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PREFACE

The Environmental Statement has been prepared to provide a project description, site description, discuss all potential effects of the expanded Willogoleche Wind Farm on the existing environment and community, and the measures proposed to mitigate any potential adverse effects. The proposed development is for the purpose of generating electricity from wind energy.

The Environmental Statement has been prepared in five volumes:

Volume 1: Executive Summary (this volume)

Volume 2: Main text

Volume 3: Figures

Volume 4: Photomontages

Volume 5: Appendices

Inspection of the Environmental Statement

The Development Application and the Environmental Statement will be available for inspection at the Regional Council of Goyder office in Burra from January 2011.

Copies of the Executive Summary (this volume), or other volumes of this Environmental Statement are available in CD Format from International Power (Australia) Pty Ltd or Wind Prospect Pty Ltd upon request.

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1. INTRODUCTION

The Proposal

The Willogoleche Hill Wind Farm was consented by the Regional Council of Goyder in November 2004, and more recently was deemed to be substantially commenced in November 2009.

It is proposed that the existing consented twenty-six (26) turbines will be expanded by the addition of a further eleven (11) turbines. The additional eleven turbines and associated crane hardstand areas will be accompanied by extensions to the roads and underground cable network of the existing consented wind farm. In addition, it is proposed that eleven (11) of the existing twenty-six (26) turbines will be re-located outside of their existing final-positioning allowance of a radius of 100m. The remaining fifteen (15) existing turbines will be located within 100m of their original consented location.

The nearest turbine will be approximately 3.5 km west of the town of Hallett in the Mid-North region of South Australia. The turbines will be erected for the purpose of generating electricity from wind energy.

The proposed expansion was made known publicly in October 2010 at a community open day held in Hallett. Feasibility studies commenced many months ago. Results of public consultations and feasibility assessments are presented in this Environmental Statement, as part of the Development Application for the expanded Willogoleche Wind Farm proposal.

The purpose of the Environmental Statement is to support the Development Plan Consent application associated with the construction and operation of the expanded Willogoleche Wind Farm, including:

- Construction and operation of up to 37 turbines with a maximum blade tip height above ground level of up to 152 metres (and that the final position of these turbines will be within a radius of 100m from the locations indicated in **Figure 2** and **Figure 3**)
- Construction of access tracks, hardstand areas and other associated on-site infrastructure
- On-site electrical connections and infrastructure, including an underground cable network, and an on-site cable marshalling yard (approval is sought for the final positioning of the cable marshalling yard within a radius of 500 m from the location indicated in **Figure 4**)

The Environmental Statement may also be used in support of subsequent Land Division Consent applications associated with the lease of land for the turbine sites and associated infrastructure.

Given the scale of the project, Development Plan Consent is requested to allow for substantial construction works to begin within 5 years of the date of Development Plan Consent (as opposed to the statutory 12 months). In addition, it is requested that the date for substantial completion of the existing consented expanded Willogoleche Wind Farm be revised to 7 years from the date at which consent is granted for the expanded Willogoleche Wind Farm.

Referral will also be made to the Federal Department of the Sustainability, Environment, Water, Population and Communities in conjunction with this application for consideration under the *Environment Protection & Biodiversity Conservation (EPBC) Act 1999*.

The Proponent

The expanded Willogoleche Wind Farm proposal is being developed by International Power (Australia) Pty Ltd (International Power), a wholly owned subsidiary of International Power plc of the UK. International Power is a leading independent power generator and the largest independent electricity generator in Australia. Worldwide it has 20,949MW (net) of capacity in operation (34,408MW gross capacity) and 1,393MW (net) under construction. International Power owns and operates power plants in the UK and Europe, North America, the Middle East, Asia and Australia. Within its portfolio International Power has 1,341MW of operating wind generation, which includes 46MW in South Australia at Canunda near Millicent. Other Australian assets include Pelican Point, Mintaro, Snuggery, Port Lincoln and Dry Creek in South Australia, Hazelwood and Loy Yang B in Victoria, and the Kwinana cogeneration plant in Western Australia.

2. BACKGROUND INFORMATION AND PROJECT RATIONALE

The consensus of scientific opinion as presented to world governments by the Intergovernmental Panel on Climate Change (IPCC)¹ is that there is a link between man's actions and a variety of climate-related issues. Industrialisation and the resultant emissions of greenhouse gases from the burning of fossil fuels have created, and continue to exacerbate, a global environmental problem – the Greenhouse Effect.

Australian Federal Government policy currently provides encouragement and incentives for renewable energy generation, of which the Renewable Energy Target (RET) is a principal example.

The development of the proposed expanded Willogoleche Wind Farm would result in the generation of significant amounts of electricity for the supply to the National Electricity Market. It would contribute to the Federal Government's target of 20 % (or an additional 45 000 GWh) of electricity to be generated by renewable energy sources by 2020 under the expanded Renewable Energy Target (RET) scheme. This would displace energy that would have otherwise been generated using fossil fuels, thus reducing emissions of greenhouse gases and assisting Australia's international obligations to control harmful atmospheric emissions.

The expanded Willogoleche Wind Farm is highly suited to wind energy generation due to a combination of outstanding wind resource, and grid capacity at a nearby connection point. This will enable the development of a high-yielding and efficient wind farm, providing power for approximately **56,690** South Australian households.

A typical wind turbine produces the equivalent of the energy required to manufacture it in approximately 3-5 months of operation, after which it is a net producer of 100 % clean and renewable energy.

3. PLANNING THE DEVELOPMENT

A range of factors are considered during the 'site selection' phase of a wind farm project which can potentially constrain development. These include:

- Suitable wind resource
- Capacity within and ease of connection to the electricity transmission network

¹ The Intergovernmental Panel on Climate Change (IPCC) is a body established by the World Meteorological Organisation and the United Nations Environment Programme to research and report on the scientific, technical and socio-economic aspects of climate change.

- Access and general ground conditions
- Proximity to residential properties and the nature of surrounding land uses
- Availability of turbine sites
- Presence (or absence) of nationally and locally significant areas with regard to environment, landscape, nature conservation, archaeology and cultural heritage

After selecting the project area as being fundamentally suitable for a wind farm development, a wind farm site feasibility study addressing specific design issues was undertaken. This study included detailed assessment of a number of environmental, social and commercial factors such as ecology, cultural heritage, visual amenity and communications. Operational requirements were also considered and evaluated. Results of feasibility studies led to the preferred final design.

