bird populations has been examined previously, as summarised below:

- The Project's Flora and Fauna assessment (EBS, 2013; DPEA, 2015) undertaken to support the original development application. This assumed a wind turbine size of 122 diameter, with a minimum ground clearance of 25m.
- The report *Supplementary Studies on Shorebird* (DPEA, 2016) previously referred to above. This assumed a wind turbine size of 130m diameter, with a minimum ground clearance of 20m.
- The report *Implications for Shorebird Collisions Arising from use of 137m Diameter Turbines* (NRP, 2016) reported additional collision modelling undertaken to predict the change in collision risks to Eastern Curlew and Curlew Sandpiper that would result from increasing turbine size from 130m to 137m diameter and reducing ground clearance to 13m was later also examined.

8. The Project achieved initial planning consent in 2015 & variation consent for rotor diameters of up to 140m and tower heights of up to 82m in 2017. Since then there have been significant advances in turbine technology, and DPEA intends to seek a variation to the development consent for the project to facilitate larger turbines to further reduce the project's levelised cost of energy (LCOE). As part of this process, DPEA wishes to ensure that ornithology issues continue to be rigorously examined. To this end, DPEA has commissioned this updated assessment to reflect the larger turbines and to ensure that any changes to bird species conservation priorities are captured and taken into consideration. It is DPEA's intention that construction work will commence in late 2019.

Changes to Threatened Species Lists

9. The federal EPBC threatened species list (http://www.environment.gov.au/epbc/about/epbc-act-lists) and the threatened species schedules of the South Australia National Parks and Wildlife Act 1972 (Version:15:3.2017, https://www.legislation.sa.gov.au/LZ/C/A/NATIONAL20PARKS20AND20WILDLIFE20ACT201972/CURRENT/1972.56.AUTH.PDF) were checked online on the 6th September 2018 to see if any changes made over the past two years are relevant to the Project (i.e. since the lists were lasted checked for the Project in February 2016). Bird species classified as Critically Endangered, Endangered or Vulnerable were checked against the list of bird species recorded in the Project site and its vicinity (i.e., the study area covered by baseline surveys), or which, on the grounds of general information on a species' range, status and habitat preferences, might reasonably be expected to sometimes occur there.
10. The checks revealed that five species of shorebird that are regularly recorded in South Australia and potentially occur in the vicinity of the Project have been recently added to the EPBC threatened species list, as follows:
    - Great Knot, added to EPBC Critically Endangered List in 2016;
    - Red Knot, added to EPBC Endangered List in 2016;
    - Lesser Sand Plover, added to EPBC Endangered List in 2016;
    - Bar-tailed Godwit ('*baueri*' sub-species), added to EPBC Vulnerable List in 2016; and,
    - Great Sand Plover, added to EPBC Endangered List in 2016.
11. The checks also revealed that there have been no recent changes to the South Australia threatened species classification for bird species potentially relevant to the Project.
12. All five of the EPBC newly-listed shorebird species, as with Curlew Sandpiper and Eastern Curlew (both classified as Critically Endangered in 2015), are long distance migrants to Australia from

breeding grounds in the east Siberian Arctic that outside the breeding season depend on intertidal habitats (principally mud and sand flats). In all cases their recent rapid population declines are linked to habitat loss and hunting pressures at migration stop-over sites in the Yellow Sea region.

13. Apart from a single Lesser Sand Plover recorded on one day only in the February 2016 shorebird surveys, none of these newly listed EPBC threatened species were recorded during the Project's baseline surveys. Thus the baseline surveys indicate that the development site and its vicinity have negligible importance for these species.

14. With the exception of Red Knot, the five EPBC newly listed shorebird species are classified as 'Rare' species in South Australia (South Australia National Parks and Wildlife Act 1972 species schedules). The results of shorebird survey work across South Australia (Purnell *et al*., 2013; Carpenter and Langdon, 2014) indicate that the Spencer Gulf has low importance for these shorebird species. The two sand plover species are rarities in South Australia and the whole of southern Australia lies beyond their regular Australian range. Great Knot, Red Knot, Bar-tailed Godwit all regularly occur in small to moderate numbers in suitable habitat in the Spencer Gulf and elsewhere in South Australia. However, the numbers using these sites are small in comparison to the numbers in other states, especially north-west Western Australia, and not of national importance (i.e., >1% of the Australian population) (Bamford *et al*., 2008).

15. Great Knot, Red Knot and Bar-tailed Godwit require extensive areas of bare soft mud or muddy sands. However the inter-tidal habitats adjacent to the western edge of the Project have rather sandy substrates with greater or lesser amounts of salt marsh or mangrove vegetation, and thus are likely to be unattractive to these three species. Furthermore, these three species typically congregate in relatively large flocks and frequent the same favoured areas of suitable habitat year-to-year. This means that these species are easy to detect and count and that there is a good general knowledge from wider survey work concerning where they occur and their numbers.

16. Although it is possible that a few individuals of the five newly-listed EPBC shorebird species could occasionally visit the intertidal habitats to the west of the project site, these would be uncommon or rare events (e.g., the single short-staying Lesser Sand Plover seen in February 2016). On the basis of the evidence reviewed, it is concluded that the intertidal habitats adjacent to the western edge of the Project site have negligible importance for these shorebird species. Nor is it likely that they regularly overfly the site at heights at which they would be at risk of collision with wind turbines. It is concluded that the Project poses a negligible risk to these species.

Collision Risk

17. The implications of using 150m or 155m turbines for collision risks to Eastern Curlew and Curlew Sandpiper was examined using the same Band CRM method (Band *et al*., 2007) as used previously (DPEA, 2016; NRP, 2016), but with revised turbine parameter values. The method used calculates how many flights by a species there would need to be across the footprint of the wind farm to give rise to a single collision event.

18. The Band CRM method has two stages. Stage 1 concerns the prediction of the number of bird transits through the rotor swept volume (RSV) of turbines in a wind farm. Stage 2 calculates the likelihood that a bird of a given species flying through the RSV of a turbine will collide with a rotor blade.

19. The modelling was initially done on the basis that all flight activity is at rotor height and that birds do not show any avoidance behaviour. Of course both these assumptions are unrealistic, however the initial model outputs were then adjusted to accommodate more realistic scenarios concerning flying height and avoidance behaviour.

Determinants of collision risk

20. The likelihood of collision strikes occurring is affected by several turbine specifications. Turbines with rotors of a larger diameter and/or greater rotor blade width occupy a greater volume of air-space. Therefore, if other turbine specifications remain the same, increasing rotor size will lead to an increase in the likelihood of bird collision strikes. However, the proposed changes to the turbine specifications include two other changes which also affect the likelihood of collision. These are the height above the ground level at which the turbine rotors will operate and rotation speed of the rotors.

21. The larger-sized turbines being proposed would operate with a significantly greater rotor ground clearance (30m) compared to that previously proposed (20m and 13m, depending on the turbine). Flight activity by most bird species, including the species of greatest concern to the Project (i.e., shorebirds) is disproportionately concentrated relatively close to ground level. Therefore, increasing rotor ground clearance is expected to reduce the proportion of flight activity that coincides with the rotor height range, and therefore will reduce the likelihood of collision.

22. For a given size of turbine, collision risk increases as rotation speed increases. The average rotation speed of the proposed larger-sized turbines is lower than for the smaller turbines previously proposed, and this change will reduce the likelihood of collision.

23. CRM enables the combined effects of the various turbine specification changes (rotor diameter, rotor blade width, ground clearance and rotation speed), to be integrated together and thereby predict the overall change in collision risk resulting from the proposed changes.

Bird and site parameters

24. The values of parameters used in CRM relating to the size of the wind farm and the size and flight speed of birds are tabulated in Table 1. These are the same values that were used in previous modelling (DPEA, 2016; NRP, 2016).

Table 1. Wind farm size and bird specific parameter values used in Band collision models for the full wind farm comprising 59 turbines.

Parameters and derived metrics	**Eastern Curlew**	**Curlew Sandpiper**
Wind farm footprint (km^2)	38.0	
Average length of transit across windfarm footprint (m)	3338	
Flight velocity (Alerstam *et al*., 2007) (m/s)	16.3	15.3
Average time of transit across wind farm (s)	204.8	218.2
Bird length (m) (mean of range given by Van Gils, Wiersma & Kirwan, 2016)	0.60	0.21
Bird wingspan (m) (mean of range given by Van Gils, Wiersma & Kirwan, 2016)	1.04	0.40

Turbine specifications

25. The assumed turbine specifications for the 150m and 155m turbines CRM are tabulated in Table 2 and compared to the specifications for the smaller turbine designs previously considered.

Table 2. Turbine specifications used in collision modelling

Parameter	130m turbine	137m turbine	150m turbine	155m turbine
Rotor blade maximum chord (m)	4.0	4.0	4.2	4.5
Rotor blade pitch (degrees)	30	30	-10 to 95	-2 to 90
Assumed average blade pitch (degrees)	30	30	30	30
Rotor diameter (m)	130	137	150	155
Rotation period (s)	3.4	5.0	4.9-12.0	5.5-11.29
Assumed average rotation period (s)	3.4	5.0	6.0	6.0
Assumed average turbine speed (rpm)	17.6	12.0	10	10
Rotor disk area (m^2)	13,273	14,741	17,671	18,869
Hub height (m)	85	81.5	105	107.5
Ground clearance (m)	20	13	30	30
Max tip height (m)	150	150	180	185
Where CRM reported	DPEA, 2016	NRP, 2016	This report	This report

26. The proposed 150m and 155m turbines would have a variable rotor blade pitch and variable rotation speed (Table 2). The blade pitch and rotation speed would change in unison such that as rotation speed increases pitch decreases and *vice versa*. During operation blade pitch would be adjusted to optimise electricity generation yield for the wind conditions.

27. Stage 2 of the Band CRM calculates the likelihood that a bird of a given size flying through the rotor swept area of a turbine will collide with a rotor blade. Blade pitch and rotation speed both affect the Stage 2 calculation. Precise values for average pitch and average rotation speed during turbine operation, the parameter values required for CRM, are unknown and will depend on wind speeds. For the purposes of CRM, precautionary values were chosen that approximate to the likely average. This choice was informed by calculating the Stage 2 collision risk for each species for three scenarios as follows (Table 3):

    - the minimum pitch and maximum rotation speed,
    - the maximum pitch and minimum rotation speed,
    - the mid-range pitch and mid-range rotation speed.

28. This exercise shows that for both species the Stage 2 collision risk was broadly similar for all three scenarios evaluated (Table 3). Although the Stage 2 collision risk value derived from the mid-range pitch and rotation speed values is considered likely to closely approximate to average operational conditions, there is some uncertainty about this. In recognition of this uncertainty, additional precaution has been incorporated into the Stage 2 calculation used for assessment by assuming

an average pitch of 30 degrees (i.e. the same as was assumed in previous modelling) and an average rotation speed of 10 rpm. This combination results in Stage 2 collision risk values that are approximately 10% to 20% higher (and therefore lead to more cautious assessment conclusions) than the values derived from the other three rotor pitch/speed scenarios (Table 3).

Table 3. Band Stage 2 collision risk estimates for various scenarios of rotor blade pitch and rotation speed

Scenario	Blade pitch (degrees)	Rotation speed (rpm)	Stage 2 collision risk	
			Eastern curlew	Curlew sandpiper
150m diameter rotor				
Minimum pitch/maximum speed	-2	11.3	5.60%	4.19%
Mid-range pitch/mid-range speed	44	8.395	5.66%	4.74%
Maximum pitch/minimum speed	90	5.5	5.36%	4.85%
Cautious 'average' assumed for assessment	30	10.0	6.16%	5.07%
155m diameter rotor				
Minimum pitch/maximum speed	-2	11.3	5.72%	4.31%
Mid-range pitch/mid-range speed	44	8.4	5.90%	5.03%
Maximum pitch/minimum speed	90	5.5	5.62%	5.12%
Cautious 'average' assumed for assessment	30	10.0	6.39%	5.34%

Height of flight activity

29. Predictions of collision risk are highly sensitive to the assumptions made regarding the proportion of flight activity that is assumed to be at rotor height. The question of the height distribution of Eastern Curlew and Curlew Sandpiper flight activity is discussed in the two previous reports on collision risk (DPEA, 2016; NRP, 2016). These reports examine the information on Eastern Curlew flight height obtained from observing flights by this species during the baseline ornithology studies (Table 4). No flights by Curlew Sandpiper were seen during baseline studies and so there is a lack of information on flight height for species. For the previous modelling it was considered reasonable to assume that this species showed the same pattern of flight height distribution as Eastern Curlew; this assumption is also considered reasonable for the evaluation of collision risk from larger sized turbines.

30. For the 130m turbine it was cautiously assumed that 35% of flight activity by Eastern Curlew was within the then proposed rotor swept height band of 20-150m above ground level (agl). The baseline survey data on flight heights estimated that only 12% of flight activity was at a height of greater than 30m agl (Table 4).

31. In recognition that the number of flights of Eastern Curlew observed during the baseline surveys was small, that accuracy of the estimated heights of the flight activity seen is unknown and that it is desirably for CRM predictions to be inherently precautionary, it is assumed that 20% (rather than 12%) of flight activity would be above 30m agl and that all of this activity would be below 150m agl. So, for the purposes of modelling the collision risk posed by the 150 and 155m turbines it is assumed that 20% of flight activity occurs at rotor height.

Table 4. Frequency distribution of flight height bands recorded at 15-sec intervals for the seven Eastern Curlew flights seen during the baseline survey flight activity watches (copied from DPEA 2016)

Analysis type	Height bands				
	<10m	10-30m	30-50m	50-100m	>100m
By flock					
No. of 15-s intervals	19	22	4	0	0
%	42%	49%	9%	0%	0%
By individual					
No. of 15-s intervals	300	339	85	0	0
%	41%	47%	12%	0%	0%

Avoidance rate

32. A key consideration in interpretation of the outputs from Band Model is the adjustment that needs to be made to account for behavioural avoidance. For the reasons explained in the *Supplementary Studies on Shorebirds* report, it is considered that a 99% avoidance rate is appropriate and likely precautionary for Eastern Curlew and Curlew Sandpiper (DPEA, 2016). This assumption is therefore retained for the purposes of evaluating the collision risk posed by the larger sized turbines.

CRM results for Eastern Curlew and Curlew Sandpiper

33. The CRM calculations for Eastern Curlew and Curlew Sandpiper for 130m, 137m, 150 and 155m turbines for the full wind farm are presented in Table 5. The CRM results are summarised in Table 6 and Table 7 for Eastern Curlew and Curlew Sandpiper respectively.

34. The CRM outputs indicate that turbines of 150m or 155m diameter would pose a lower collision risk to both Eastern Curlew and Curlew Sandpiper compared to the using turbines of 130m or 137m diameter (Tables 6 and 7). For example, for Eastern Curlew the 155m turbine with 30m ground clearance is conservatively estimated to pose a 52% lower collision risk than a 130m turbine with 20m ground clearance. The corresponding comparison for Curlew Sandpiper is a 48% lower risk.

35. Although increasing the size of the turbines increases the rotor swept volume, this does not lead to an increase the risk of collision risk as might at first be expected. This is because the potentially adverse effect of increasing rotor swept volume is more than offset by the large increase in rotor ground clearance, which results in there being a much lower proportion of flight activity being at the height of the rotors. The slower rotation speed of the larger turbines also contributes to the reduction in risk.

36. **It is concluded that for all turbine sizes examined, the predicted magnitude of the collision risk to Eastern Curlew and Curlew Sandpiper is extremely small. Furthermore, the CRM shows that the potential for collision risk from the larger turbines (up to 155m diameter) would be substantially lower than the turbines sizes previously proposed (130m and 137m) provided they had 30m ground clearance.**

37. **The previous conclusion that the collision risks to these species from the Project are negligible (DPEA, 2016; NRP, 2016) remains unchanged.** The previous conclusion of that risks were negligible was reached on the basis that no flight activity by either species was recorded over the proposed footprint of the wind farm during the baseline surveys (DPEA, 2015; DPEA, 2016) and supported by an examination of the likely flight routes that birds would take when moving between known feeding sites in South Australia (DPEA, 2016).

Table 5. Band collision rate modelling calculations for turbines of 150m and 155m diameter and with 30m ground clearance.

