

## Visual Impact and Shadow Flicker Fact Sheet



In September 2022 a modification application was submitted to the Department of Planning and Environment (DPE) for the Liverpool Range Wind Farm (Mod-1 Project). In response to submissions received during the public exhibition period we have made a number of changes to the Mod-1 Project (RTS Project). These changes are reflected in the Response to Submissions (RTS) Report and the Amendment Report. The reports will be assessed by DPE who will then make a determination on the application. These reports contain information about how the RTS Project is different from the Approved Project, and how these changes would affect the environment and how they can be managed.

This factsheet sets out what visual changes and shadow flicker the community can expect from the RTS Project. It also shows what we are proposing to do to manage potential impacts. The impacts presented are a worst-case scenario. With the measures proposed, the RTS Project's impacts should be reduced or mitigated.

If you would like to read more about visual impact and shadow flicker, please refer to the updated Visual Impact Assessment and Shadow Flicker Assessment reports that are included in the RTS report documentation.

### What changes have been made to the Project?

Following a review of submissions received, we have reduced the maximum blade tip height to 215 m (we had previously proposed an increase to 250 m) and reduced the number of turbines to 185 (reduction of 35 turbines). This equates to an increase of 50 m to the maximum blade tip height and reduction of 82 turbines compared to the Approved Project (see Figure 1). As part of this, we removed five turbines that were proposed by the Mod-1 Project in the north-east portion of the site near Coolah Tops National Park in an effort to minimise visibility of turbines from nearby Pinnacle Lookout.

### What visual impact and shadow flicker should I expect?

This fact sheet refers to two types of residences:

- **Associated residences:** host landholders, landholders providing access during construction or operation and other landowners with a financial or in-kind agreement with the Project
- **Non-associated residences:** owners or occupiers who do not have a financial or in-kind agreement with the Project

The NSW Visual Impact Bulletin requires varying levels of assessment of visual impact at Non-associated residences located within the 'blue line' and the 'black line' of visual magnitude.

There are 30 Non-associated residences within 4,250 m of a proposed turbine (the 'blue line'), and four Non-associated residences within 2,850 m of a proposed turbine (the 'black line'). Non-associated residences within the 'black line' are subject to more detailed impact assessment which involved site visits and a detailed review of the existing vegetation, structures, and topography at those residences.

If you would like to read more see the Response to Submissions Report.

## Visual Impact

The updated Visual Impact Assessment found that the level of impact for the RTS Project remains consistent with the Approved Project. While the turbine height is higher in the RTS Project compared to the Approved Project, the Visual Impact Assessment found the magnitude of change is largely consistent with the Approved Project. It also found that the proposed changes to ancillary infrastructure would not result in any additional visual impacts to the Approved Project.

Compared to the Approved Project the RTS Project results in the following impacts:

### *Non-associated residences within 4,250 m of a turbine ('blue line')*

- Increased number of turbines visible at 8 x Non-associated residences and reduced number of turbines visible at 22 Non-associated residences
- The distance to the nearest turbine has been reduced (i.e. shifted closer) for 19 x Non-associated residences and increased (i.e. shifted further away) for 11 x Non-associated residences

### *Non-associated residences within 2,850 m of a turbine ('black line')*

Three of the four Non-associated residences have had their visual impact ratings reduced due to intervening vegetation and structures which reduce visibility of turbines. No change in impact rating is recommended for the fourth Non-associated residence.

### *Cumulative Visual Impact*

In response to concerns raised by the community, the Visual Impact Assessment has been updated to consider potential cumulative impacts associated with the proposed Valley of the Winds Wind Farm project, located west of Coolah township. Its key findings are:

- The distance between the two projects limits the opportunity to view both the Liverpool Range Wind Farm and Valley of the Winds Wind Farm concurrently in the one field of view from Coolah. There are limited opportunities to view both projects along key public road routes.
- 13 x Non-associated residences are located within 8 km of both wind farm projects, of which nine would have turbines visible within 2 x 60 degree sectors, which is deemed acceptable. The remaining four residences would have turbines visible within 3 x 60 degree sectors, but intervening vegetation and structures surround all four residences which is likely to reduce the number of 60 degree sectors occupied by a turbine.

Visual mitigation measures, such as screen planting, would be made available, in accordance with the requirements of the Development Consent, as amended.

The visual impact of the RTS Project is generally consistent with the Approved Project.

No residence would be subject to shadow flicker.