The land proposed for the project area is freehold land, falling within land Certificate of Titles Volumes 5212, 5696, 5192, and 5664 in the Hundreds of Anne and Hallett. A number of land uses exist in the region, which are described in **Chapter 10**. Broadly speaking, they are agriculture, mineral exploration and recreation. A total of 7 land titles are included in the proposal. Land tenure details are presented in **Table 3.1**.

Approval is sought for the final positioning of the 37 turbines within a radius of 100 m of the locations indicated in **Figure 2** and **Figure 3**. International Power is applying for Development Plan Consent to allow for substantial construction to begin within 5 years of the date of Consent. The actual timing of construction will principally be driven by the length of time taken to obtain other permits and authorisations, attaining Board approval/project financing for commencement and the long lead times for wind farm components, with particular emphasis on lead times for transmission connection to ElectraNet's 275kV system. Additionally, market conditions within Australia, which has seen a number of significant changes to Federal Government legislation affecting renewable energy, has a significant effect on project construction timing.

4. PUBLIC CONSULTATION

Public consultation for the project commenced during the early stages of the project. Consultation at this time aimed to inform the general public, neighbouring residents, statutory regulators and other stakeholders of the project, in order to identify issues that require addressing during project planning and design.

A number of local community stakeholders have provided input into the proposal, raising a broad range of issues for consideration. Issues raised have been addressed, and have resulted in a number of modifications to the original layout.

A public information forum was also held on Wednesday 20th October 2010 at the Hallett Town Hall in Hallett. The public information forum presented provisional details of the proposed expanded Willogoleche Wind Farm, including its likely appearance illustrated by means of plans and photomontages. In addition, a time-lapse photography computer model/DVD of the project was run continuously on a large television screen, which compared the existing 26 approved turbines with the expanded 37 turbine layout, including potential changes to hub height (this computer model, produced by Truescape, is provided as part of the material being lodged with the Council). A number of information panels and brochures were also displayed. These contained information about the project and wind energy in general and included a series of Frequently Asked Wind Energy Questions.

More than 70 people attended the exhibition. Attendees were invited to complete a public opinion survey of the project expansion and wind energy in general (provided in **Volume 5 Appendix 8**), of which 22 people did so. Results of the survey were as follows:

- 64 % were in favour of the expanded Willogoleche Wind Farm (14 respondents)
- 5 % neither approved nor disapproved (1 respondent)
- 32 % did not approve (7 respondents)

5. GENERAL PROJECT DESCRIPTION

The proposed expanded Willogoleche Wind Farm development consists of the installation of thirty-seven (37) wind turbines, an onsite electrical cable network, a grid connection 2.4km to the South-West of the southernmost turbine, access tracks, crane hardstand areas, up to two (2) wind monitoring masts, site operations facilities, potentially a cable marshalling yard and appropriate site signs. The proposed wind farm is to have an installed capacity of up to 111MW, depending on the model of the turbine selected and if all 37 locations were to be utilised with the largest capacity turbines. Operation of the wind farm is to be carried out by a combination of remote computer control and local operations and maintenance staff.

The turbines proposed for the development are likely to be approximately 3.0 MW machines (although could vary from anywhere between 1.5 MW and 3.3 MW, depending on the turbine selection, which will occur closer to construction). The Suzlon S88, 2.1 MW machine (as installed at the Hallett Wind Farm) is typical of the type of wind turbine that could be installed. Alternative turbines would be very similar in appearance, size and all major characteristics, although longer blade lengths and higher hub heights would be considered to maximise energy production. In general, larger turbines with longer blades would result in fewer numbers being installed due to the greater spacing required between them.

Sample specification sheets for the Suzlon S88 and Siemens SWT-3.0-101 turbine are included in **Appendix 9**. The turbines are three-bladed, semi-variable speed, pitch regulated machines, with the rotor and nacelle mounted on a reducing cylindrical steel tower. Each turbine will rise approximately 125-152 m from the ground to the tip of the blades, with typical tower heights of between 80 and 100 m, and with blades between 30 and 51 m in length. It should be noted that a likely height will be around 130 m, although the height used for visual assessment analysis takes the maximum possible option as the extreme case (see **Chapter 12**). As examples, the Suzlon turbine with its new 95m rotor blade assembly would be 127.5 m tall from base to blade tip; a Siemens 3MW turbine with a 101m rotor diameter would be 130.5m to blade tip; and a Vestas V112 3MW turbine on a 95m tower would be 150m at the blade tip. Most turbines begin to generate energy at wind speeds in the order of 4 ms^{-1} (14.4 kph) and shut down (for design and safety reasons) in wind speeds greater than 25 ms^{-1} (90 kph). The blades typically rotate at about 15 rpm at low wind speeds and up to 18 rpm at higher wind speeds.

Currently two temporary met masts exist on site, one of 65 m and one of 40 m. Up to two permanent 80 m wind monitoring masts will be installed on-site. Under DA 422/0078/004, consent exists for two permanent 80m wind monitoring masts. The purpose of the monitoring masts is to provide necessary information for the performance monitoring of the wind turbines. The wind monitoring masts would be of a guyed, narrow lattice or tubular steel design. A further planning application will be submitted to finalise the location of the permanent wind monitoring masts once a turbine supply contract has been finalised.

The electricity produced by each wind turbine generator would most likely be transformed from 690 V up to 33 000 V (33kV) by a transformer generally located within or adjacent to each turbine, (although some turbine models generate at 12kV and then collect and transform the power for small groups of turbines up to 33kV) (see **Image 7** of **Appendix 10**). Underground electrical cables will be installed at a depth of between 0.8-1 m below the ground surface to conduct the electricity from the turbines to the substation. The underground electrical cables will most likely follow site access tracks where practical (See **Image 5** of **Appendix 10**).