Parameter	Eastern curlew		Curlew sandpiper	
	150m turbines	155m turbines	150m turbines	155m turbines
Average time of transit across wind farm (s) (from Table 1)	204.8	204.8	218.2	218.2
Mean time for 1 transit through RSA (s)	0.294	0.294	0.288	0.288
Rotor max chord (m)	4.2	4.5	4.2	4.5
Rotor diameter (m)	150	155	150	155
Turbine number	59	59	59	59
Flight risk volume (WF area x rotor diameter) (m^3)	5,739,330,000	5,929,330,000	5,715,010,000	5,905,010,000
Risk volume swept by rotors (includes allowance for length of bird) (m^3)	5,068,573	5,748,177	4,616,944	5,264,724
Proportion of risk volume occupied by rotors	0.0008831	0.0009694	0.0008079	0.0008916
At risk time in Rotor Swept Volume for average windfarm transit (s)	0.1809	0.1985	0.1763	0.1945
Ppt. an average transit through , Rotor Swept Volume	0.615	0.675	0.612	0.676
No. windfarm transits required for 1 rotor transit	1.627	1.482	1.633	1.480
% of time turbines operating	85%	85%	85%	85%
Stage 1 collision calculation Number of windfarm transits at rotor height required for 1 pass through a turbine Rotor Swept Area	1.914	1.743	1.922	1.741
Stage 2 collision risk Likelihood of collision for 1 pass through rotor swept area of a turbine (from Table 3)	6.16%	6.39%	5.07%	5.34%
Stage 1 x Stage 2 Number of windfarm transits at rotor height for one collision assuming no avoidance behaviour and 85% operation time	31.1	27.3	37.9	32.6
Assumed % flight activity at rotor height (i.e., >30 m agl) (see text)	20%	20%	20%	20%
No. windfarm transits required for 1 collision assuming No avoidance behaviour	155	136	189	163
No. transits for 1 collision for 98% avoidance rate	7,769	6,816	9,475	8,160
No. transits for 1 collision for 99% avoidance rate	15,537	13,632	18,949	16,320
No. transits for 1 collision for 99.5% avoidance rate	31,074	27,263	37,899	32,639

Table 6. Summary for Eastern Curlew of Band CRM outputs for 59-turbine windfarm layouts for the various combination of turbine diameter and rotor ground clearance examined.

Model stage	Description of output	130m turbines, 20m clearance	137m turbines, 13m clearance	150m turbines, 30m clearance	155m turbines, 30m clearance
Stage 1	No. of transits of wind farm at rotor height needed for one pass through a rotor sweep (for 85% operation time)	2.21	2.09	1.91	1.74
Stage 2	Likelihood of collision if a bird passes through rotor swept area of a turbine	9.72%	6.99%	6.16%	6.39%
Stages 1 & 2	No. of transits at rotor height for one collision assuming no avoidance behaviour (for 85% operation time)	22.7	29.94	31.1	27.3
Assumed % flight activity at rotor height		35%	50%	20%	20%
Apply 99% avoidance rate	No. of flights over wind farm footprint needed for 1 collision	6,481	5,989	15,537	13,632

Table 7: Summary for Curlew Sandpiper of Band CRM outputs for 59-turbine windfarm layouts for the various combination of turbine diameter and rotor ground clearance examined.

Model stage	Description of output	130m turbines, 20m clearance	137m turbines, 13m clearance	150m turbines, 30m clearance	155m turbines, 30m clearance
Stage 1	Number of transits of wind farm at rotor height needed for one pass through a rotor sweep (for 85% operation time)	2.22	2.10	1.922	1.741
Stage 2	Likelihood of collision if a bird passes through rotor swept area of a turbine	8.0%	5.7%	5.07%	5.34%
Stages 1 & 2	Number of transits at rotor height for one collision assuming no avoidance behaviour (for 85% operation time)	27.8	36.8	37.9	32.6
Assumed % flight activity at rotor height		35.0%	50.0%	20%	20%
Apply 99% avoidance rate	No of flights over wind farm footprint needed for 1 collision	7,949	7,370	18,949	16,320

Other species

38. Changes to turbine size and rotor ground clearance potentially affect collision risk to bird species other than Eastern Curlew and Curlew Sandpiper. The other species considered here are the bird species recorded during baseline fauna and flora surveys (EBS, 2013). These are listed in Table 8. The original assessment of the potential for collision risk to these species (EIA) assumed a turbine diameter of 122m and a minimum ground clearance of 25m (EBS, 2013; DPEA, 2015).

39. For the great majority of bird species, flight activity is likely to be strongly disproportionately concentrated closer to the ground, this is especially so for passerines and shorebird species.

Therefore, windfarm designs with a ground clearance below that specified in the original assessment (25m) are likely to result in an increase in collision risk to the other species. The wind farm designs previously evaluated involving 130m and 137m turbines both have reduced surface clearance (to 20m and 13m respectively) and would therefore be expected to pose a greater collision risk to some species, possibly substantially so in some cases (NRP, 2016). Conversely, the two windfarm designs using the larger sized turbines (150m and 155m) both have a greater ground clearance than that specified in the original assessment and despite the larger size of the turbines are likely to pose a lower collision risk to most species, as has been demonstrated above for Eastern Curlew and Curlew Sandpiper.

40. The data collected on flight heights from birds seen flying during the baseline bird surveys (EBS, 2013) accord with what would be expected for the species concerned based on available generic information on their behaviour. For the purposes of a qualitative examination of collision risk, four broad groups can be identified.

- **Group 1: wetland species.** The various species that use wetland habitats are unlikely to be affected by collision risk because the proposed turbine location are well away (at least 500m) from wetland habitats. The Group 1 species include all wader, duck, heron, cormorant, tern and gull species together with Whistling Kite and White-bellied Sea-eagle.
- **Group 2: low-air-space scrubland species.** Many of the species listed in Table 8 use scrubland habitats of one type or another (e.g. acacia, mallee and chenopod) and forage either on the ground or in the scrub vegetation. These are mostly small passerines (song birds) but also include Red-rumped Parrot and the two kingfisher species. It is likely that all or almost all the flight activity by these species in the footprint of the Project is below 10m above the ground and therefore it is unlikely that there would be an appreciable collision risk to these species from any of the designs evaluated. Emu, a flightless species, also best fits into this group. These species may however show a localised displacement response to the presence of operating turbines and if so are likely to show a stronger response to turbines that reach closer to the ground. The Group 2 species are:, Australasian Pipit, Australian Magpie, Black-faced Cuckoo-shrike, Brown Songlark, Chestnut-rumped Thornbill, Chirruping Wedgebill, Common Bronzewing, Emu, Gilbert's Whistler, Grey Butcherbird, Grey-fronted Honeyeater, Grey Shrike-thrush, Mistletoebird, Orange Chat, Red-capped Robin, Redthroat, Red-backed Kingfisher, Red-rumped Parrot, Redthroat, Rufous Fieldwren, Rufous Whistler, Sacred Kingfisher, Shy Heathwren, Singing Honeyeater, Striated Pardalote, Weebill, White-browed Babbler, White-winged Fairy-wren, White-winged Fairy-wren, White-fronted Chat, White-plumed Honeyeater, White-winged Triller, Yellow-plumed Honeyeater and Yellow-throated Miner (Table 8).
- **Group 3: medium-height air-space scrubland species.** Other species listed in Table 8 would be expected to mainly typically fly above the scrub canopy but mostly below 40m, either whilst foraging (e.g. swallow, bee-eater and falcon species, and Spotted Harrier) or when moving between locations (e.g. parrot species). A proportion of flight activity by these species would be expected to be within the rotor swept height of all the wind farm designs examined, and thus these species would be potentially subject to a collision risk. However, in all cases, the flight activity by these species would be expected to be disproportionally greater relatively close to the ground (say below 20m), and thus as discussed earlier, windfarm designs with greater ground clearance are likely to pose a lower collision risk. The Group 3 species are: Australian Ringneck, Black-faced Woodswallow, Brown Falcon, Crested Pigeon, Elegant Parrot, Galah, Little Raven, Masked Woodswallow, Nankeen Kestrel, Rainbow Bee-eater, Spotted Harrier, Tree Martin and Welcome Swallow (Table 8).
- **Group 4, Soaring raptors**. The Group 4 species are Black Kite and Wedge-tailed eagle. These are the only species that were recorded in baseline surveys for which a significant proportion

of their flight activity is likely to be spent above 40m above ground level, indeed these species commonly flies at heights in excess of 150m. For this reason it is considered likely that flight activity by these species will be approximately evenly distributed with respect to height up to very approximately 150m, and thereafter rapidly diminish with further height increases. Therefore, for these species, collision risk is like to increase as turbine size increases. The lower rotation speed of larger turbines means that the increase in collision risk would be expected to be well below direct proportionality to the increase in rotor swept area. For example, the rotor swept area of a 155m turbine is 28% greater than that of a 137m turbine, but because the rotation speed would be approximately 9% less the resultant increase in collision risk would be only approximately 15%.

41. On the basis of the above qualitative examination it is considered likely that the 137m turbines with a 13m ground clearance, would pose no appreciable collision risk to birds in Group 1 (wetland species) with the possible exception of White-bellied Sea-eagle. The examination also shows that the wind farm designs comprising 150m or 155m turbines with 30m ground clearance are expected to pose a lower collision risk to Group 1 species.

42. The potential for the Project to affect White-bellied Sea-eagle, a species that is categorised as Endangered in South Australia (DEWNR, 2018), is examined in detail in the Project's development application (DPEA, 2015) and it is considered that using the larger sized turbines does alter the original assessment conclusions for this species. White-bellied Sea-eagle conservation status is classified as Least Concern at both the national (i.e., EPBC Act) and global level (DOE, 2018; BirdLife International, 2017).

43. It is considered that the larger turbine sizes would pose no appreciable collision risk to birds in Group 2 (low-airspace scrub species).

44. It is considered that the larger turbine sizes would result in potential for a moderate increase to collision risk to Group 4 birds (Wedge-tailed Eagle and Black Kite), probably an increase in risk of 10% to 20% depending on the species and turbine. Nevertheless it is considered very unlikely that any adverse effects on these two species arising from the Project would be so great as to cause regional population level impacts; rather, any adverse impacts are likely to be localised to the Project's footprint and its immediate vicinity.

45. For Group 3 species (medium-height air-space scrubland species) the potential for collision risk is expected to be very sensitive to the ground clearance of turbines. The two wind farm designs where rotor ground clearance is increased to 30m (i.e., the 150m and 155m turbine designs) are expected to pose a lower collision risk to Group 3 species compared to the original assessment. In contrast, the two wind farm designs previously examined that would deploy turbines with lower ground clearance (i.e. the 130m turbines with 20m clearance, and 137m turbines with 13m clearance designs) are both expected to increase the potential for collision (and displacement) for Group 3 species compared to the original assessment.

46. Even though 137m or 140m turbines with a 13m or 10m ground clearance respectively are likely to pose a substantially greater collision risk to Group 3 species, this does not mean that the magnitude of the risk to these species would be assessed as unacceptable or requiring mitigation. All but one of the Group 3 species are reasonably common and widespread in South Australia and there is no evidence or expectation that the development site has particularly high value to any of the Group 3 species. Because all the Group 3 species are widespread and have extensive areas of alternative habitat available to them it is considered very unlikely that any adverse effects arising from the Project would be so great as to cause regional population level impacts; rather, any adverse impacts are likely to be localised to the Project's footprint and its immediate vicinity.

47. Elegant Parrot is categorised as a rare species in South Australia (DEWNR, 2018) and therefore there may be some concern over potential collision risk to this species, particularly for designs

with a rotor clearance of less than 30m. Nevertheless the places where this species was seen during the baseline flora and fauna surveys were outside the proposed windfarm footprint (EBS, 2013). Elegant Parrot conservation status is classified as Least Concern for Australia EPBC Act (DOE, 2017) and globally (BirdLife International, 2017).

48. The local population size of Group 3 tree-hole-nesting species such as Nankeen Kestrel, Elegant Parrot and Australian Ringneck (another parrot species), may be constrained by lack of suitable nest sites. These species will potentially breed in man-made nest boxes. Therefore, the provision of suitably designed, carefully sited and well maintained nest boxes close to but not inside the wind farm could be an effective mitigation measure to help the local populations of these species. Birds Australia is likely to be able to provide further advice on this subject.

49. Galah and Common Starling (Group 3) can be agricultural pests in South Australia (DEWNR, 2017) and so it is unlikely there would be any concerns for potential adverse effects on these species.

Table 8. Bird species recorded in baseline bird survey and their status. 'Group' refers to assigned species group for consideration of collision from 140m diameter turbines.

Group	Species	Latin name	EPBC Act migratory species [1]	EPBC Act status [2]	South Aus. NPW Act status [3]	No. seen in baseline survey [4]
1	Aus. Pied Oystercatcher	*Haematopus longirostris*	-	-	Rare	9
1	Black Swan	*Cygnus atratus*	-	-	-	1
1	Caspian Tern	*Hydroprogne caspia*	Yes	-	-	7
1	Crested Tern	*Thalasseus bergii*	Yes	-	-	3
1	Curlew sandpiper	*Calidris ferruginea*	Yes	Critically Endangered	-	Not recorded
1	Eastern Curlew	*Numenius madagascariensis*	Yes	Critically Endangered	Vulnerable	11
1	Great Cormorant	*Phalacrocorax carbo*	-	-	-	6
1	Grey Teal	*Anas gracilis*	-	-	-	60
1	Intermediate Egret	*Ardea intermedia*	-	-	Rare	8
1	Little Black Cormorant	*Phalacrocorax sulcirostris*	-	-	-	1
1	Red-capped Plover	*Charadrius ruficapillus*	-	-	-	330
1	Red-necked Stint	*Calidris ruficollis*	Yes	-	-	200
1	Silver Gull	*Chroicocephalus novaehollandiae*	-	-	-	114
1	Sooty Oystercatcher	*Haematopus fuliginosus*	-	-	Rare	23
1	Whiskered Tern	*Chlidonias hybrida*	-	-	-	4
1	Whistling Kite	*Haliastur sphenurus*	-	-	-	1
1	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	-	-	Endangered	2
1	White-faced Heron	*Egretta novaehollandiae*	-	-	-	5
2	Australasian Pipit	*Anthus novaeseelandiae*	-	-	-	2
2	Australian Magpie	*Gymnorhina tibicen*	-	-	-	21

Group	Species	Latin name	EPBC Act migratory species [1]	EPBC Act status [2]	South Aus. NPW Act status [3]	No. seen in baseline survey [4]
2	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	-	-	-	14
2	Brown Songlark	*Cincloramphus cruralis*	-	-	-	3
2	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	-	-	-	19
2	Chirruping Wedgebill	*Psophodes cristatus*	-	-		19
2	Common Bronzewing	*Phaps chalcoptera*	-	-	-	15
2	Emu	*Dromaius novaehollandiae*	-	-	-	7
2	Gilbert's Whistler	*Pachycephala inornata*	-	-	Rare	2
2	Grey Butcherbird	*Cracticus torquatus*	-	-	-	23
2	Grey Shrike-thrush	*Colluricincla harmonica*	-	-	-	13
2	Grey-fronted Honeyeater	*Lichenostomus plumulus*	-	-	-	10
2	Mistletoebird	*Dicaeum hirundinaceum*	-	-	-	17
2	Orange Chat	*Epthianura aurifrons*	-	-	-	17
1	Red-capped Robin	*Petroica goodenovii*	-	-	-	5
2	Red-rumped Parrot	*Psephotus haematonotus*	-	-	-	32
2	Redthroat	*Pyrrholaemus brunneus*	-	-	-	15
2	Rufous Fieldwren	*Calamanthus campestris*	-	-	-	3
2	Rufous Whistler	*Pachycephala rufiventris*	-	-	-	1
2	Sacred Kingfisher	*Todiramphus sanctus*	-	-	-	1
2	Shy Heathwren	*Calamanthus cautus*	-	-	Rare	7
2	Singing Honeyeater	*Lichenostomus virescens*	-	-	-	78
2	Southern Whiteface	*Aphelocephala leucopsis*	-	-	-	63
2	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	-	-	50

Group	Species	Latin name	EPBC Act migratory species [1]	EPBC Act status [2]	South Aus. NPW Act status [3]	No. seen in baseline survey [4]
2	Striated Pardalote	*Pardalotus striatus*	-	-	-	40
2	Variegated Fairy-wren	*Malurus lamberti*	-	-	-	85
2	Weebill	*Smicrornis brevirostris*	-	-	-	25
2	White-browed Babbler	*Pomatostomus superciliosus*	-	-	-	63
2	White-fronted Chat	*Epthianura albifrons*				2
2	White-fronted Honeyeater	*Purnella albifrons*	-	-	-	7
2	White-plumed Honeyeater	*Lichenostomus penicillatus*	-	-	-	12
2	White-winged Fairy-wren	*Malurus leucopterus*	-	-	-	74
2	White-winged Triller	*Lalage tricolor*	-	-	-	1
2	Willie Wagtail	*Rhipidura leucophrys*	-	-	-	2
2	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	-	-	-	22
2	Yellow-throated Miner	*Manorina flavigula*	-	-	-	250
3	Australian Ringneck	*Barnardius zonarius*	-	-	-	77
3	Black-faced Woodswallow	*Artamus cinereus*	-	-	-	33
3	Brown Falcon	*Falco berigora*	-	-	-	1
3	Common Starling	*Sturnus vulgaris*	-	-	-	25
3	Crested Pigeon	*Ocyphaps lophotes*	-	-	-	14
3	Dusky Woodswallow	*Artamus cyanopterus*	-	-	-	40
3	Elegant Parrot	*Neophema elegans*	-	-	Rare	6
3	Galah	*Eolophus roseicapilla*	-	-	-	14
3	Little Raven	*Corvus mellori*	-	-	-	9
3	Masked Woodswallow	*Artamus personatus*	-	-	-	35

Group	Species	Latin name	EPBC Act migratory species [1]	EPBC Act status [2]	South Aus. NPW Act status [3]	No. seen in baseline survey [4]
3	Nankeen Kestrel	*Falco cenchroides*	-	-	-	10
3	Rainbow Bee-eater	*Merops ornatus*	-	-	-	19
3	Red-backed Kingfisher	*Todiramphus pyrrhopygius*	-	-	-	3
3	Spotted Harrier	*Circus assimilis*	-	-	-	1
3	Tree Martin	*Petrochelidon nigricans*	-	-	-	2
3	Welcome Swallow	*Hirundo neoxena*	-	-	-	20
4	Black Kite	*Milvus migrans*	-	-	-	5
4	Wedge-tailed Eagle	*Aquila audax*	-	-	-	1

Information sources:

[1] http://www.environment.gov.au/cgi-bin/sprat/public/publicshowmigratory.pl

[2] DOEE EPBC (2016). EPBC Act 199 List of Threatened Fauna http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl

[3] DEWNR (2018). http://www.environment.sa.gov.au/managing-natural-resources/plants-and-animals/Threatened_species_ecological_communities/Regional_significant_projects/Regional_Species_Conservation_Assessment_Project Accessed on 12/04/2017.