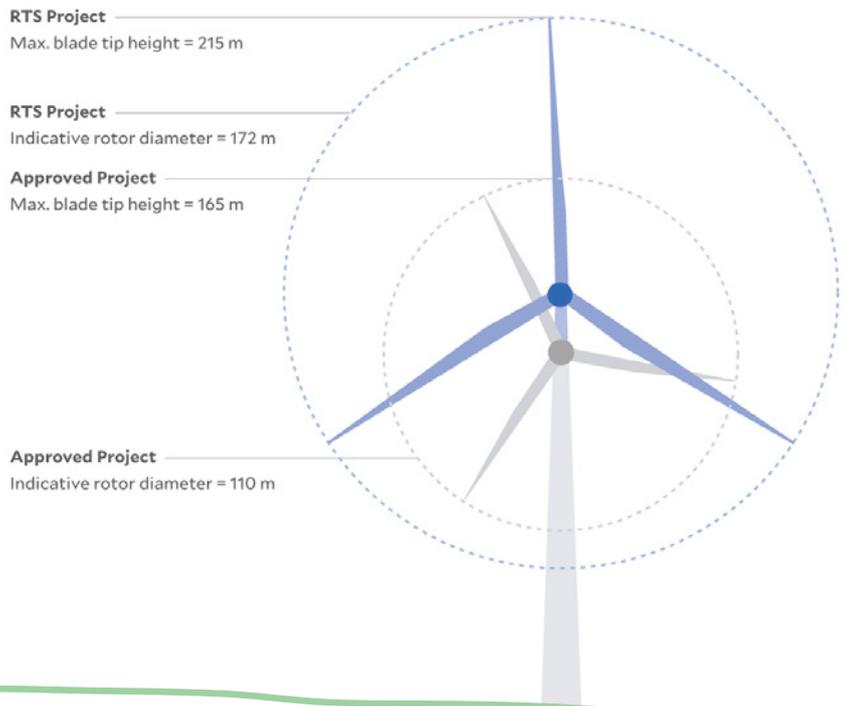
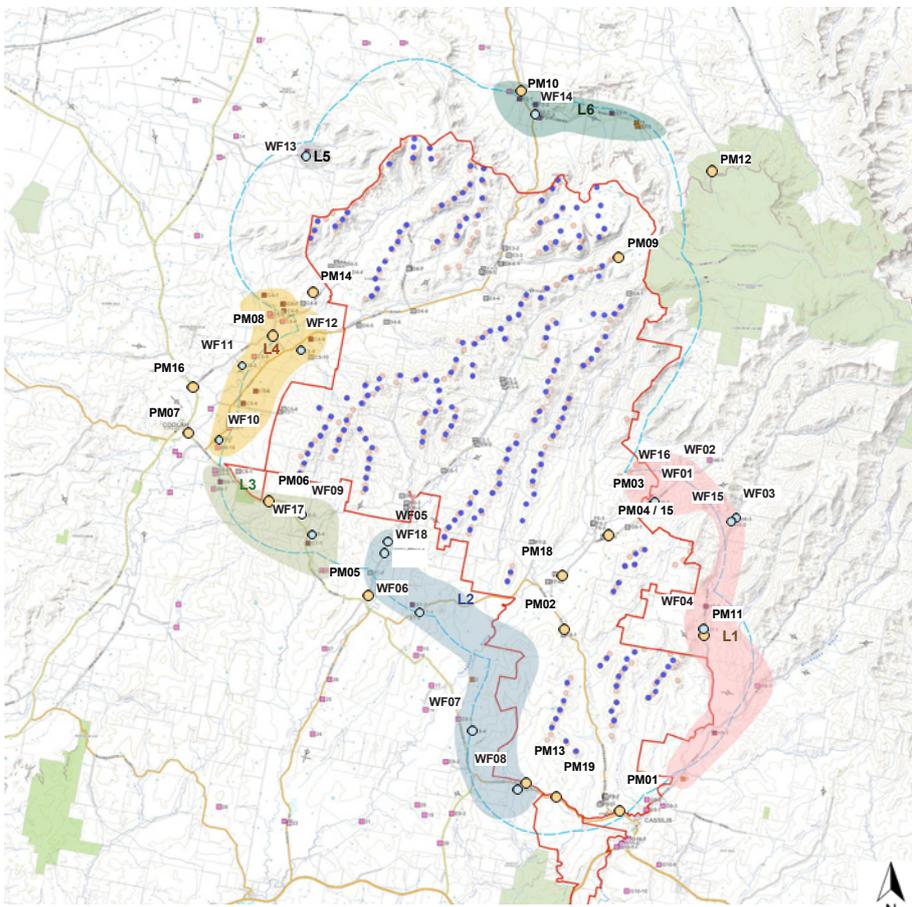