The planned grid connection point for a new ElectraNet substation is located approximately 2.4km south-west of the southern most turbine on the site, on McAskill Rd, Willalo (Hundred of Anne, Title Volume/Folio references 5254/550 and 5469/728 for substation and cable underground route), SA Department of Planning Development Number 422/V015/09. The ElectraNet owned 275 kV transmission line passes adjacent to this substation location. The substation site is expected to require between 2 to 5 ha of land and will include standard grid connection infrastructure and buildings. The chosen location minimises the visual impact of the wind farm by siting the substation away from frequently used public roads and is as close as practically possible to the wind farm site and the 275kV transmission line. This position also allows for the wind farm's internal electrical infrastructure and grid connection to have a reduced visual impact by utilising underground cabling to the substation.

Negotiations over the exact type, size and location of the grid connection infrastructure are still underway with ElectraNet, other relevant agencies and landowners. If for technical reasons the proposed connection point becomes unfeasible, International Power would propose to consult with the local council to determine what impacts this will have on the development approval process. Council will then determine whether the changes to the grid connection require minor or major amendments to the application or whether a separate application for the connection is possible.

The expanded Willogoleche Wind Farm is currently being developed by International Power. Project management will continue under International Power unless commercial or other arrangements change. All project and construction management will comply with the appropriate company's Quality Assurance System and Environmental Management System, or equivalent, ensuring that relevant procedures, statutory requirements and operational standards are met. Project management will also comply with the project Environmental Management Plan (EMP) (see **Appendix 13**).

Project management will also be in accordance with this Environmental Statement and any subsequent documents developed, such as Environmental Management Implementation Plans (EMIPs) and Work Procedures. A base Environmental Management Plan has been developed for the project, which contains a summary of proposed environmental management actions (see **Appendix 13**). It will be a requirement that all actions contained in the EMP are considered and incorporated into the site EMIPs and other environmental documentation. The construction contractor will address on-site and public safety issues, through the development and implementation of a project Health and Safety Plan. This shall include emergency prevention and response measures for events such as chemical spill and fire.

6. SITE WORKS

On-site works for the project include pre-construction activities (such as geotechnical investigations, detailed site surveying and site preparation earthworks), establishment of access tracks and crane hardstand areas, laying of turbine foundations, laying of underground electrical cables,

establishment of an Operations and Maintenance Compound and turbine erection. The project will also require the erection of temporary infrastructure such as portable field offices, toilet facilities, concrete batching plant (if required), materials storage areas and parking bays. The storage of hazardous chemicals and wastes such as fuels, oils and other machinery lubricants and liquids will be carried out in accordance with statutory regulations and guidelines.

Construction vehicles are most likely to gain access from the Barrier Highway, the Hallett to Jamestown Road and the network of unsealed and secondary roads that occur in the project area.

Once operational, the wind farm would be monitored both by on-site staff and by remote staff. Maintenance staff are likely to be on-site throughout the year, making routine checks of the wind turbines on an ongoing basis. Planned major maintenance would be carried out approximately twice a year on each wind turbine. Each planned maintenance visit would potentially involve a number of maintenance vans (with two technicians per van) on site.

Each turbine of the proposed expanded Willogoleche Wind Farm will have an operational life of approximately 20-25 years. After this time, the nacelles may be replaced to extend the operational life of the wind farm. When the development is finally decommissioned, the parts of the site occupied by the components of the wind farm will be returned to their former use.

7. APPROACH TO ENVIRONMENTAL ASSESSMENT

International Power, along with a number of specialist consultants and stakeholders, have worked together during the feasibility and planning stages of the expanded Willogoleche Wind Farm proposal to determine the baseline environmental conditions at the site, identify potential impacts and develop management strategies to mitigate those impacts where possible.

The assessment process has involved stakeholder consultations, site-specific survey work (including desktop and on-ground assessment) carried out by specialist consultants, and observation of relevant literature. These assessments, along with stakeholder input, have been consolidated into this document. All external assessments and consultations have been extensively drawn upon to develop an optimal wind farm design that balances environmental, social, economic and cultural needs.

8. PHYSICAL ENVIRONMENT

The Hallett region experiences a Mediterranean climate, with cool to mild to wet winters and hot dry summers, with a mean annual rainfall of 470 mm, although historically the values range between 200 mm and 600 mm.

Geologically the region is part of the Mount Lofty Block, principally composed of combinations of Proterozoic tillites, quartzites, slates, shales, siltstones and dolomites, mixed with Cainozoic slope deposits and recent alluvial plains.

Soil types are dominated by uniform clays or clay loams. Chiefly non-arable, shallow stony soils with variable rock outcrops occur along the majority of the ridges. Generally soils of the region are either formed on basement rock, or on outwash sediments. Soils vary in physical condition, from hard setting/sealing soils (some with poor subsoil structure) to soils with no significant soil structure problems. Soil types found within the overall project area are considered to have a low risk of wind

erosion but predominantly moderate to high risk of water erosion. Erosion events can lead to siltation and consequential habitat disturbance both on and off-site, decreased productivity from loss of top soil, disturbance to soil structure and general instability of soil.

Since European settlement, the majority of the watercourses in the region have been significantly modified, and the biodiversity values of the system are currently low, particularly in terms of lack of native vegetation following widespread vegetation clearance. There are few natural surface water bodies near the project area that retain water permanently. All creeks and potential wetland areas (low-lying areas) are ephemeral. The water resources of the Willogoleche range are a part of the Broughton River Catchment, falls under the jurisdiction of various government agencies, such as the Northern and Yorke Natural Resources Management Board and the Department of Water, Land and Biodiversity Conservation.

The air quality in the area surrounding the proposed wind farm site is assumed to be good. Local industry consists of farming practices, generally having a negligible impact on air quality. The nearest industrial centre is located at Jamestown, approximately 30 km north-west of the project area. Dust emissions may occur during construction activities such as earthworks and construction traffic travelling along access tracks and roads.

Management

A number of management actions will be implemented to manage surface runoff and exposed soil surfaces to ensure that soil erosion events and disturbances to water resources do not occur. These will be detailed in a Soil and Water Management Plan to be developed prior to construction. Such actions will include siting access tracks and cable trenches both along ridge tops and along contours as far as practicable (or as per expert advice), covering and stabilising appropriately exposed soil surfaces subject to an erosion risk where earthworks are carried out, and filtering silted runoff before it leaves the site.