[4] EBS (2013).Project's Flora and Fauna Assessment.

Conclusions

50. A check of the EPBC federal threatened species list showed that five species have been recently added that could have relevance to the Project on the basis of their gross habitat requirements and range in Australia. These are: Great Knot, Red Knot, Bar-tailed Godwit, Lesser Sand Plover and Great Sand Plover. All five species are long-distance migrants from east Siberian breeding grounds and require intertidal sand and mud habitats outside the breeding season.

51. Apart from a record of a single Lesser Sand Plover on one occasion only, these species were not recorded during the baseline surveys of the vicinity of the development site, suggesting the site has negligible importance for them. Furthermore, on the basis of their reported status in South Australia and habitat preferences, it is considered very unlikely that any of the five newly-listed species regularly use the vicinity of the development site. It is concluded that the Project poses a negligible risk to the five newly-listed EPBC species. Therefore, with regard to the EPBC Act, it is concluded that the species of relevance to the Project remain the same as previously identified, namely Eastern Curlew and Curlew Sandpiper.

52. A check of the South Australia threatened bird species list revealed that there have been no recent changes of potential relevance to the Project.

53. The collision risk modelling for Eastern Curlew and Curlew Sandpiper for turbines of 150m or 155m diameter and installed with a ground clearance of 30m indicates that the risk of collision mortality would be substantially lower than for the smaller sized turbines with lower ground clearance modelled previously (DPEA, 2016; NRP, 2016). The likelihood of collision mortality for all the turbine size/ground clearance scenarios is evaluated as very low for both species. The previous conclusion that the risks to these species from the Project are negligible remains unchanged.

54. The potential for collision risk to other bird species that use the development site is examined qualitatively. It is concluded that the increasing ground clearance to 30m would reduce, the collision risks to most other bird species. This is particularly so for those species that tend to fly at or a little above the canopy of the scrub vegetation that occurs across parts of the development site (Group 3 species in Table 8). Compared to the smaller turbines, turbines of 150m or 155m diameter turbines could potentially lead to a modest increase (by approximately 10 – 20%) in the relative collision risk to the two species that typically fly at heights above 30m, namely wedge-tailed eagle and black kite. However the absolute risk to these species' receptor populations remains negligible.

References

Bamford, M., Watkins, D., Bancroft, W., Tischler, G. and Wahl, J. (2008). Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites. Wetlands International - Oceania, 2008 ISBN 9 789 0588 20082

Band, W., Madders, M., & Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (Eds.) Birds and Wind Farms: Risk Assessment and Mitigation, pp. 259- 275. Quercus, Madrid.

BirdLife International (2017). Species factsheet: *Neophema elegans* http://www.birdlife.org accessed on 12/04/2017.

Carpenter, G. and Langdon, P. (2014) Chapter 13: Seabirds and shorebirds of the Spencer Gulf. In: Shepard, S.A., Madigan, S.M., Gillanders, B.M., Murry-Jones, S. and Wiltshire, D.J.(Eds). Natural History of Spencer Gulf. Royal Society of South Australia Inc.

DPEA (2015). Port Augusta Renewable Energy Park Development Application, Chapter 8: Ecology. DP Energy Australia Pty Ltd.

DPEA (2016). Port Augusta Renewable Energy Park: Supplementary Studies on Shorebirds. Prepared by Natural Research (Projects) Ltd for DP Energy Australia Pty Ltd.

EBS Ecology (2013) Port Augusta Renewable Energy Park - Flora and Fauna Assessment. Version 3.2. Prepared by EBS Ecology for DP Energy Australia Pty Ltd.

DOEE (2018). EPBC Act 1999, List of Threatened Fauna website. http://www.environment.gov.au/epbc/about/epbc-act-lists . Accessed on 09/09/2018.

DEWNR (2017). Government of South Australia. Department of Environment, Water and Natural Resources website http://www.environment.sa.gov.au/managing-natural-resources/Plants_Animals/Abundant_species/Little_corellas_other_flocking_birds .

DEWNR (2018). Government of South Australia. Department of Environment, Water and Natural Resources website. https://www.legislation.sa.gov.au/LZ/C/A/NATIONAL%20PARKS%20AND%20WILDLIFE%20ACT%201972/CURRENT/1972.56.AUTH.PDF

NRP (2016). Port Augusta Renewable Energy Park: Implications for Shorebird Collisions Arising from use of 137m Diameter Turbines. Prepared by Natural Research (Projects) Ltd for DP Energy Australia Pty Ltd.

Purnell, C., Peter, J., Clemens, R. (2013). Shorebird Population Monitoring within Gulf St Vincent: July 2011 to June 2012 Annual Report. BirdLife Australia report for the Adelaide and Mount Lofty Ranges Natural Resources Management Board and the Department of the Environment, Water, Heritage and the Arts.

Appendix 21: Updated Environmental Noise Assessment

Port Augusta

Renewable Energy Park

Wind Farm Environmental Noise Assessment

March 2019

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sonus.

Document Title	Port Augusta Renewable Energy Park - Wind Farm - Environmental Noise Assessment
Document Number	S4154C18
Date	March 2019
Author	Jason Turner, MAAS
Reviewer	Mathew Ward

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GLOSSARY

A-weighting	Frequency adjustment applied to measured noise levels to replicate the frequency response of the human ear.
Background noise level	The ambient noise level which excludes intermittent noise sources.
Beneficiary	landowner with commercial agreement with the wind farm developer
CONCAWE	The oil companies' international study group for conservation of clean air and water - Europe, The propagation of noise from petrochemical complexes to neighbouring communities (May 1981).
dB	Un-weighted (or linear) noise or sound power level in decibels.
dB(A)	A-weighted noise or sound power level in decibels.
EPA	Environment Protection Authority
$L_{A90,10}$	A-weighted noise level exceeded for 90% of a 10 minute time period. Represents the background noise level.
Neighbour	landowner without a commercial agreement
2009 Guidelines	*Wind Farms Environmental Noise Guidelines 2009*
Sound power level	A measure of the sound energy emitted from a source of noise.
Weather category 6	Weather category which is most conducive for the propagation of noise, resulting in highest predicted noise levels when using CONCAWE.
WHO	World Health Organisation
WHO Guidelines	WHO Guidelines for Community Noise
Worst-case	Conditions resulting in the highest noise level at residences.
WTG	Wind turbine generator

1 INTRODUCTION

Sonus has previously conducted environmental noise assessments for the *DP Energy* Port Augusta Renewable Park project, located to the southeast of Port Augusta (the project).

The project was assessed in 2 Stages. Stage 1 comprised wind turbine generators (WTGs) and solar photovoltaic arrays; and Stage 2 comprised additional solar photovoltaic arrays, battery storage and a synchronous condenser capacity component.

The Stage 1 assessment is summarised in Sonus report "S4154C10" dated October 2015 (the Stage 1 assessment). The Stage 1 project incorporated 59 WTGs with a maximum tip height of 150m.

The Stage 1 wind farm has been granted development approval.

DP Energy is seeking a variation to the approval for the WTGs with an increased hub height from a maximum of 82m to 107.5m, albeit with minor modifications to their locations in comparison to the Stage 1 assessment. In addition to these minor changes to the layout, the total number of WTGs will be reduced from 59 to 50, meaning that 9 WTGs will be removed from the final layout. The 9 WTGs that will be removed will be determined after detailed geotechnical investigations have taken place.

This report provides an updated assessment of the operational noise from the wind farm with a WTG that has a hub height of 105m and for the modified layout. For the purposes of this environmental noise assessment, a "beyond worst-case" scenario has been considered, whereby it is assumed that WTG's will exist at all 59 potential turbine locations.

Should a different turbine with a greater hub height be selected, a final assessment will be made following the detailed design phase to confirm that the final WTG selection and layout will comply with the relevant noise requirements.

The layout of the WTGs considered for this assessment is provided as Appendix A.

The locations and status of the surrounding dwellings has not changed from the Stage 1 assessment but are included in Appendix B to assist in considering this report.

2 DEVELOPMENT PLANS

The Development Plan provisions for the latest versions of the Port Augusta Council Development Plan[1] and the Mount Remarkable Council Development Plan[2] have been reviewed, and the relevant provisions that relate to acoustics have not altered since the Stage 1 assessment.

3 ASSESSMENT METHODOLOGY

As for the Stage 1 assessment, the final make and model of the equipment used for the project will be selected through a competitive procurement process and therefore is not yet finalised. The sound power levels in this assessment are provided for indicative purposes to show that a suitable contemporary selection can achieve the relevant objective requirements. This assessment has been based on the Vestas V150-4.0/4.2 WTG with a hub height of 105m

A final assessment will be made following the detailed design phase to confirm that the final WTG selection and layout will comply with the project criteria.

3.1 Noise Prediction Model

Noise predictions have been made using the Stage 1 assessment approach.

4 NOISE ASSESSMENT

4.1 Background Noise Monitoring

Background noise monitoring was previously conducted in accordance with the South Australian Environment Protection *Wind farms environmental noise guidelines July 2009* (the 2009 Guidelines) at 5 locations in the vicinity of the proposed wind farm between 19 August and 6 October 2015.

During the 2015 background noise monitoring period, DP Energy measured the average wind speed and direction at a wind mast located at the wind farm site. Table 4.1 provides details of the wind mast.

Table 4.1: Wind mast details

Mast ID	Coordinates (UTM WGS84 z54)		Measurement Heights (m)
	Easting	Northing	
Mast 004	767328	6391651	40, 50, 60

[1] Consolidated 7 July 2016.
[2] Consolidated 5 September 2013.

The 2009 Guidelines specify that the background noise should be correlated with wind speeds at the WTG hub height. DP Energy has calculated the wind speeds at a hub height of 105m (equivalent to the hub height of the contemporary WTG selection considered in this assessment) for the 2015 background noise monitoring period using previous measurements at different anemometer heights.

The background noise data has been re-analysed based on the increased hub height and operating range of the contemporary turbine selection.

Table 4.2 summarises the monitoring locations and the number of data points at each location. It is noted that the number of points has increased from the Stage 1 assessment as the wind data has been sheared up to a hub height of 105m, and the operational wind speed range of the contemporary WTG is greater than the previously assessed models.

Table 4.2: Monitoring locations and periods

Monitoring Location ID	Comment	Coordinates (UTM WGS84 53H)		Number of Data Points
		Easting	Northing	
1A[3]	At an alternate location equivalent to residence 1	774620	6385216	5832
3	At dwelling 3	773135	6387178	5831
6A	At an alternate location equivalent to residence 6	775216	6392585	5832
8	At dwelling 8	764895	6394970	5832
31A	At an alternate location equivalent to residence 31	769947	6387316	5832

The resultant background noise data for each monitoring location were correlated with the hub height wind speed data to produce a least squares regression analysis and line of best fit in accordance with the 2009 Guidelines. The data and the regression curves for a hub height of 105m are provided in Appendix C.

4.2 Noise Criteria

Noise criteria are consistent with the Stage 1 assessment approach using the 2009 Guidelines and the World Health Organisation (WHO) *Guidelines for Community Noise* (WHO Guidelines); being, the predicted noise from the wind farm should not exceed the following levels:

[3] The equipment at monitoring location 1A was damaged by live stock during the monitoring period. The data has been provided for informational purposes only.

Neighbours

- *35 dB(A) at relevant receivers in localities which are primarily intended for rural living, or*
- *40 dB(A) at relevant receivers in localities in other zones, or*
- *the background noise (LA90,10) by more than 5 dB(A)*

whichever is greater, at all relevant receivers for wind speed from cut-in to rated power of the WTG and each integer wind speed in between.

Where the wind farm noise exhibits a tonal characteristic, a 5 dB(A) penalty is to be applied to the criteria.

Beneficiary

- 45 dB(A) outside (correlates to an internal noise level of less than 30 dB(A) inside with the windows open); or,
- 52 dB(A) outside and 30 dB(A) inside the dwelling with acoustic treatment.

Summary of Criteria

The co-ordinates of the neighbours and beneficiaries, the land use zoning and the resultant noise criteria determined from the 2009 Guidelines and WHO Guidelines are provided in Appendix B. The closest WTG and direction to each residence is also provided in Appendix B.

4.3 Noise Predictions

WTG Locations and Sound Power Levels

The assessment has considered a wind farm layout with up to 59 WTGs, even though the total number of WTGs will be reduced to 50, with the co-ordinates provided in Appendix D.

This assessment has been made based on a representative WTG option, being the Vestas V150-4.0/4.2 with a hub height of 105 m. The following total *Sound Power Levels* used for the assessment are for power optimized (PO1) operation mode of the Vestas V150-4.0/4.2 that have blades with a serrated trailing edge. Third octave data provided for the Vestas V150-4.0/4.2 are also provided in Appendix E.

Table 4.3: Monitoring locations and periods

Hub Height Wind Speed (m/s)	Total Sound Power Level (dB(A) re 1 pW)
3	91.1
4	91.3
5	93.2
6	96.4
7	99.9
8	103.3
9 and above	104.9

The above sound power level data are provided for indicative purposes to show that a contemporary WTG selection can comply with the Project criteria. An assessment will be made during the detailed design phase to confirm that the final WTG selection will comply with the project criteria. In addition, a guarantee will also be obtained from the manufacturer to ensure that the WTG will be free of tonality at all surrounding dwellings.

Predicted Noise Levels

The noise level at dwellings has been predicted based on the WTG layout and sound power levels; and compared with the relevant criteria. The maximum noise levels from the wind farm are compared with the corresponding noise criterion at each residence in Table 4.4.