Refuelling procedures for plant and equipment and the management of hazardous materials and wastes will also avoid soil and water contamination. The proposed development is assessed to have no impact on the current recharge rate to the overall aquifer system nor will it cause increased stress on the groundwater resources of the area.

Site earthworks for turbines will be located on ridge tops and away from residential areas. As such, any dust emissions from earthworks are expected to have a negligible impact. Further, dust suppression practices, such as watering down in adverse conditions, can reduce dust emissions from construction traffic. All access roads will be of an appropriate standard, with most surfaced with compacted gravel. Full details of environmental management actions relating to air quality control are listed in the EMP.

9. ECOLOGICAL ENVIRONMENT

To date, a number of ecological site surveys have been carried out to determine the extent and likelihood of occurrence of various fauna and flora species in the region. International Power commissioned Environmental and Biodiversity Services (EBS) to conduct an assessment of the ecological environment of the Willogoleche site, as well as the interconnection route between the on-site substation and the proposed substation to the south-west. Searches of state and national databases were also conducted to determine what other species have previously been recorded in the area. Overall, the potential impact of the proposed development upon the ecological value of the Willogoleche site is relatively low, with potential impacts able to be mitigated by the

implementation of appropriate management actions through the project EMP. As such, the proposed wind farm is not expected to have any significant adverse effects on the site's ecological environment.

Existing situation

Fauna

A fauna survey was conducted at the expanded Willogoleche Wind Farm site during the spring of 2003 and Autumn of 2004 and again in February 2010. A number of fauna species, both native and introduced, were detected. No nationally threatened fauna species were recorded at the site during the surveys. It is anticipated, however, that some bird species of conservation significance may occur at the proposed site, as the habitats present in the area are known to support some of these species (EBS, 2004). Listed migratory bird species are also expected to occur within the site, and one migratory bird species were observed during the ecological survey (EBS, 2004).

The survey suggests that the proposed site potentially supports several bird species that may be susceptible to interactions with wind turbines. However, relatively low numbers of individuals would be expected to occur on site, most occur irregularly or seasonally, and are rare or uncommon in abundance. The nationally **vulnerable** Plains-wanderer may potentially use the site, however it would be an irregular visitor and is not likely to occur in significant numbers. Raptor species use of the project area is likely to bring them into conflict with the wind farm more frequently compared to non-raptor species, however the impact of the wind farm on raptor species in particular is difficult to predict and requires further survey efforts. There are however no potential Wedge tailed Eagle nests within the project area.

Native Grasslands that exist in the vicinity of the proposed site could provide suitable habitat for the nationally threatened Pygmy Bluetongue Lizard (**endangered**) and the Flinders Worm Lizard (**vulnerable**). Neither of these species nor any other threatened reptiles were observed during any of the surveys. Despite extensive searches of spider holes within suitable habitat for the Pygmy Bluetongue Lizard (**endangered**), no specimens were found within the project area.

The total impact of the wind farm development on fauna species and their habitat is likely to be low. Significant species, if present, are mostly likely to be low in abundance at the site, and no nationally threatened species were observed. There will be some impact to a small proportion of non-threatened vegetation communities, which may provide habitat for some species. Management actions, such as micro-site surveys prior to construction, the relocation of significant reptile species found, monitoring, and actions to regenerate disturbed areas will result in any impacts to these species, communities and habitats being minimal. A referral will be submitted under the *EPBC Act 1999* to ensure appropriate management of any impact on species listed under its legislation (nationally listed species).

Flora

Flora surveys were also undertaken at the Willogoleche Wind Farm site during the Spring of 2003, March 2004, the autumn of 2004, February 2005, April 2005 (transmission line vegetation survey), September 2009 and in February 2010. A number of species were observed, including both native species and introduced species. Some species of state and regional conservation significance were recorded, one flora species, *Cryptandra* sp. Long hypanthium (Long-flower *Cryptandra*), which has a rare rating under the NPW Act, was recorded as a scattered species within the *Austrostipa* sp. (Spear-grass) Grassland association. No flora species listed as threatened under the *EPBC Act 1999* were detected within the survey area. The impact on threatened species will be minimised by construction activity through a pre-construction site survey and use of an Environmental Management Plan ("EMP").

Three different vegetation associations were observed during the flora survey of the proposed site. The condition of the vegetation communities varied, with each of the communities having been disturbed through various levels, mainly through grazing. Six areas within the *Lomandra multiflora* ssp. *dura* (Hard Mat-rush) Tussock Grassland were identified during the survey as meeting the criteria of Iron-grass Natural Temperate Grassland of South Australia threatened ecological community under the EPBC Act.

The proposed wind farm development will seek to minimise the disturbance to threatened Iron-grass Grassland of South Australia. The vast majority of the development is proposed to occur within the *Austrostipa* sp. Grassland, which is in the worst condition with most having an SEB of 4:1 or less (Considerable Disturbance), or within the modified remnant vegetation communities in primarily Exotic Herb/Grassland vegetation. International Power has reviewed its layout of wind farm infrastructure in line with EBS recommendations which has resulted in realignment of some turbines and infrastructure corridor segments. Development occurring in remnant vegetation communities will be minimised and will be appropriately managed through an EMP and, if clearance is required, it will be subject to assessment and additional consent by the Native Vegetation Council. In addition, it will be necessary to submit a referral under the *Environment Protection and Biodiversity Conservation Act 1999* as the nationally listed threatened ecological community *Iron-grass Natural Temperate Grassland of South Australia* has been identified within the project area, and this is planned to occur in December/January when documentation is completed.

The proposed underground connection line for the wind farm will have a minimal impact on native vegetation along the majority of the route, mostly being within cropped land and the remaining in a heavily disturbed *Austrostipa* sp. Grassland.

No conservation reserves are located within, or in the near vicinity of, the project area.

Management

Fauna

Mitigation and management of potential impacts to fauna includes appropriate planning of the turbine layout and access track locations to avoid areas of potential habitat for significant fauna as much as possible. In addition to this, buffer zones to significant habitats have been determined through site assessments and consultations.

Areas that represent important habitat for fauna species have been avoided through careful planning of turbine locations and the associated wind farm infrastructure, particularly the areas of Threatened Iron-grass Grassland of South Australia. These areas will be managed in accordance with the project EMP.

The extensive Pygmy Blue-tongue Lizards surveys undertaken have indicated the absence of this species from within the project area. Spring surveys will be conducted in order to gain a better understanding of the presence of certain species and pre-construction micro-site surveys will also be carried out to identify any areas in which they may exist. Access to such areas will be managed and, where appropriate, restricted. If required, translocation of any significant reptile species found to nearby, suitable habitats will take place. Surveys will be carried out by a qualified ecologist.

The turbine layout maintains relatively large distances between turbines, which will aid in minimising the potential for bird-strike. The solid steel towers will also prevent use by birds for perching. Lattice masts used for wind monitoring are of a small lattice design only, which will also prevent most raptors and other medium to large sized birds from perching.

The EMP will effectively mitigate any potential environmental impacts of habitat disturbance, direct mortality, and indirect disturbance, upon other fauna species known to occur in the region.

Flora

Planning of turbine layouts and access track locations at wind farms is conducted so that areas of known Threatened vegetation are avoided as far as possible. Clearance of such areas will be minimised and the infrastructure corridor will mostly be within the poorer quality *Austrostipa* sp. Grassland wherever possible.

The location of the on-site substation/cable marshalling yard will be located within cropping land. Significantly, International Power has realigned a number of turbine locations in to ensure that impacts to native vegetation are avoided where possible.

Avoidance of most threatened vegetation has been achieved through effective project planning and design. Stockpiles of materials and any associated infrastructure (*e.g.* tracks) will be placed in cleared land or the lower quality native vegetation.

Any clearance of native vegetation that is required, will be subject to assessment and additional consent by the Native Vegetation Council. In addition, it will be necessary to submit a referral under the *Environment Protection and Biodiversity Conservation Act 1999* as the nationally listed threatened ecological community *Iron-grass Natural Temperate Grassland of South Australia* has been indentified within the project area.

Pre-construction micro-site surveys will be undertaken along all areas that could potentially be disturbed during construction activities to identify any area that should be avoided and to restrict access to such areas. Surveys will be carried out by a qualified ecologist and will occur in the pre-construction phase.

10. LAND USE

The expanded Willogoleche Wind Farm project is proposed to be developed within the Primary Production zone in the Regional Council of Goyder².

Approximately 38 ha (1.7 %) of arable and grazing land would be lost to non-agricultural use, for the duration of the economic life of the wind farm. Of the 38 ha total, the 11 additional turbines and associated infrastructure occupy 10 ha (0.4%). The land-take includes for turbines, substation, access tracks and crane hardstands, and other wind farm infrastructure. This loss of land within the agricultural holding would not significantly affect farm productivity. The wind farm therefore would not have a significant adverse effect on existing agricultural land use.

Land management matters such as soil conservation, fire prevention, weed control and access have been considered and will be effectively managed to ensure a negligible impact to landowners and their neighbours.

The prominent recreational facilities include the Heysen Trail for bushwalking and the Mawson Trail for bicycle riding. Both of these trails pass through the southern portion of the expanded Willogoleche Wind Farm. There will be no significantly greater impact on these trails due to the 11 additional turbines of the expanded Willogoleche Wind Farm compared to the original 26 turbines of

² (Development Plan, 2010. Regional Council of Goyder)

the consented Willogoleche Wind Farm.

Management

Agricultural land use

The design of the wind turbine layout minimises effects on the use of agricultural land, by rationalising land-take areas and using existing tracks where possible. Further to this, any land that is not part of the final land-take will be reinstated after disturbance. Following reinstatement, residual loss of land for agricultural use would be confined to the areas occupied by the 37 individual turbines, substation, fire breaks, access tracks and crane hardstand areas.

Any loss of land within the agricultural holding would be restricted to the duration of the life of the wind farm. Following this, the wind farm would be decommissioned and the land that was part of the wind farm land-take would be reinstated and once again be available for agricultural use.

Earthworks required for the installation of the turbines, access tracks and underground cabling will be effectively managed to ensure no significant erosion or site sedimentation occurs as a result of construction activity. An EMP will be implemented, which will outline appropriate soil and water management procedures and remedial action strategies. Such procedures will include topsoil stockpiling and installation of erosion prevention devices where required. Actions will be taken to prevent and control the spread of agricultural weeds and plant diseases to uninfested areas.

Inconvenience to landowners and their normal farming activities will be minimised through consultation and forward planning. Fire prevention and control will be of paramount importance during the construction and operation of the wind farm site.

Recreational land use

Access through the Mawson and Heysen trails within the site may be temporarily disrupted during the construction phase of the wind farm. International Power will work closely with the trail operators to ensure that users are kept informed and that diversions are put in place where necessary. Because the permanent infrastructure is not proposed to impinge upon the trails, any disruption will be very short in duration and will not significantly affect the public's enjoyment of these trails. Disruption to trail use during the operational phase of the wind farm will be insignificant.

11. CULTURAL HERITAGE

Results of the desktop archaeological/anthropological studies undertaken by TimeMap Pty Ltd (2003) and Vivienne Wood Heritage Consultant Pty Ltd (2010) revealed that there are no known Aboriginal sites within the project site boundary. However, due to a historical gap in the investigative surveys undertaken over the project area and the environmental indicators present, there is a potential for archaeological and anthropological sites to be present.

For the original consented Willogoleche Wind Farm, an application pursuant to Section 12 of the Aboriginal Heritage Act 1988 was submitted in 2007. The Aboriginal Affairs and Reconciliation Division ("AARD") determined that no Aboriginal Sites or Objects were identified with the project area. For the additional 11 turbines of the expanded Willogoleche Wind Farm, it is proposed that a pre-construction survey of the additional areas that will be required to be disturbed during construction of the wind farm will be conducted by a qualified archaeologist/anthropologist(s) as required, and recognised representatives from the relevant Aboriginal groups. If such areas are found, discussions with the relevant Aboriginal group will take place to resolve the ways in which to

avoid or minimise potential impacts, and the layout design or wind farm features will be altered accordingly if necessary. Management during construction will be negotiated via a cultural heritage agreement detailing the monitoring processes used and actions to respond to additional finds and incidental/accidental disturbance.

No sites of non-indigenous heritage were recorded for the project area. All potential sites, such as old homesteads and ruins will be avoided. Management actions will also be put in place to respond to incidental/accidental disturbance of potential sites.