Table 4.4: Predicted noise levels and noise criterion

Residence ID	Baseline External Noise Criterion (dB(A))	Maximum Predicted Noise Level (dB(A))	Compliance
Beneficiary Dwellings			
2	45	38	Yes
10	52 (30dB(A) inside with acoustic treatment)	47	Yes
11	45	45	Yes
12	45	40	Yes
13	45	36	Yes
14	52 (30dB(A) inside with acoustic treatment)	47	Yes
Neighbouring Dwellings			
1	40	31	Yes
3	40	36	Yes
5	40	24	Yes
6	40	32	Yes
7	40	29	Yes
8	35	29	Yes
9	40	30	Yes
16	35	28	Yes
17	40	25	Yes
19	35	21	Yes
20	35	22	Yes
21	35	23	Yes
22	35	25	Yes
23	35	26	Yes
24	35	25	Yes
25	35	26	Yes
26	35	26	Yes
27	35	28	Yes
28	40	24	Yes
29	40	23	Yes
30	40	21	Yes
31	40	34	Yes

Residence ID	Baseline External Noise Criterion (dB(A))	Maximum Predicted Noise Level (dB(A))	Compliance
32	40	21	Yes
33	40	21	Yes
34	40	22	Yes
35	40	21	Yes
37	35	24	Yes
38	35	23	Yes
39	35	22	Yes
40	40	25	Yes
41	35	23	Yes
42	35	22	Yes
43	35	22	Yes
44	35	22	Yes
45	35	22	Yes
46	35	22	Yes
47	35	23	Yes
48	35	27	Yes
49	35	27	Yes
50	35	28	Yes
51	35	28	Yes
52	35	29	Yes
53	35	31	Yes

Based on the predicted noise levels, the contemporary WTG can comply with the noise criteria at all neighbour locations, therefore satisfying the 2009 Guidelines. In addition, the noise predictions in this assessment are less than the maximum levels predicted from the WTGs in the Stage 1 assessment.

To ensure the WHO sleep disturbance level is achieved (30 dB(A) inside) at beneficiary dwellings, the agreements with landowners of residences 10 and 14 includes measures to either install an air conditioning system which provides sufficient outside air such that windows can be closed, or by installing acoustic outside air vents.

In addition, it is noted that to assist the landowners of residences 10 and 14 in being adequately informed, a simulation of the highest noise level and typical characteristic of noise (as predicted in the Stage 1 assessment) was also previously demonstrated at each of the dwellings. As the noise from the Vestas V150-4.0/4.2 is predicted to be less than the maximum levels predicted from the WTGs in the Stage 1 assessment, the demonstrations represented a conservative indication of the noise at these locations.

The predicted noise level contours at 10 m/s (the wind speed associated with the highest predicted noise levels) are also provided as Appendix F.

5 CONCLUSION

An environmental noise assessment has been made of the proposed variation to the approval for the WTGs with an increased hub height and minor modifications to their locations.

This report provides an updated assessment of the operational noise from the wind farm with a contemporary WTG selection that has a hub height of 105m.

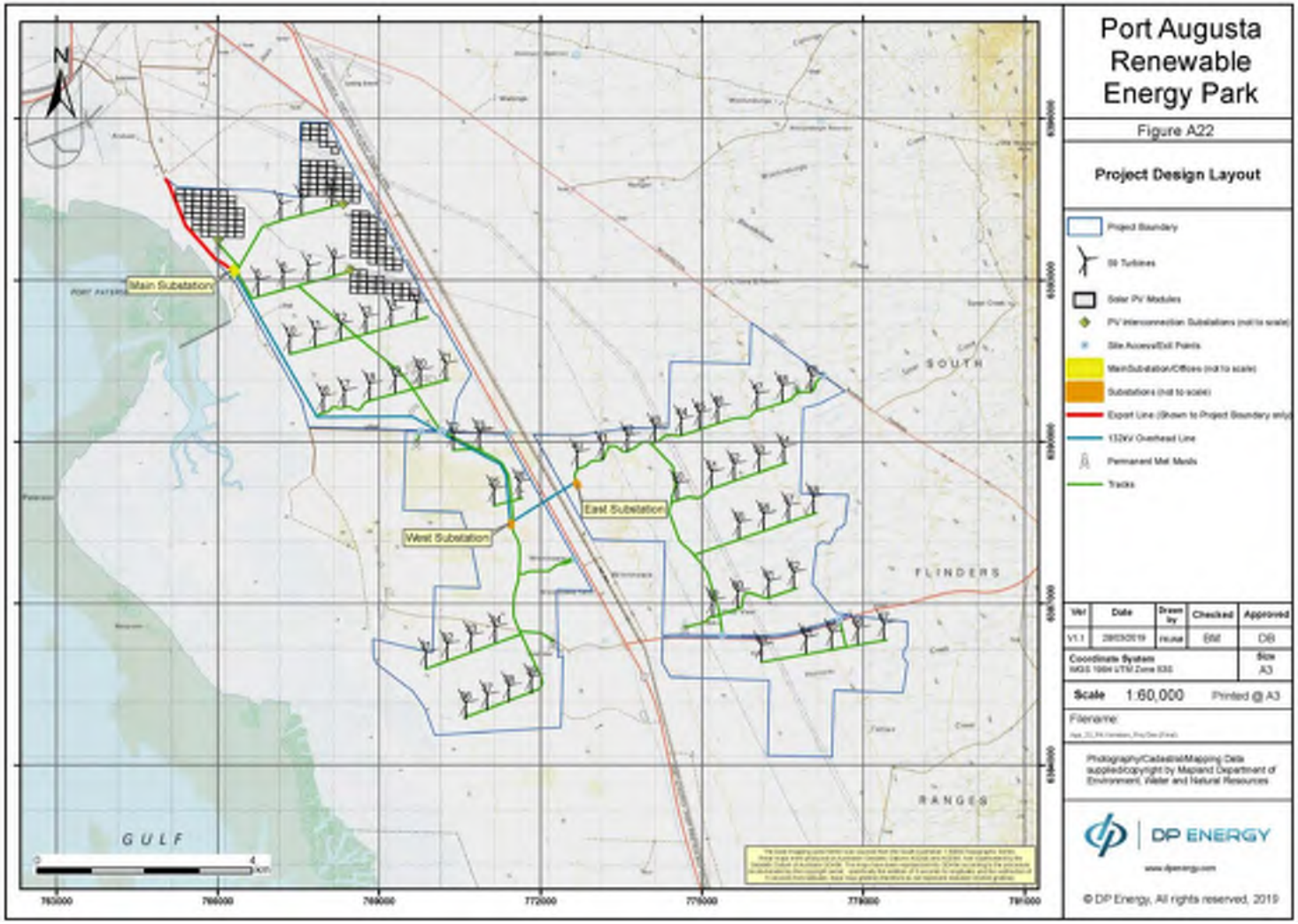
Noise predictions have been made and assessed against criteria developed in accordance with the South Australian Environment Protection Authority *Wind farms environmental noise guidelines July 2009*, and the World Health Organisation guidelines (for beneficiaries to the project).

Based on the predictions, the noise from the proposed variation results in:

- lower noise levels compared to the Stage 1 Assessment;
- noise criteria being achieved at all receivers where the landowners do not have a commercial agreement with the Project (neighbours);
- beneficiaries being protected from unreasonable interference to their amenity with the inclusion of the recommendations of this report.

Based on the above it is considered that the proposal can be designed and constructed to *prevent adverse impact* and ensure it does *not detrimentally affect the amenity of the locality,* thereby satisfying the relevant provisions of both the Port Augusta Council and the Mount Remarkable Council Development Plans.

APPENDIX A: WTG Layout



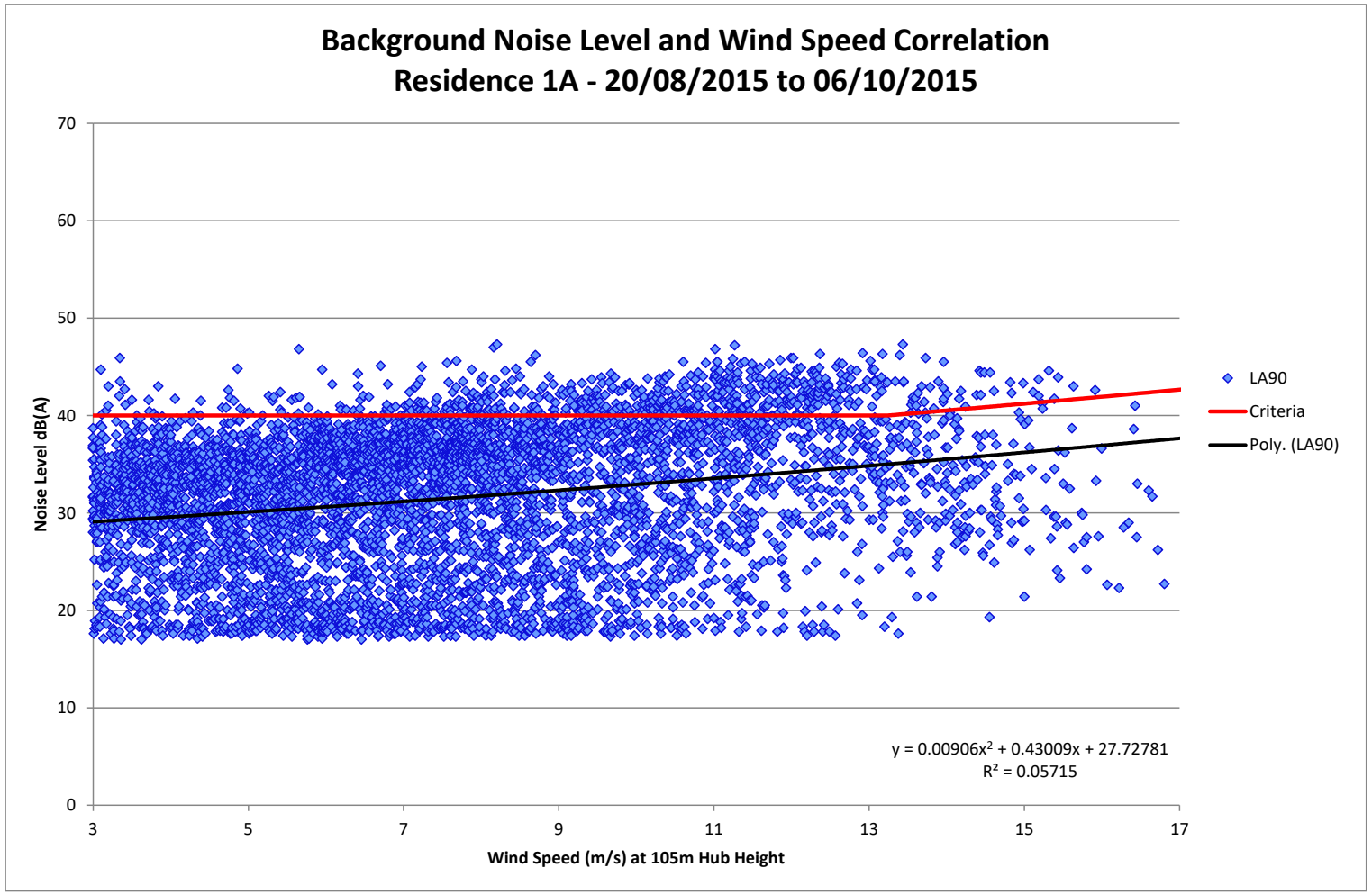
APPENDIX B: Residence Locations

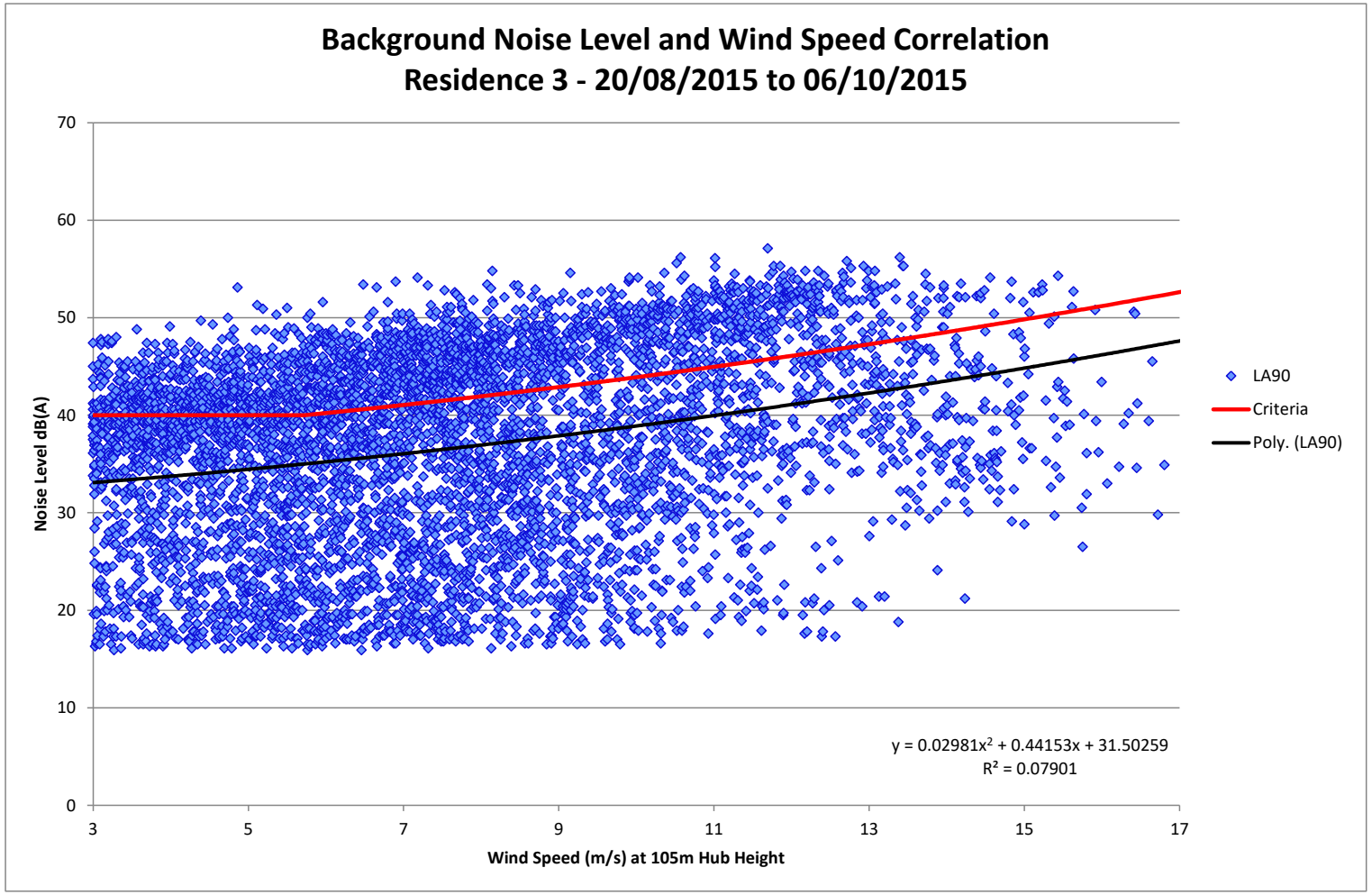
Residence ID	Coordinates (UTM WGS84 H53)		Development Plan Zone	"Baseline" Noise Criterion	Nearest Turbine	Distance to Nearest Turbine (m)	Downwind Direction from Nearest Turbine (degrees)
	Easting	Northing					
Beneficiary Dwellings							
2	772609	6387799	PIn (PA)	45	26	1533	319
4[4]	775287	6386813	PrPro (MR)	-	59	95	239
10	769030	6390394	PIn (PA)	52 (30dB(A) inside)	18	438	333
11	766764	6393407	PIn (PA)	45	5	693	181
12	772359	6386135	PIn (PA)	45	39	959	213
13	773076	6384747	PIn (PA)	45	39	1376	295
14	767108	6392365	PIn (PA)	52 (30dB(A) inside)	6	490	13
Neighbouring Dwellings							
1	774824	6384240	PrPro (MR)	40	63	2121	37
3	773126	6387184	PIn (PA)	40	59	2122	101
5	773864	6394828	PIn (PA)	40	46	4695	162
6	775586	6392941	PrPro (MR)	40	48	2376	157
7	764861	6395096	PIn (PA)	40	1	2510	113
8	764867	6394950	CstCon (PA)	35	1	2452	110
9	765019	6395016	PIn (PA)	40	1	2334	113
16	764901	6395468	RuL(PA)	35	1	2642	121
17	764476	6395617	In (PA)	40	1	3085	119
19	764613	6397153	RuL(PA)	35	1	3968	140
20	765598	6397598	RuL(PA)	35	1	3816	156
21	765829	6397445	RuL(PA)	35	1	3584	158
22	766040	6397163	RuL(PA)	35	1	3245	160
23	766288	6396916	RuL(PA)	35	1	2931	162
24	765710	6396847	RuL(PA)	35	1	3093	152
25	765948	6396803	RuL(PA)	35	1	2948	155
26	765732	6396632	RuL(PA)	35	1	2894	150
27	765721	6396255	RuL(PA)	35	1	2581	146
28	781466	6387100	RuLP (MR)	40	67	3180	256
29 **(UTM WGS84 H54)**	218660	6387291	RuLP (MR)	40	67	3425	254
30 **(UTM WGS84 H54)**	219111	6386760	RuLP (MR)	40	67	3763	263
31	768982	6387721	PIn (PA)	40	31	2110	155
32	780694	6392564	RuLP (MR)	40	49	4002	246
33	780681	6392437	RuLP (MR)	40	49	3940	247
34	780688	6392081	RuLP (MR)	40	49	3824	252