Given the nature of the terrain in the project area, the nature of potential sites that may be identified on-site and the management practices to be put in place on identifying sites, there is likely to be a negligible impact to the heritage values of the project area.

Management

In addition to the desktop studies undertaken, a pre-construction survey of the areas not covered by the 2007 Section 12 application process, will be conducted by a qualified archaeologist/anthropologist(s) as required, and recognised representatives from the relevant Aboriginal groups. If required an additional Section 12 process will be initiated, prior to construction, with the Aboriginal Affairs and Reconciliation Division (AARD). Such a process will include close consultation with relevant Aboriginal groups and, if required, a walkover survey of areas that will be disturbed during construction of the wind farm by a qualified archaeologist/anthropologist(s) as required, as well as recognised representatives from the relevant local Aboriginal groups. Site recording will result in site avoidance.

Areas that offer a higher potential for revealing archaeological or anthropological sites will particularly be targeted during the survey and include:

- Prominent geographical features
- Deflated surfaces of moderate gradient
- Fresh water sources
- Outcropping good quality quartzite or silcrete
- Overhangs and exposed faces
- Peaks and passes

While there are no registered sites of Aboriginal heritage in the expanded Willogoleche Wind Farm project area, the presence of potential significant sites has been considered and caution is required to ensure minimal disturbance to such areas. Walshe and Bonell (2003) consider it likely that there will be anthropological interests within the study area, but do not consider it unexpected nor unusual. Such interests will be identified during the site survey to be carried out with relevant Indigenous representatives, and managed accordingly.

Avoidance of indigenous heritage areas can be maximised by avoiding the areas of greatest sensitivity as listed above and generally there is a lower potential for archaeological sites to be located on a ridge. If it is determined after the survey, that wind turbines or other wind farm features are proposed for an area of archaeological and/or cultural heritage significance, discussions with the relevant aboriginal group will take place to resolve the ways in which to avoid or minimise potential impacts, and the layout design or wind farm feature will be altered accordingly, if required. Such sites will also be flagged (or pegged) and all site personnel will be informed of such areas and instructed that they are 'no go' zones.

Consultation will be carried out with identified local Aboriginal groups and other interested parties with regards to potential cultural heritage issues, including anthropology, within the project area, to ensure all issues are appropriately addressed.

Appropriate management actions for responding to accidental/incidental heritage site disturbance during construction, will be included in the environmental management plan for the project. Such actions will be in line with legislative requirements.

12. VISUAL AMENITY

Thorough internal and independent visual assessments have been carried out to establish the current landscape values, predicted visual influence of the wind farm and other potential visual impacts. A variety of methods were used in the visual assessment of the proposed expanded Willogoleche Wind Farm, such as public consultation, assessment by an independent consultant, on-ground surveys, ZTV's, photomontage production, and assessment of shadow flicker effects.

Results of the landscape assessment carried out for the expanded Willogoleche Wind Farm project show that the context of the Willogoleche region is one of an agricultural setting, made up predominantly of cleared land used for intensive grazing and cropping. Human influences, including roads, dwellings, sheds, buildings, fencelines and vertical elements such as telecommunication masts, grain silos and both lattice mounted transmission lines and stobie poles occur within the region.

It was found during the consultation process that the majority of visual user groups held no major objection to the development of wind farms in the region. The wind farm was assessed from a variety of viewpoints; incorporating different methods, distances and directions. The majority of available views would be seen in a cleared agricultural setting.

There are a number of potential visual effects associated with the wind farm. The likely incidence of glinting is impossible to predict, but experience suggests that this occurs relatively rarely, and will be reduced by the use of non-reflective paint on turbines. Whilst shadow flicker effects are likely to be experienced at some residences, the effects are not likely to be a significant issue for any of the local dwellings due to careful planning of the turbine layout.

The expanded Willogoleche Wind Farm will have some degree of visual influence, due to the noted scenic quality of the landscape, but it is expected that this will be moderated by the existing landscape modification and existing wind farm in the region being integrated into the landscape. The level of visual impact is largely subjective and therefore a function of the perception of the viewer. The visual impact of the 11 additional turbines of the expanded Willogoleche Wind Farm is believed to be a minor impact when viewed in the context of the existing consent for the 26 turbines of the original Willogoleche Hill Wind Farm.

The proposed underground 33 kV interconnection route from the southern most turbine to the planned ElectraNet substation (located approximately 2.4km south-west of the southernmost turbine on the site) is not expected to have a major visual influence over the landscape. The chosen location minimises the visual impact of the wind farm by siting the substation away from frequently used public roads and is as close as practically possible to the wind farm site and the 275kV transmission line. This position also allows for the wind farm's internal electrical infrastructure and grid connection to have a reduced visual impact by utilising underground cabling to the substation.

Overall, the cumulative visual impact of the expanded Willogoleche Wind Farm in combination with

other wind farms in the region is predicted to vary throughout the area, being greatly influenced by the location of the viewpoint and the relative location of the sites and landscape features. Given the distances between sites and the generally open landscape around the project area, it is considered that the development is well-suited to the scale of the landscape and is unlikely to give rise to an unacceptable cumulative visual influence.

A full visual impact assessment is currently being undertaken by Swanbury Penglasse and will be completed in January 2011 for consideration with this Environmental Statement.

Management

It is inevitable that structures of the size of the proposed wind turbines at expanded Willogoleche Wind Farm will have some level of visual impact. However, a number of parameters have been incorporated into the design of the wind farm with the aim of minimising visual impact. These include:

- The wind farm received 64 % support from the 22 survey respondents at the public exhibition held at the Hallett Hall in October 2010. This suggests that the majority of the community surveyed support the proposed layout and predicted levels of visual impact of the project (albeit from a small sample size of respondents).
- Full shadow flicker analysis was undertaken, to ensure that no households receive an inappropriate amount of shadow flicker as a result of the wind farm.
- Ensuring turbine towers and blades are white or light grey in colour, so that they blend in with the sky and clouds and reduce glinting as much as possible.
- Ensuring only modern rotors that spin relatively slowly are used.
- Ensuring access to the site is designed to utilise existing farm tracks and roads where practical, thereby minimising the need for new access points and new access tracks on the landscape.
- Tracks will be constructed to follow contour lines as much as possible, which will minimise cut and fill and consequential landscape scarring.
- Ensuring electrical connections within the site (*i.e.* cables between the turbines and the switchgear building) are located underground, in order to further reduce potential visual impacts.
- Identifying height limits (the wind turbines at the expanded Willogoleche Wind Farm will be no higher than 152m).

13. ELECTROMAGNETIC SIGNALS

A number of radio/communications services operate in the area, including mobile phone services, mobile radio services and the South Australian Government Network Radio (SAGRN). Such services can be affected by the presence of nearby structures such as wind turbines, however they will vary in their susceptibility to interference.

Consultation with various radio/communications managers, and a dedicated study on the services in the area revealed a number of required buffer zones from radio/communications links and transmission towers. Such buffer zones were applied during the design phase of the wind farm to ensure the integrity of the services will be maintained.

Residences in the vicinity of the proposed expanded Willogoleche Wind Farm site receive television

reception primarily from The Bluff, near Port Pirie. The signal strength varies from medium to low and the expanded Willogoleche Wind Farm site exists on the edge of the viable reception area. There is also limited and low level reception received from the Adelaide (Mt Lofty) transmitters in some locations, although the region is outside the commercial broadcast licence area.

An investigation into the potential interference of the proposed expanded Willogoleche Wind Farm indicated that TV reception varied from good to very poor. Some residences require reception from the Adelaide (Mount Lofty) stations. Reception from Adelaide stations at the northern end of the project area may be effected by this proposal. TV reception at homesteads located to the western side of the Willogoleche Range with currently good TV reception from The Bluff are not expected to be effected by the proposal.

In some cases digital reception was also unstable. As significant numbers of residences surveyed did not have UHF antennas installed which will be required for digital reception from The Bluff, there may be more potential interference cases from turbines

Management

The turbine layout has been designed to avoid any potential impacts to radio/communications services, including links and towers. However, should it be found that the turbines do cause detrimental effects on communications systems operating from the project area, a strategy will be developed in consultation with affected parties to rectify the problems.

A sample of local residences in areas that may experience interference to television signals from the Bluff station as a result of the expanded Willogoleche Wind Farm would be surveyed during the post-construction phase of the project. Any interference to television transmissions would then be rectified to ensure reception to all local users affected by the turbines is restored. Potential solutions for reception restoration include:

- Upgrading existing antennas at affected locations to industry best practice and provide affected households with digital decoders
- Providing satellite TV to all those affected (although GTS/BKN is not available via Satellite)

14. ROADS AND TRAFFIC

Access roads for the wind farm will consist of both main and secondary roads, with some sections of secondary roads requiring updating to cater for construction traffic. The planning of such works will be carried out in consultation with the Regional Council of Goyder and Transport SA.

Due to the 11 additional turbines of the expanded Willogoleche Wind Farm, traffic volumes will increase by approximately 40% when compared to that due to the 26 turbines of the original consented Willogoleche Wind Farm.

Upgrade work on roads will avoid the disturbance of significant flora and fauna, through the implementation of the pre-construction surveys and the project EMP. Regular inspections of road condition and ongoing maintenance will ensure road conditions are maintained for the life of the wind farm.

Traffic issues, including public safety and increased visitations, will be addressed in consultation with the Regional Council of Goyder and Transport SA to ensure increased traffic does not impact on road safety in the region.

Management

Upgrade works will be carried out in consultation with the Regional Council of Goyder and Transport SA to ensure works comply with relevant legislative requirements. Disturbance to existing roadside vegetation will be avoided through management actions contained in the project EMP. Such actions will include:

- A pre-construction flora survey to be carried out by a qualified botanist to determine the extent of significant roadside vegetation/habitat in areas of the road network requiring upgrading. If significant vegetation is likely to be impacted upon by road upgrades, compensatory measures will be carried out, and the activity of road widening will be carefully managed through appropriate EMPs to mitigate any adverse impacts.
- A pre-construction fauna survey to be carried out by a qualified ecologist to identify significant fauna in areas of the road network that require upgrading. Appropriate actions for the management of any significant fauna found will be implemented as part of an appropriate EMP.
- Planning of road expansion works to avoid significant ecological and heritage areas where practicable.
- Implementation of offset actions where disturbance to significant vegetation is unavoidable; that is, offset revegetation in other areas.
- Application for permits to clear native vegetation, where necessary.

Preparation works for access roads and tracks will involve resurfacing or complete rebuilding of roads or tracks to ensure road conditions are appropriate for safe and effective transport of wind farm components. During construction, the Project Manager will ensure that regular road inspections are conducted and will implement remedial action where required to maintain satisfactory road conditions.

Roads and access tracks will be maintained during the operational life of the wind farm, in consultation and cooperation with the Regional Council of Goyder and Transport SA.

Anticipated delays will be minimised as much as possible by strategic scheduling of traffic loads (usually managed by Transport SA) and advanced warning of potential transportation times. The oversized loads will require a safety escort. Likely management actions to be implemented include:

- Stone and other material for the roads to be sourced from local quarries (where possible) thus reducing long-distance haulage
- Public notices of traffic restrictions or conditions to be posted regionally, as necessary
- Appropriate warning signs to be erected in the vicinity of the site (to Transport SA specifications)
- All oversized and heavy load vehicles to use the approved routes and scheduled timing
- Safety/police escort vehicles to be used where appropriate
- Instructions to be given to on-site personnel to always remain courteous to all road users and maintain awareness of traffic conditions

Public viewing locations and suitable parking areas and facilities will be determined and may be established if deemed suitable so that site visits do not disadvantage existing road users. These areas will be determined in consultation with the Regional Council of Goyder and Transport SA. Signage for site visitors may also be required, including information on safety and 'no go' areas.

15. AVIATION

In essence, the Civil Aviation Safety Authority (“CASA”) is concerned with two main aviation issues with respect to wind farms. The first is the protrusion of wind turbines into the Obstacle Limitation Surface (OLS) of aerodromes or their vicinity to the OLS. The OLS is essentially a defined area of airspace above and around a licensed aerodrome. The second issue is the height of turbines outside the OLS, but still in areas of aviation activity (air traffic).