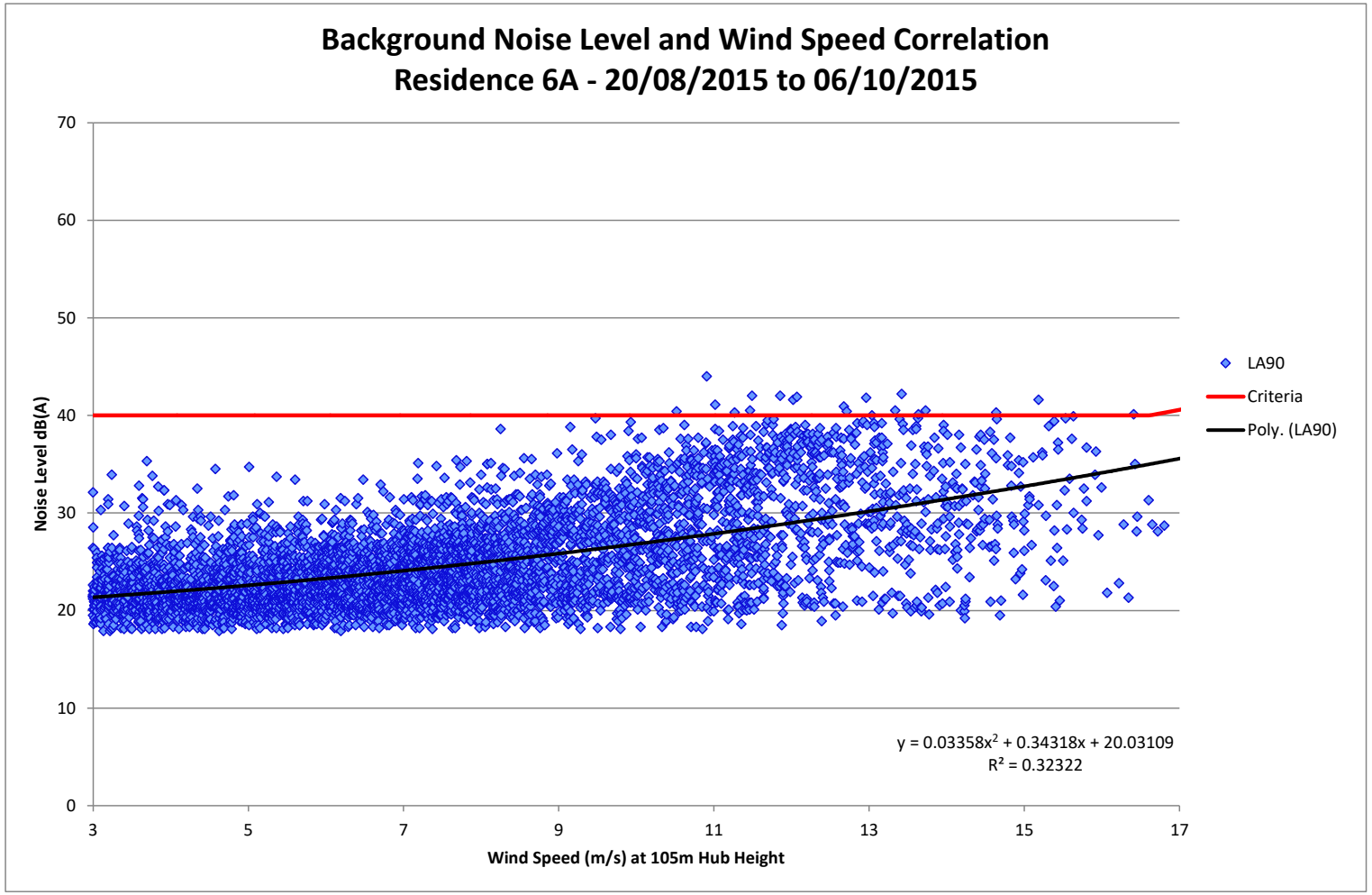
[4] Residence 4 has not been included as part of the assessment as it is understood that it is currently derelict and an agreement will be made with the owner not be occupy the dwelling during the life of the wind farm.

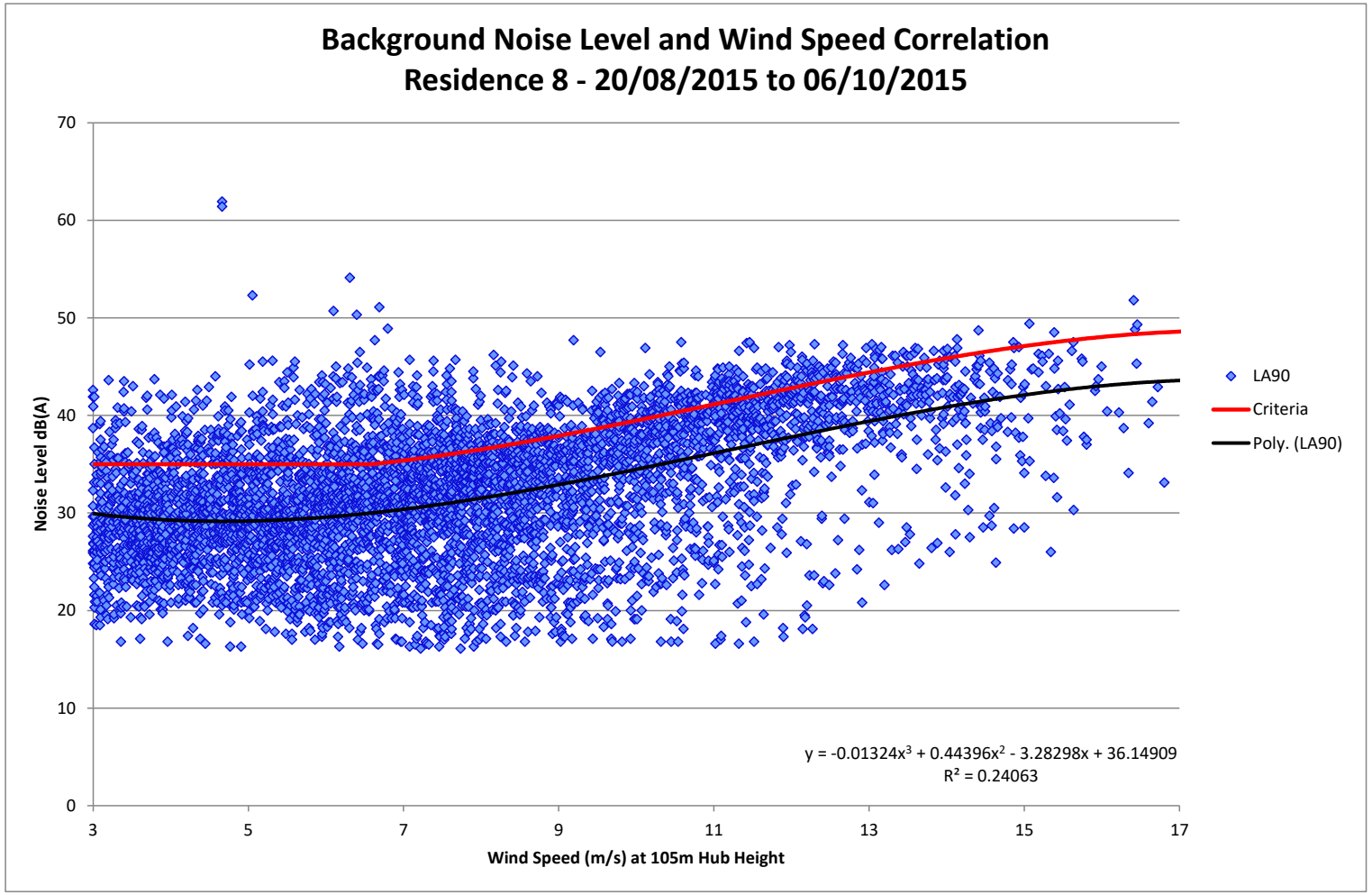
Residence ID	Coordinates (UTM WGS84 H53)		Development Plan Zone	"Baseline" Noise Criterion	Nearest Turbine	Distance to Nearest Turbine (m)	Downwind Direction from Nearest Turbine (degrees)
	Easting	Northing					
35 (UTM WGS84 H54)	219064	6387869	RuLP (MR)	40	67	3999	247
37	765712	6397077	RuL(PA)	35	1	3297	154
38	765651	6397313	RuL(PA)	35	1	3535	154
39	765258	6397291	RuL(PA)	35	1	3703	149
40	767291	6397500	PIn (PA)	40	3	3233	165
41	766811	6397810	R (PA)	35	2	3661	168
42	766639	6397935	R (PA)	35	2	3822	166
43	766521	6397908	R (PA)	35	2	3826	164
44	766366	6398009	R (PA)	35	2	3967	162
45	766264	6397921	R (PA)	35	1	3906	167
46	766699	6397917	R (PA)	35	2	3790	167
47	765808	6397331	RuL(PA)	35	1	3487	157
48	765233	6396040	RuL(PA)	35	1	2729	135
49	765100	6395960	RuL(PA)	35	1	2771	132
50	765319	6395950	RuL(PA)	35	1	2604	135
51	765489	6395953	RuL(PA)	35	1	2488	137
52	764523	6394386	CstCon (PA)	35	1	2665	96
53	764913	6394360	CstCon (PA)	35	1	2274	96

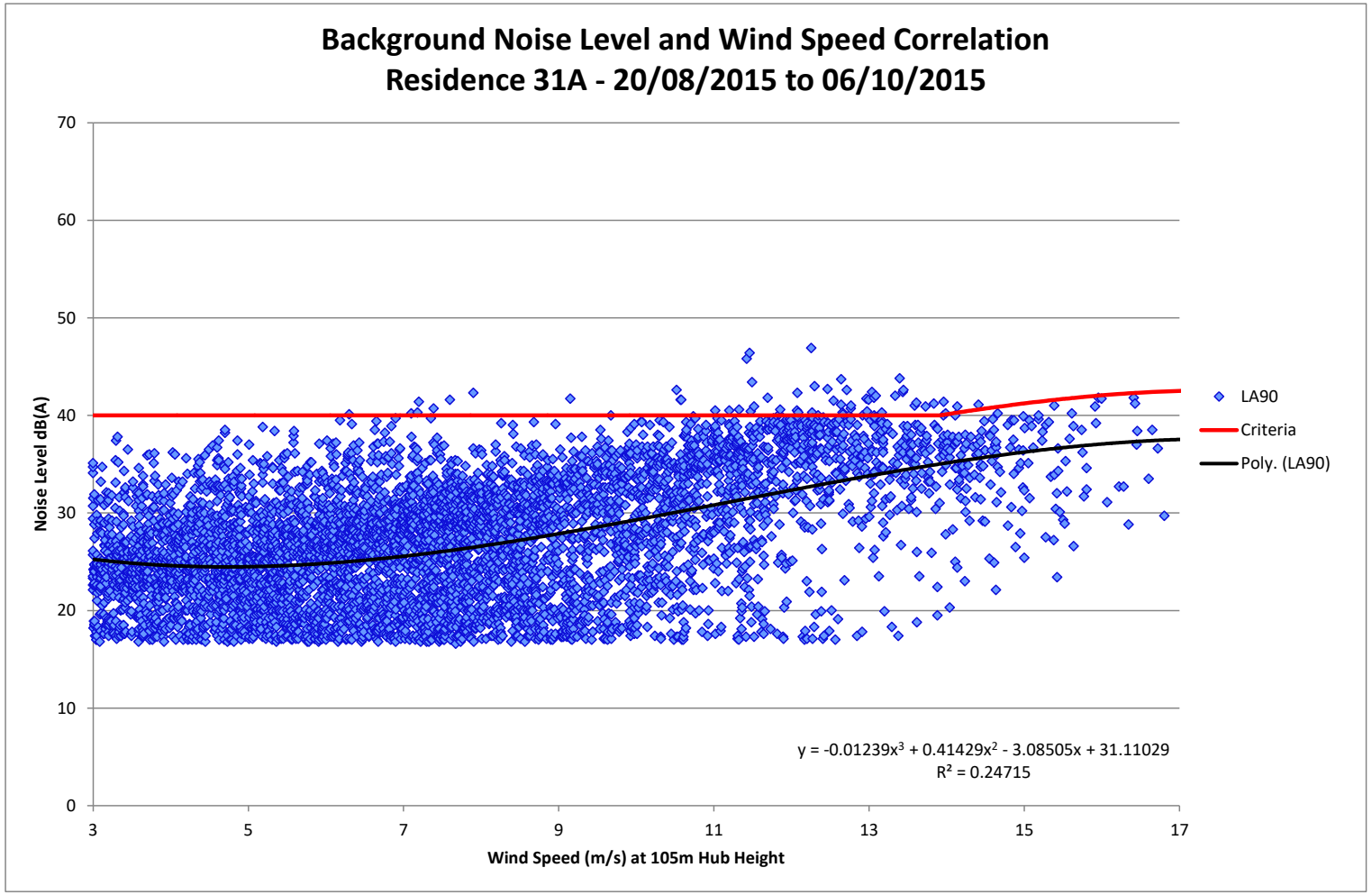
APPENDIX C: Background Noise Regression Curves




Background Noise Level and Wind Speed Correlation
Residence 3 - 20/08/2015 to 06/10/2015
Noise Level dB(A)
70
60
50
40
30
20
10
0
3
5
7
9
11
13
15
17
Wind Speed (m/s) at 105m Hub Height
LA90
Criteria
Poly. (LA90)
y = 0.02981x² + 0.44153x + 31.50259
R² = 0.07901


Background Noise Level and Wind Speed Correlation
Residence 6A - 20/08/2015 to 06/10/2015
Noise Level dB(A)
70
60
50
40
30
20
10
0
3
5
7
9
11
13
15
17
Wind Speed (m/s) at 105m Hub Height
LA90
Criteria
Poly. (LA90)
y = 0.03358x² + 0.34318x + 20.03109
R² = 0.32322


Background Noise Level and Wind Speed Correlation
Residence 8 - 20/08/2015 to 06/10/2015
Noise Level dB(A)
70
60
50
40
30
20
10
0
3
5
7
9
11
13
15
17
Wind Speed (m/s) at 105m Hub Height
LA90
Criteria
Poly. (LA90)
y = -0.01324x³ + 0.44396x² - 3.28298x + 36.14909
R² = 0.24063


Background Noise Level and Wind Speed Correlation
Residence 31A - 20/08/2015 to 06/10/2015
Noise Level dB(A)
70
60
50
40
30
20
10
0
3
5
7
9
11
13
15
17
Wind Speed (m/s) at 105m Hub Height
y = -0.01239x³ + 0.41429x² - 3.08505x + 31.11029
R² = 0.24715
LA90
Criteria
Poly. (LA90)

APPENDIX D: WTG Locations

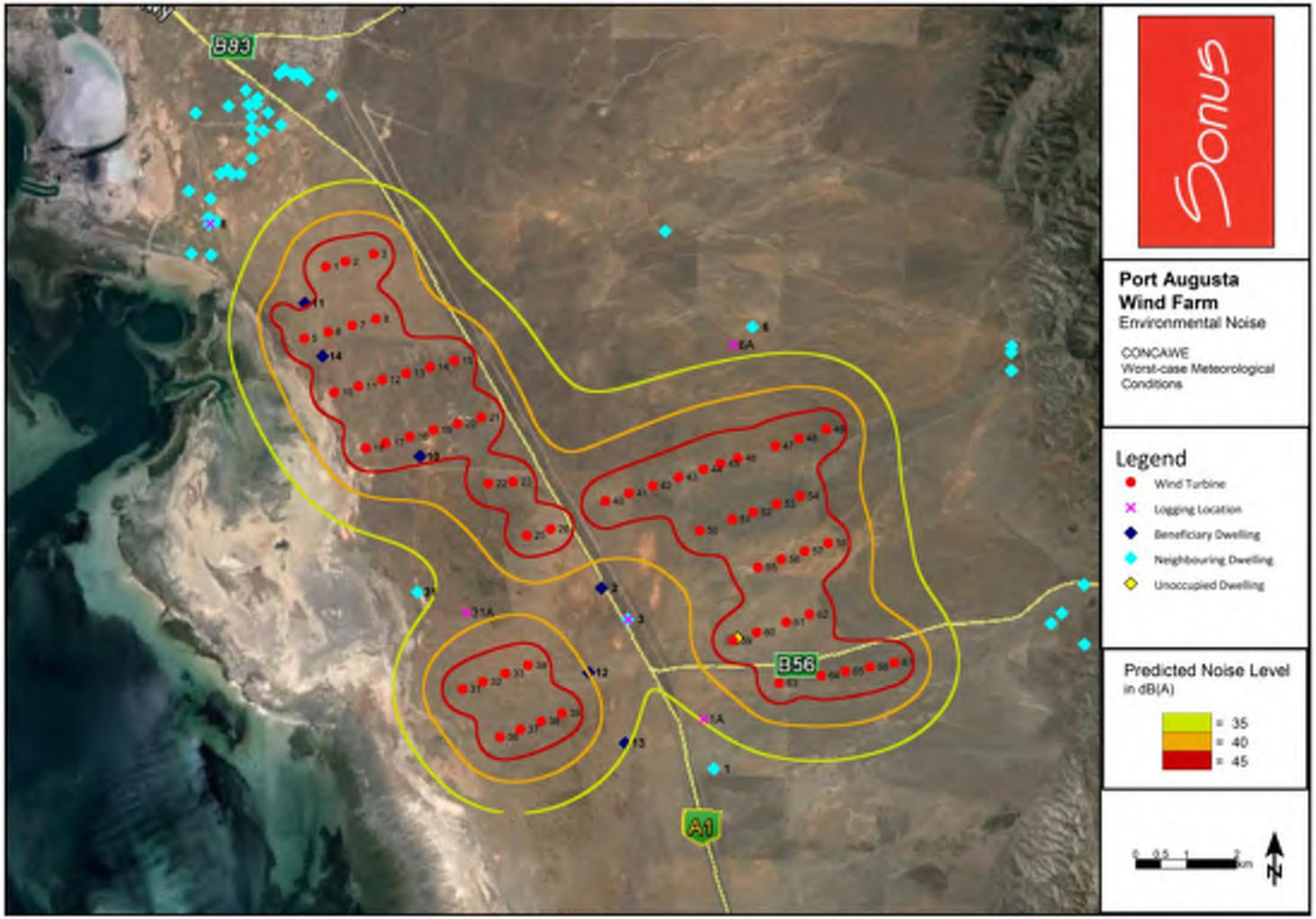
WTG ID	Coordinates (UTM WGS84 H53)	
	Easting	Northing
1	767175	6394123
2	767564	6394227
3	768118	6394375
5	766752	6392714
6	767222	6392841
7	767693	6392969
8	768165	6393097
10	767344	6391647
11	767817	6391773
12	768288	6391898
13	768759	6392023
14	769231	6392149
15	769707	6392276
16	767965	6390551
17	768357	6390656
18	768828	6390783
19	769300	6390909
20	769771	6391035
21	770243	6391161
22	770382	6389859
23	770868	6389893
25	771137	6388834
26	771608	6388960
31	769869	6385807
32	770271	6385953
33	770715	6386114
34	771164	6386278
36	770610	6384863
37	771010	6385017
38	771420	6385176
39	771832	6385334

WTG ID	Coordinates (UTM WGS84 H53)	
	Easting	Northing
40	772686	6389510
41	773150	6389661
42	773622	6389814
43	774129	6389979
44	774618	6390136
45	774956	6390246
46	775297	6390357
47	776035	6390595
48	776499	6390747
49	777043	6390923
50	774546	6388931
51	775186	6389150
52	775602	6389293
53	776064	6389452
54	776525	6389610
55	775692	6388206
56	776153	6388364
57	776614	6388523
58	777076	6388682
59	775206	6386764
60	775667	6386924
61	776247	6387124
62	776708	6387284
63	776110	6385927
64	776939	6386075
65	777417	6386160
66	777897	6386246
67	778380	6386332

APPENDIX E: One Third Octave Band Sound Power Levels

		Sound Power Levels in Octave Band Centre Frequency (dB(A) re 1 pW)																															Total Sound Power Level (dB(A) re 1 pW)
		6.3 Hz	8 Hz	10 Hz	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	
Hub Height Wind Speed (m/s)	3	17.4	24.0	29.9	35.5	41.3	46.3	50.8	55.3	59.5	63.1	66.5	69.6	72.2	74.5	76.7	78.3	79.6	80.6	81.3	81.6	81.5	81.1	80.4	79.4	77.9	76.3	74.2	71.8	69.0	66.0	62.5	58.6	54.6	**91.1**
	4	15.8	22.7	28.7	34.5	40.5	45.5	50.3	54.8	59.2	62.9	66.3	69.6	72.3	74.6	76.8	78.5	79.8	80.8	81.5	81.8	81.8	81.4	80.7	79.6	78.0	76.3	74.2	71.7	68.8	65.6	62.1	58.0	53.9	**91.3**
	5	17.7	24.6	30.7	36.4	42.4	47.5	52.2	56.8	61.1	64.8	68.3	71.5	74.2	76.5	78.8	80.4	81.7	82.8	83.4	83.7	83.7	83.3	82.5	81.5	79.9	78.1	76.1	73.5	70.6	67.5	63.9	59.8	55.7	**93.2**
	6	21.3	28.1	34.2	39.9	45.9	50.9	55.6	60.1	64.4	68.1	71.6	74.8	77.5	79.8	82.0	83.6	84.9	86.0	86.6	86.9	86.9	86.5	85.7	84.7	83.1	81.3	79.3	76.7	73.8	70.7	67.1	63.1	58.9	**96.4**
	7	25.7	32.4	38.4	44.0	49.9	54.9	59.5	64.0	68.2	71.9	75.3	78.5	81.1	83.4	85.5	87.2	88.5	89.4	90.1	90.4	90.3	89.9	89.2	88.2	86.6	84.9	82.8	80.3	77.4	74.4	70.8	66.8	62.8	**99.9**
	8	29.4	36.1	42.1	47.7	53.5	58.5	63.1	67.5	71.8	75.4	78.8	81.9	84.5	86.8	89.0	90.6	91.9	92.8	93.5	93.8	93.7	93.3	92.6	91.5	90.0	88.3	86.2	83.8	80.9	77.8	74.3	70.3	66.2	**103.3**
	9	31.6	38.3	44.2	49.7	55.5	60.4	65.0	69.4	73.6	77.1	80.5	83.6	86.2	88.5	90.6	92.2	93.5	94.4	95.1	95.4	95.3	94.9	94.2	93.1	91.6	89.9	87.9	85.4	82.6	79.5	76.1	72.1	68.1	**104.9**
	10	32.1	38.7	44.5	50.0	55.8	60.6	65.2	69.5	73.7	77.2	80.6	83.7	86.2	88.5	90.6	92.2	93.4	94.4	95.1	95.3	95.3	94.9	94.2	93.2	91.6	90.0	87.9	85.5	82.7	79.7	76.2	72.3	68.3	**104.9**
	11	33.1	39.6	45.4	50.8	56.4	61.2	65.6	69.9	74.0	77.5	80.8	83.8	86.3	88.5	90.6	92.2	93.4	94.4	95.0	95.3	95.3	94.9	94.2	93.2	91.7	90.0	88.1	85.7	82.9	80.0	76.6	72.8	68.9	**104.9**
	12	34.0	40.4	46.0	51.4	56.9	61.6	66.0	70.2	74.2	77.7	80.9	83.9	86.4	88.6	90.6	92.2	93.4	94.4	95.0	95.3	95.2	94.8	94.2	93.2	91.7	90.1	88.2	85.9	83.1	80.2	76.9	73.1	69.3	**104.9**
	13	34.6	40.9	46.5	51.8	57.3	61.9	66.3	70.4	74.4	77.8	81.0	84.0	86.5	88.6	90.7	92.2	93.4	94.3	95.0	95.2	95.2	94.8	94.2	93.2	91.8	90.2	88.3	86.0	83.2	80.4	77.1	73.4	69.6	**104.9**
	14	35.1	41.3	46.9	52.1	57.6	62.2	66.5	70.6	74.6	77.9	81.1	84.1	86.5	88.6	90.7	92.2	93.4	94.3	94.9	95.2	95.2	94.8	94.2	93.2	91.8	90.2	88.3	86.0	83.4	80.5	77.3	73.6	69.8	**104.9**
	15	35.5	41.7	47.2	52.4	57.8	62.4	66.7	70.8	74.7	78.0	81.2	84.1	86.5	88.7	90.7	92.2	93.4	94.3	94.9	95.2	95.2	94.8	94.2	93.2	91.8	90.2	88.4	86.1	83.4	80.6	77.4	73.8	70.1	**104.9**
	16	35.9	42.1	47.5	52.7	58.1	62.6	66.8	70.9	74.8	78.1	81.3	84.2	86.6	88.7	90.7	92.2	93.4	94.3	94.9	95.2	95.2	94.8	94.2	93.2	91.8	90.3	88.4	86.2	83.5	80.8	77.6	74.0	70.3	**104.9**
	17	36.3	42.5	47.9	53.0	58.3	62.8	67.0	71.1	74.9	78.2	81.3	84.2	86.6	88.7	90.7	92.2	93.3	94.3	94.9	95.2	95.1	94.8	94.2	93.2	91.9	90.3	88.5	86.3	83.6	80.9	77.7	74.1	70.5	**104.9**
	18	36.6	42.7	48.1	53.2	58.5	63.0	67.2	71.2	75.0	78.3	81.4	84.3	86.6	88.7	90.7	92.2	93.3	94.3	94.9	95.2	95.1	94.8	94.1	93.2	91.9	90.3	88.5	86.3	83.7	81.0	77.8	74.3	70.6	**104.9**
	19	37.0	43.0	48.4	53.4	58.7	63.2	67.3	71.3	75.1	78.4	81.5	84.3	86.7	88.7	90.7	92.2	93.3	94.2	94.9	95.1	95.1	94.8	94.1	93.2	91.9	90.4	88.6	86.4	83.8	81.1	78.0	74.4	70.8	**104.9**
	20	37.3	43.3	48.6	53.6	58.9	63.3	67.4	71.4	75.2	78.4	81.5	84.3	86.7	88.8	90.7	92.2	93.3	94.2	94.8	95.1	95.1	94.8	94.1	93.2	91.9	90.4	88.6	86.4	83.8	81.2	78.1	74.5	70.9	**104.9**

APPENDIX F: Predicted Noise Level Contour (10m/s)



Appendix 22: Updated Route Feasibility Assessment

REF: S164190

DATE: 2 April 2019

DP Energy Australia
2/53 Mabel Street
ATHERTON QLD 4883

Attention: Mr. Blair Marnie

Dear Blair,

RE: PORT AUGUSTA RENEWABLE ENERGY PARK STAGE 1 – DA VARIATION

GTA Consultants has prepared an updated route assessment to facilitate the transportation of a 76.0-metre-long wind turbine between Port Adelaide and Port Augusta Renewable Energy Park.

The original assessment was carried out by GTA Consultants in 2015, which considered a 60-metre-long blade being transported to the site from Port Adelaide and Port Pirie. Since the original assessment, DP Energy has confirmed that the only port of entry will be Port Adelaide with the assessment relating to Port Pirie no longer required.

A revised swept path assessment has been provided for an 82-metre-long wind farm vehicle at the following locations:

- Ocean Steamers Road / Eastern Parade
- Eastern Parade / Port River Expressway
- Salisbury Highway Horizontal Curve
- Salisbury Highway / Port Wakefield Road
- Augusta Highway /Horrocks Pass Road

As per the previous assessment, the haulage vehicle will shorten to the same dimensions as the previous assessment (~40 metre long truck).

Subject Site

The Port Augusta Renewable Energy Park is proposed to be located approximately eight kilometres south east of Port Augusta. The REP will incorporate both wind turbines and solar modules. The wind component will consist of up to 59 turbines with up to 155 metre rotor diameters and up to 107.5 metre hub heights. The solar component will consist of conventional photovoltaic modules. These will be ground mounted and could cover an area of up to 400 hectares subject to final design options.

The total development covers an area of approximately 5,400 hectares and straddles Highway 1 to the east and west.

The location of the REP is shown in Figure 1.

VIC | NSW | QLD | SA | WA
Level 5, 75 Hindmarsh Square
ADELAIDE SA 5000
PO Box 119
RUNDLE MALL SA 5000
t// +618 8334 3600
www.gta.com.au

Figure 1: Port Augusta Renewable Energy Park Site

Source: DP Energy Australia Pty Ltd

Proposed Transport Routes

The proposed transport route to the site for the wind turbine components, PV modules and ancillary equipment will be from Port Adelaide via Highway One. An equipment laydown area has been identified in Port Adelaide at the western end of Eastern Parade. The proposed laydown area is shown in Figure 2.

Figure 2: Proposed Port Adelaide Equipment Laydown Area

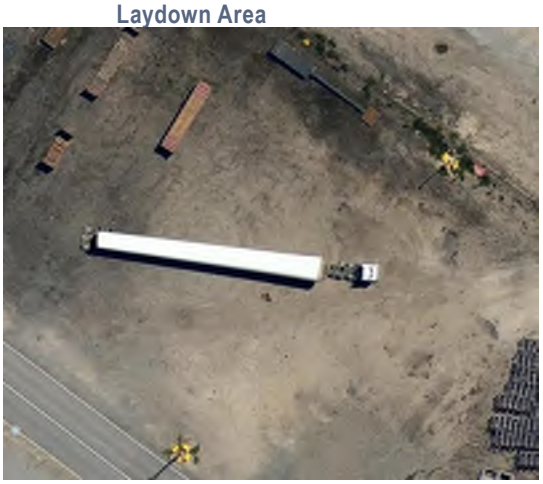
Source: Nearmap

The proposed laydown area has previously been used for several windfarm projects including the Snowtown II windfarm located off Highway One.

Figure 3 and Figure 4 show wind farm blades and tower sections being transported from the proposed laydown area in 2013.

Figure 3: Wind Farm Blades Leaving Laydown Area

Figure 4: Wind Farm Tower Sections Leaving Laydown Area

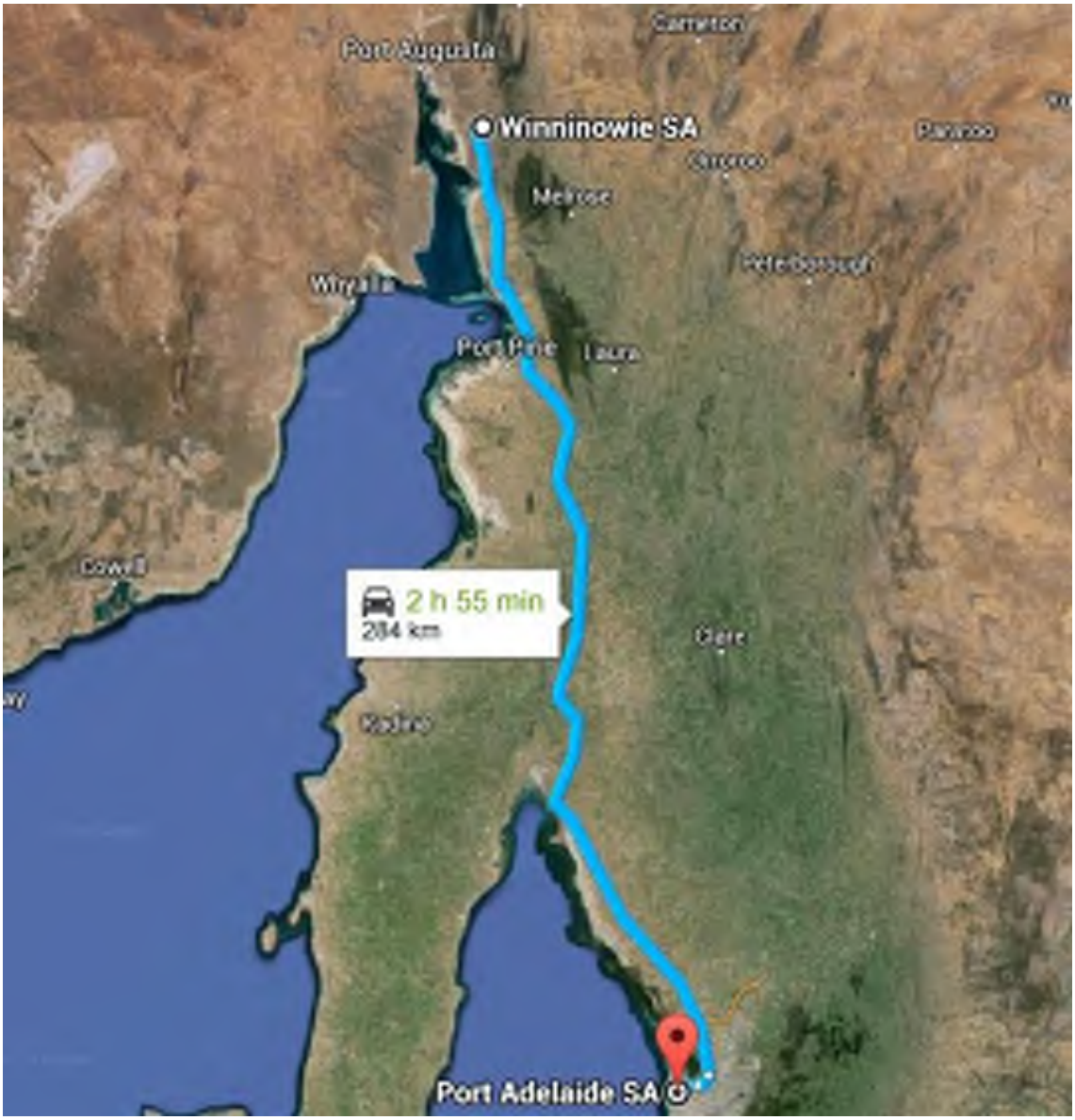


Source: Nearmap

Upon exiting the laydown area, vehicles would travel east along Eastern Parade and make a left turn onto the Port River Expressway. Vehicles would then proceed in a north-east direction along the Port River Expressway before making a left turn onto Port Wakefield Road (Highway One). Once on Highway One, vehicles would continue travelling north until reaching the project site.