CASA released Advisory Circular AC 139-18(0) in July 2007 to provide advice for wind farm developers with regard to turbine lighting. This Circular has been withdrawn by CASA. CASA have also advised that their statutory power to require obstacle marking and lighting on obstacles only applies within the vicinity (approximately 30 km) of a licensed aerodrome. Therefore, CASA cannot mandate the lighting or marking of structures outside the vicinity of aerodromes. Having said this, CASA is currently undertaking an appropriate safety study into the risk to aviation posed by wind farms and intends to develop a new set of guidelines. This process will include appropriate consultation with industry and stakeholders on wind farms and a risk management approach with respect to aviation.

There are no licensed aerodromes within, or in the immediate vicinity of, the expanded Willogoleche Wind Farm project area, so there are no concerns with regards to aerodromes or OLSs.

Hart Aviation Pty Ltd were engaged to undertake an assessment of the aviation impacts of the expanded Willogoleche Wind Farm. The results of this assessment show that so long as the turbine remain below 152m in height, due to the low risk to aviation, lighting is not required Dunn (2010). This result will be confirmed with CASA once they have re-issued guidance on wind farm management.

CASA will be consulted once a Development Plan Consent has been received. CASA may recommend that obstruction lighting will be required on anywhere between zero and 37 turbines. International Power will negotiate with CASA to strike a balanced solution, which takes into account the impact on local residents as well as the safety of aviators. Shielding may be incorporated to mitigate the visual impact of the lighting.

Agricultural aerial spraying activity occurs for pest management and pasture top-dressing. These activities will require care by pilots applying the material to properties along the ridgelines.

Some private landing strips are present on low-lying land, located and orientated away from turbine areas. As such the proposed turbines are unlikely to present a hazard to the use of these strips.

Management

The risk to aviation operations would be further reduced if, in the fullness of time, the wind turbines are identified on the relevant aeronautical charts i.e. both the civil World Aeronautical Charts (WACs) and the RAAF produced chart series. This is considered essential risk mitigation element. Pending such identification on maps, it would be advisable to ensure that all aviation operators are made aware of the existence of the wind farm. Airservices, if they were made aware of the wind farm, would normally do this via NOTAM action covering both the construction phase and prior to identification on maps. It is, therefore, essential that the wind farm developer advise both Airservices and the RAAF AIS.

HART Aviation is of the view that the overall risk to aviation operations in the vicinity of the proposed Willogoleche Hill Wind Farm, even during the night or in low visibility conditions, is sufficiently low such that obstacle lights are not required for the wind turbines.

16. NOISE

Noise emissions from wind farms are unique, with the main source of noise being aerodynamic noise from rotation of the turbine blades. Other temporary and localised noise emissions result from construction works.

The EPA's *Wind Farms Environmental Noise Guidelines for Wind Farms* (July 2009) stipulate noise criteria to be met at relevant receiver locations (i.e. neighbouring residences). That is:

"The predicted equivalent noise level ($L_{Aeq, 10}$), adjusted for tonality in accordance with these guidelines, should not exceed:

- 35 dB(A), or
- 40 dB(A) in a primary production/rural industry zone, or
- the background noise ($L_{A90,10}$) by more than 5 dB(A),

whichever is the greater, at all relevant receivers for each integer wind speed from cut-in to rated power of the [wind turbine]".

Based on the Suzlon S88 turbine, results of noise level predictions show that all eighteen (18) residences included within the noise modelling are compliant with the EPA criterion. Modelling based on a larger Siemens SWT-101-3.0 turbine indicated that the noise requirements of the EPA guidelines were breached at two residences – one of which is financially involved in the project Sonus (2010).

Compliance using the Siemens turbine can be achieved either by removing 3 of the turbines, or using what is known as 'noise restricted operation' which adjusts the power output from specific turbines during particular wind conditions in order to adjust the noise characteristics of those turbines.

When the selected turbine supplier is known, it will be the responsibility of the turbine manufacturer to undertake the study prior to finalising the turbine layout. International Power is committed to ensuring EPA compliance for all impacted landowners (financially and non-financially involved).

There is a potential for noise emissions during construction, major maintenance and decommissioning. These will be minimal, localised and temporary and in compliance with guidelines for construction noise.

Management

International Power has developed a final wind farm layout that has all wind turbines at least 750 m

from economic neighbouring houses and 1500 m from non-economic neighbours.

Noise modelling has indicated that compliance can be achieved subject to the final turbine selection. In order to achieve noise compliance with all available turbine models, it may be necessary to utilise some form of 'noise restricted operation' to modify the characteristics of particular turbines under certain wind conditions.

Beyond this, no further management in regards to turbine noise output is required.

17. SOCIO-ECONOMIC IMPACTS

The economy within the Regional Council of Goyder relies on the combined effect of its population, agriculture and tourism. It is considered that the expanded Willogoleche Wind Farm will help to encourage diversification and growth of the local economy, and may also lead to considerable local and regional employment opportunities.

In summary, the socio-economic spin-offs from the proposed expanded Willogoleche Wind Farm can potentially include:

- Enhanced agricultural viability of the farms involved through rental income from the wind farm
- Local and regional employment (in both the construction of the wind farm, and in its subsequent maintenance)
- Income to local small business due to potential increases in tourism numbers through the region
- Local project funding through a Community Fund
- An educational resource for local schools, community organisations, and other interested groups
- An upgraded and well maintained fire track for the ranges
- A safe, environmentally friendly and diverse electricity supply for the Mid-North
- Clean, green energy production, making a significant contribution to the solution of national and global pollution/global warming problems
- Increased Council revenue and significant Development Application Fees

18. GREENHOUSE GAS SAVINGS

Bringing about greenhouse gas savings is an important national and global avenue to minimise future environmental effects of rapid global warming. The supply of energy through wind power is a significant mechanism to achieve greenhouse gas savings.

The proposed expanded Willogoleche Wind Farm would provide an opportunity to contribute to the emissions savings by displacing around **284,934** tonnes of CO₂-e emissions per year, and **5,698,680** tonnes saved over the 20-year operational life of the wind farm

The proposed 37 wind turbines will also generate, on average, enough electricity to meet the needs equivalent of approximately **59,690** average South Australian households.

19. REFERENCES

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