The proposed Port Adelaide route is shown in Figure 5.

Figure 5: Proposed RAV Route from Port Adelaide to Development Site



Source: Google Maps

Route Feasibility Study

The updated assessment has identified that the site pinch points remain the same as the previous assessment along the proposed transport route from Port Adelaide to the project site. For the purposes of the review, the entry turn paths from Augusta Highway were also considered as part of the review:

The identified pinch points along the route are shown in Figure 6, Figure 7 and Figure 8.

Figure 6: Port Adelaide Route – Identified Pinch Points (Port Adelaide Area)

Source: Nearmap

Figure 7: Port Adelaide Route – Identified Pinch Points (Salisbury Highway)

Source: Nearmap

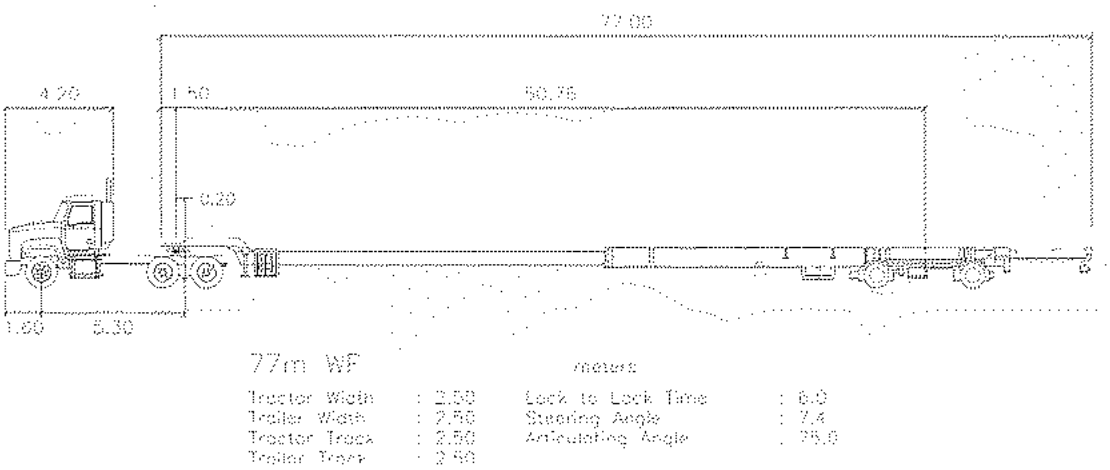
Figure 8: Port Adelaide Route – Identified Pinch Points (Site Accesses)

Source: Nearmap

Design Vehicle

Swept path assessments (using AutoTURN) for each of the key intersections and potential pinch points along the Port Adelaide route (including the return journey) were undertaken. An 82.0-metre-long find farm truck was used for the route starting at Port Adelaide and ending at the site in Port Augusta. Figure 9 considers the vehicle template for the 82-metre-long wind farm truck.

Figure 9: 82m Wind Farm Vehicle (77m Blade)



The return trip was tested for the packed vehicles which are 40 metres long, and is far less onerous than the 82-metre-long wind farm vehicle.

AutoTURN Results

The results of the swept path assessments for the Port Adelaide route are provided in Table 1 and Appendix A.

Table 1: Summary of Swept Path Assessment for Port Adelaide Route

Drawing No.	Location	Comments
PA1	Ocean Steamers Road / Eastern Parade	Widen gate on exit from laydown area. Relocate give way and directional sign on Eastern Parade approach to intersection.
PA2	Eastern Parade / Port River Expressway	Relocate keep left, no right turn and 2 x no entry signs. The 60km/h speed limit sign will also need to be relocated/removed. Modify central median on Eastern Parade on the west approach to the intersection to be mountable. Relocation of traffic signal post likely to be required. Modify central median to be mountable to accommodate swept path for return journey.
PA3	Salisbury Highway Horizontal Curve	No works required
PA4	Salisbury Highway / Port Wakefield Road	Remove/relocate chevron alignment marker signs
A1B56	Highway One / Horrocks Pass Road	Bidirectional marker sign no longer appears to be on-site based on street view, however should be checked prior to commencement. The turn is a little onerous which may require some vegetation clearing.
A1Gade	Gade Road / Highway One	Minor widening of Gade Road at intersection required.
B56OWR	Old Wilmington Road / Horrocks Pass Road	Minor widening of intersection required.
A1WA1	Highway One/Access Point	Modify access route to suit

All RAV movements will need to be accompanied by pilot vehicles and include appropriate traffic management measures.

Site Access Road Upgrades

The swept path assessment indicates that site specific intersection upgrades are required to accommodate the RAV's. Light poles, signage, median islands and kerbs would need modification, removal or replacement at some intersections in order to accommodate the RAV's. The site-specific upgrades would be assessed in further detail and agreed with the relevant road authority prior to commencing works.

Each of the vehicle access and egress points to the site and internal access road network will be designed to accommodate the swept path requirements of the largest vehicles.

The speed limit along Highway One adjacent to the site could be reduced from 110km/h to 80km/h during the construction phase to provide a safer environment for all road users. This would need to be determined and agreed by DPTI.

Other Considerations

No notable vertical clearance issues have been identified to existing fixed structures along the proposed routes. However vertical clearance to existing power infrastructure will need to be confirmed prior to the transportation of any equipment, in particular at the intersection of Spencer Highway and Germein Road.

It is noted that over-dimensional vehicles will be required to cross existing rail infrastructure at the following locations:

- Eastern Parade, on the exit from the Port Adelaide laydown area and within the Eastern Parade/Grand Trunkway intersection.
- Augusta Highway, approximately 500m south of Shadwells Gap Road on the approach to Snowtown.

The ownership of the above rail infrastructure will need to be confirmed with ARTC. Based on preliminary liaison with ARTC it is understood that separate approvals are not required to cross ARTC infrastructure and that DPTI will liaise with ARTC direct and apply any necessary conditions to the over-dimensional vehicle permit.

Summary

The proposed development involves the construction of 59 wine turbines and the installation of conventional solar photovoltaic modules across an area of up to 400 hectares. The total development will cover an area of approximately 5,400 hectares and straddles Highway 1.

Large components for the development will be delivered to the site by over-dimensional vehicles. The site is anticipated to generate up to 560 return over-dimensional vehicle movements over a 6 month period with an average 4 return trips per day.

The preferred route option for over-dimensional vehicles to travel to the site has been identified between Port Adelaide and the site.

Based on the findings and discussion presented in this report, GTA Consultants considers that the proposed over-dimensional transport route between Port Adelaide and the site (and the return route) will be suitable subject to some minor modifications being made to existing road infrastructure.

The locations of the proposed site access and egress points are considered appropriate with good sight distance available in accordance with relevant design standards and guidelines. The access points will be constructed to accommodate the largest design vehicles expected to enter and exit the site.

It has been demonstrated that wind turbine components have successfully been transported along sections of the proposed routes. All over-dimensional movements will be accompanied by pilot vehicles and include appropriate traffic management measures.

Any requirements from ARTC to cross rail infrastructure will also need to be adhered to. The route feasibility assessment has not identified any other significant constraints that would prevent the use of these routes.

Conclusion

Port Adelaide Route

1. A site visit and swept path assessment using AutoTURN software indicates that the existing road network and infrastructure requires minor modification in order to accommodate the swept path requirements of the largest transport vehicles (blade transporter and nacelle transporter).
2. Road network and infrastructure modifications are likely to be required at the following locations:
    - Ocean Steamers Road / Eastern Parade on exit from the Port Adelaide laydown area;
    - Eastern Parade / Port River Expressway intersection;
    - Highway One / Horrocks Pass Road intersection near the development site;
    - Gade Road / Highway One intersection near the development site;
    - Old Wilmington Road / Horrocks Pass Road intersection near the development site.

Site Access

1. There is adequate sight distance at the proposed site access and egress points in accordance with the relevant design standards and guidelines.
2. The access points will be suitable for the largest vehicles anticipated to enter and exit the site.
3. The delivery strategy that has been devised will minimise excessive crossing of the A1 from the west site to the east site with over dimensional vehicles and is considered appropriate.

On the above basis, GTA considers it feasible to transport the project components along both of the proposed routes subject to minor mitigation works and adherence to any requirements to cross rail infrastructure.

Should you have any questions or require any further information, please do not hesitate to contact me on (08) 8334 3600.

Yours sincerely

GTA CONSULTANTS

Paul Froggatt
Associate Director

Attachments

Appendix A

Entry – PA1
Entry – PA2
Entry – PA3
Entry – PA4
Entry – A1B56
Entry – A1WA1
Exit – PA1
Exit – PA2
Exit – PA3
Exit – PA4
Exit – A1B56
Exit – A1Gade
Exit – B56OWR

77m WF

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

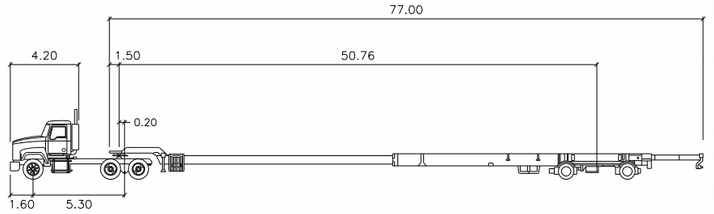
FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
PORT ADELAIDE ROUTE

07 DEC '18
SCALE 1:750 @ A3
DRAWING: PA1

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 2:35:37 PM



77m WF

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

SPEED LIMIT SIGN

EASTERN PDE

PORT RIVER EXPWY

KEEP LEFT SIGN

TRAFFIC LIGHTS

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
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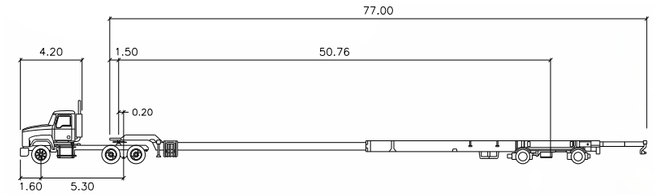
RENEWABLE ENERGY PARK
PORT ADELAIDE ROUTE

07 DEC '18
SCALE 1:1250 @ A3
DRAWING: PA2

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 2:38:36 PM



77m WF — meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

SALISBURY HWY

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

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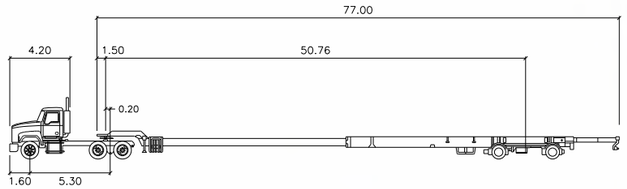
RENEWABLE ENERGY PARK
PORT ADELAIDE ROUTE

07 DEC '18
SCALE 1:1750 @ A3
DRAWING: PA3

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 2:39:17 PM



77m WF meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

CHEVRON ALIGNMENT MARKING SIGNS

SALISBURY HWY

PORT WAKEFIELD RD

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
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RENEWABLE ENERGY PARK
PORT ADELAIDE ROUTE

07 DEC '18
SCALE 1:2500 @ A3
DRAWING: PA4

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 3:13:07 PM

AUGUSTA HWY

HORROCKS PASS RD

SHRUBS

SHRUBS

SWEPT PATH KEY

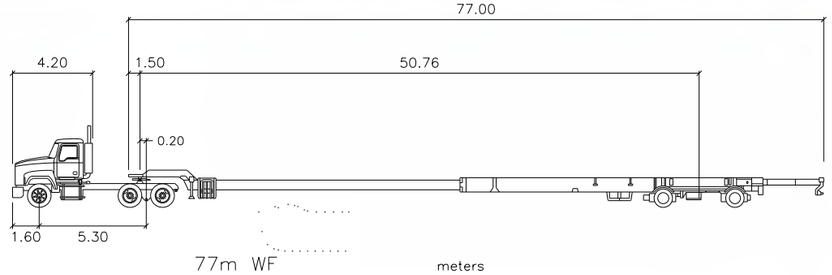
- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION



77m WF meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
SITE ACCESS

07 DEC '18
SCALE 1:750 @ A3
DRAWING: A1B56 - ENTRY

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 3:14:32 PM

AUGUSTA HWY

77m WF

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 7.4
Tractor Track	: 2.50	Articulating Angle	: 75.0
Trailor Track	: 2.50		

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
SITE ACCESS

07 DEC '18
SCALE 1:750 @ A3
DRAWING: A1-WA1

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 2:42:09 PM

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
PORT ADELAIDE RETURN ROUTE
38.6m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:750 @ A3
DRAWING: PA1

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 24.307 PM

EASTERN PDE

PORT RIVER EXPWY

STREET LIGHTING
TRAFFIC LIGHTS
'NO LEFT TURN' SIGN

FOOTPATH

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
PORT ADELAIDE RETURN ROUTE
38.6m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:1250 @ A3
DRAWING: PA2

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 2:43:40 PM

PRELIMINARY PLAN

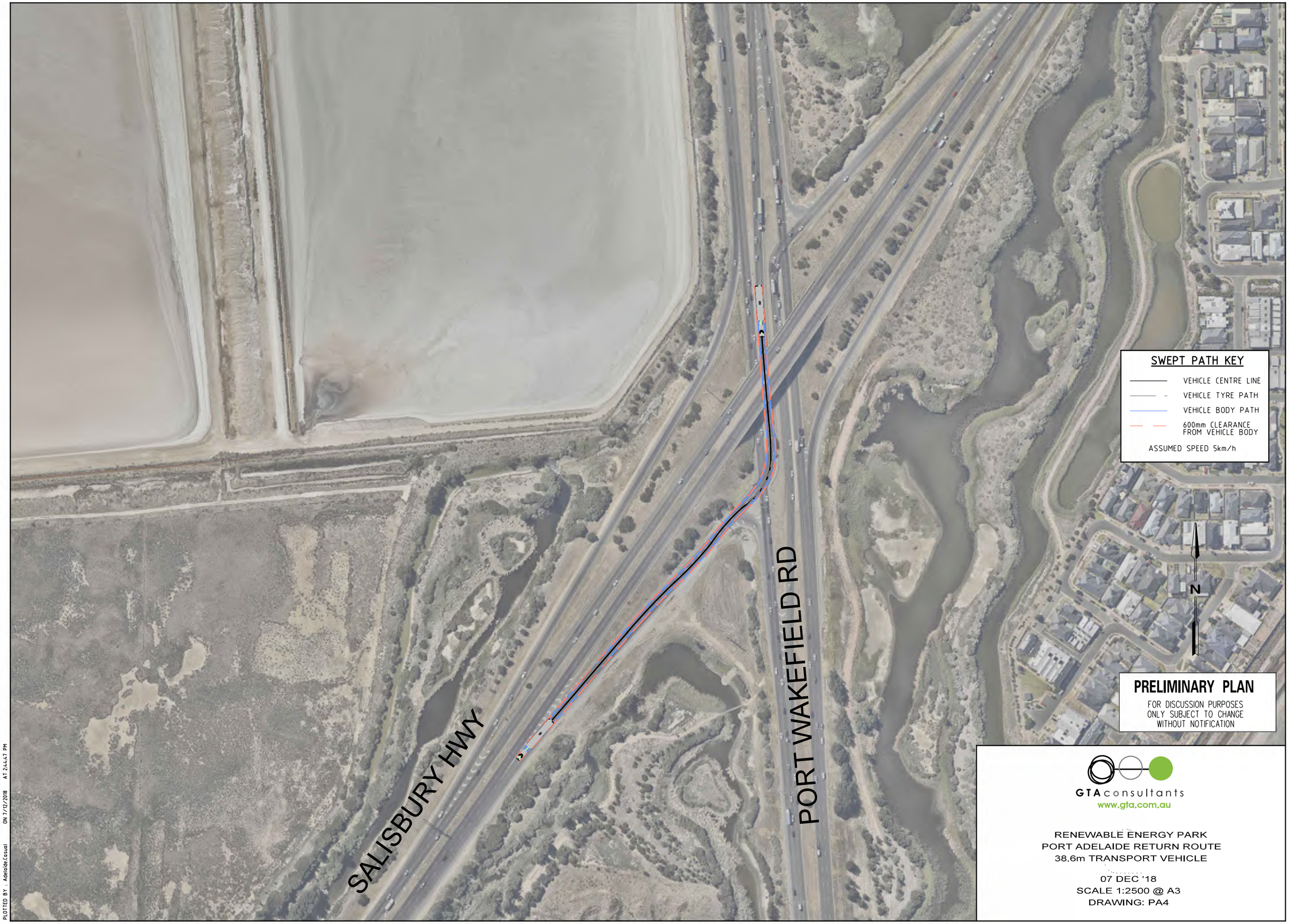
FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
PORT ADELAIDE RETURN ROUTE
38.6m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:1750 @ A3
DRAWING: PA3

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 2:44:14 PM



SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
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RENEWABLE ENERGY PARK
PORT ADELAIDE RETURN ROUTE
38.6m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:2500 @ A3
DRAWING: PA4

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 2:44:47 PM

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
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RENEWABLE ENERGY PARK
AUGUSTA HWY/HORROCKS PASS RD INT (RETURN)
38.6m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:750 @ A3
DRAWING: A1B56

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 2:1:20 PM

AUGUSTA HWY

GADE ROAD

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 600mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

N

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

GTAconsultants
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RENEWABLE ENERGY PARK
AUGUSTA HWY/GADE RD INT (RETURN)
38.6m VEHICLE

07 DEC '18
SCALE 1:750 @ A3
DRAWING: A1GADE

PLOTTED BY : Adelaide.Casual ON 7/12/2018 AT 2:54:7 PM

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
ONLY SUBJECT TO CHANGE
WITHOUT NOTIFICATION

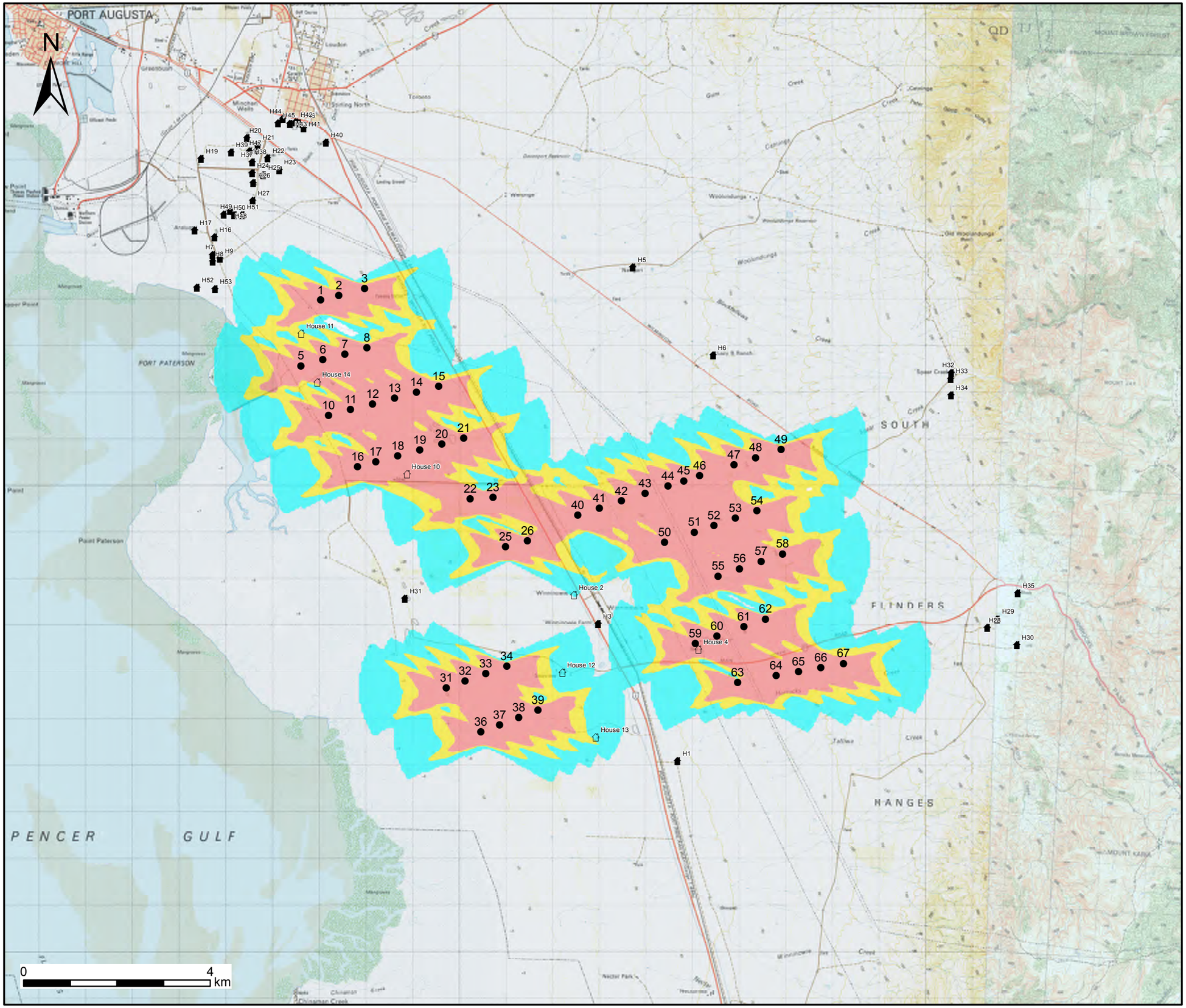
GTAconsultants
www.gta.com.au

RENEWABLE ENERGY PARK
SITE ACCESS RETURN ROUTE
36.8m TRANSPORT VEHICLE

07 DEC '18
SCALE 1:750 @ A3
DRAWING: B56OWR

PLOTTED BY : Adelaide.Casual ON 7/12/2018 A1 24644 PM

Appendix 23: Shadow Flicker Map



Port Augusta Renewable Energy Park

Figure A23

Shadow Flicker

- Neighbouring Houses
- Beneficiary Houses (incl. derelict)
- 59 Turbines

0-10 Hours/Year
11-40 Hours/Year
40+ Hours/Year

Ver	Date	Drawn by	Checked	Approved
V1.1	28/03/2019	FK/AM	BM	DB

Coordinate System
WGS 1984 UTM Zone 53S

Size
A3

Scale 1:80,000 Printed @ A3

Filename:
App_23_PA Variation_Shad Flic (Final)

DP ENERGY

www.dpenergy.com

Your Ref: 34591
Our Ref: PAVarDA8May2019_DPEAreponse

Client Services Officer
Environment Protection Authority
GPO Box 2607
ADELAIDE SA 5001
DX 228

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Atherton QLD 4883
T: 07 4091 2163
E: gabrielle.powell@dpenergy.com

By Email: epa.planning@sa.gov.au
Cc: Simon.Neldner@sa.gov.au

8 May 2019

Dear Courtney Stollznow,

Re: Letter dated 30th April 2019- EPA reference 34591.
Port Augusta Renewable Energy Park Variation Development Application
(Variation under 660/V008/15 V1)

I'm am writing in response to an information request from EPA dated 30 April 2019:

"…the EPA requires the following additional information before it gives its response.

1. *Please clarify the statement 'albeit with minor modifications to their locations in comparison to the Stage 1 assessment' stated on page 3 in the 2019 SONUS noise report. Does this mean that the final determination of the 50 wind turbines positions will be on 50 of the original 59 selected positions, or does it mean that the selected positions may vary from the original selection?*

2. *As noise levels at several noise sensitive receivers who are beneficiaries did not meet the wind farm guideline recommended noise targets for financial stakeholders in 2015, the EPA's assessment of noise in the original proposal from 2015 relied on private agreements between the proponent and nearby residents. Please provide written evidence to confirm that these agreements are still valid and current."*

Response to Question 1. - Turbine positions

For context, the design objective of the variation was to restrict the change as far as possible to the design envelope for the turbine itself i.e. increasing from 150m tip height to 185m maximum tip height. However, as part of the variation DP Energy also took the opportunity to make minor amendments to six of the 59 turbine positions in order to take account of known microwave links (some of which were incorrectly registered or unregistered at the time of the original application). This was achieved by turbines moving linearly along the rows as opposed to a redesign.

In respect of the specific question, the final determination of the 50 wind turbines positions will be on the original selection positions albeit six turbine positions have been microsited to take account of the microwave links, as shown in Appendix 13 of the Variation Development Application Report and included here as Appendix 1. The six turbines affected are numbered 2, 31, 32, 33, 36 and 38 and as indicated in Appendix 1 the movements are minimal.

Whilst the total number of turbines will be reduced from 59 to 50, it is yet to be determined which turbines will be deleted from the layout although it is likely these will predominantly be removed from the Eastern turbine block. The assessments have been made against a 59-turbine layout and hence represents a "beyond worst-case" scenario.

The Environmental Noise Assessment undertaken by Sonus (Appendix 21 of the Variation Development Application Report) found lower noise levels compared to the original approved development application leading Sonus to conclude that "…it is considered that the proposal can be designed and constructed to prevent adverse impact and ensure it does not detrimentally affect the amenity of the locality, thereby satisfying the relevant provisions of both the Port Augusta Council and the Mount Remarkable Council Development Plans. "

These reduced impacts are the result of the decreased sound power levels of the assessed wind turbines resulting from the reduced rotation speed and improved noise reduction measures as compared to the (currently approved) turbines originally proposed for the site. Hence it is contended that even neglecting the reduction in noise impact resulting from a reduced number of turbines, the proposed variation represents a significant reduction in the noise impact associated with the wind farm.

Response to Question 2. - Noise Agreements

The private agreements between DP Energy Australia and beneficiary landholders are still current and valid. These agreements are provided confidentially for your reference as Appendix 2.

I trust that the enclosed information is sufficient for your purposes, however if you require any further details please do not hesitate to contact me.

Yours sincerely,

Gabrielle Powell
Consents Manager

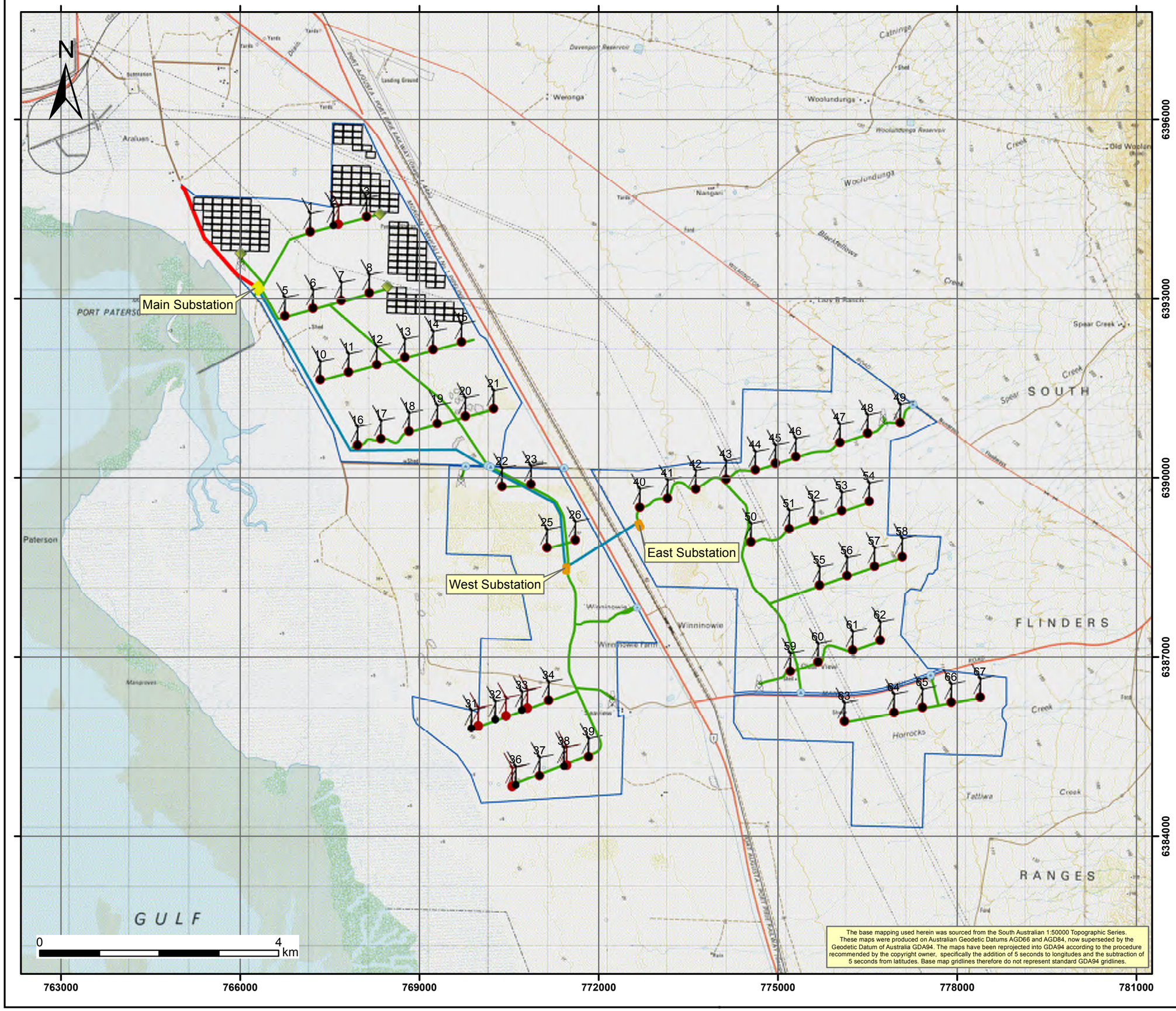
DP Energy Australia Pty. Ltd. ABN: 16 140 516 196
2/53 Mabel Street (PO Box 1451)
Atherton QLD 4883
T: 07 4091 2163

Appendix 1: Variation Layout Comparison

Port Augusta Renewable Energy Park

Figure A13

Original and Amended Project Design Layout



The base mapping used herein was sourced from the South Australian 1:50000 Topographic Series. These maps were produced on Australian Geodetic Datums AGD66 and AGD84, now superseded by the Geodetic Datum of Australia GDA94. The maps have been reprojected into GDA94 according to the procedure recommended by the copyright owner, specifically the addition of 5 seconds to longitudes and the subtraction of 5 seconds from latitudes. Base map gridlines therefore do not represent standard GDA94 gridlines.

- Original Layout
- Amended Layout
- Project Boundary
- Solar PV Modules
- PV Interconnection Substations (not to scale)
- Site Access/Exit Points
- MainSubstation/Offices (not to scale)
- Substations (not to scale)
- Export Line (Shown to Project Boundary only)
- 132kV Overhead Line
- Permanent Met Masts
- Tracks

Ver	Date	Drawn by	Checked	Approved
V1.1	28/03/2019	FK/AM	BM	DB

Coordinate System
WGS 1984 UTM Zone 53S

Size
A3

Scale 1:60,000 Printed @ A3

Filename:
App_13_PA Variation DA_Layout Comparison

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