Figure 1: Wind turbine size comparison between the Approved Project and the RTS Project

## Visual impact assessment at dwelling locations



## Residential Dwelling Locations and Dwelling Zones

### LEGEND

- Project Site Boundary
- RTS Project Turbine Location (215 m WTG)
- Approved Project Turbine Location (165 m WTG)
- Non-associated Dwelling within 4,250 m (of nearest WTG)
- Associated Dwelling within 4,250 m (of nearest WTG)
- Non-associated Dwelling outside 4,250 m (of nearest WTG)
- Additional non-associated Dwelling (Identified post approval)
- Wire Frame Analysis Location (e.g. WF03).
- Photomontage Location (e.g. PM01).
- 4,250 m from nearest proposed turbine

### Dwelling Zones

- L1 Zone L1
- L2 Zone L2
- L3 Zone L3
- L4 Zone L4
- L5 Zone L5
- L6 Zone L6

0 2 4 6 8 10km

## What did we find and how does it compare to the Approved Project?

The table below provides a snapshot of the potential impacts associated with the RTS Project and a comparison against what was previously found for the Approved Project (2018) as well as the Mod-1 Project.

The reference to Dwelling Zones 1-6 in the table below refers to the six geographic clusters (refer to figure on the previous page) of Non-associated residences that surround the LRWF site.

Parameter	Approved Project (2018)	Mod-1 Project (2022)	RTS Project (2023)	Variation (Approved vs RTS)
<b>Visual magnitude of layout</b>	Black Line: 2,200 m Blue Line: 3,300 m	Black Line: 3,350 m Blue Line: 4,950 m	Black Line: 2,850 m Blue Line: 4,250 m	+650 m (Black Line) +950 m (Blue Line)
<b>Number of Non-associated residences within 'black line' of visual magnitude:</b>	3	12	4	+1
<b>Number of Non-associated residences within 'blue line' of visual magnitude:</b>	9	45	30	+21
<b>Number of Non-associated residences with multiple 60° sectors within which a turbine is visible:</b>	Up to 3 x 60° sectors: 17 Up to 4 x 60° sectors: 2 Up to 5 x 60° sectors: 0 Up to 6 x 60° sectors: 0	Up to 3 x 60° sectors: 21 Up to 4 x 60° sectors: 2 Up to 5 x 60° sectors: 0 Up to 6 x 60° sectors: 0	Up to 3 x 60° sectors: 16 Up to 4 x 60° sectors: 1 Up to 5 x 60° sectors: 0 Up to 6 x 60° sectors: 0	Decrease in one (1) Non-associated residences with turbines in three (3) 60° sectors. Decrease in one (1) Non-associated residences with turbines in four (4) 60° sectors.
<b>Visual Impact Rating (Dwelling Zone 1)</b> Approved Project: 9 Non-associated residences RTS Project: 10 Non-associated residences	<b>Low to Medium</b> visual impact rating at 8 x Non-associated residences <b>Low</b> visual impact rating at 1 x Non-associated residence	<b>'Black line' residences (total=6)</b> Visual impact ratings reduced to <b>Negligible to Low, Low, or Low</b> at 5 x Non-associated residences <b>Negligible</b> visual impact rating at 1 x Non-associated residence (not previously assessed) <b>'Blue line' residences (total=4)</b> <b>Low to Medium</b> visual impact rating at 4 x Non-associated residences (includes one newly identified Non-associated residence - Dwelling ID: 1).	<b>'Black line' residences (total=2)</b> Visual impact ratings reduced to <b>Low</b> at 1 x Non-associated residence <b>Nil</b> visual impact rating at 1 x Non-associated residence <b>'Blue line' residences (total=2)</b> <b>Low to Medium</b> visual impact rating at 1 x Non-associated residence (Dwelling one is now outside the blue line). <b>Negligible</b> visual impact rating at 1 x Non-associated residence (not previously assessed)	Reduction in visual impact ratings at 2 x Non-associated residences. 1 newly identified Non-associated residences assessed as Negligible. No change in visual impact ratings for all other previously assessed Non-associated residences. Mitigation measures recommended.
<b>Visual Impact Rating (Dwelling Zone 2)</b> Approved Project: 8 Non-associated residences Modified Project: 9 Non-associated residences	<b>Medium</b> visual impact at 4 x Non-associated residences <b>Low to Medium</b> visual impact rating at 4 x Non-associated residence	<b>'Black line' residences (total=3)</b> Visual impact ratings reduced to <b>Negligible to Low, Low, or Low to Medium</b> at 3 x Non-associated residences <b>'Blue line' residences (total=6)</b> <b>Medium</b> visual impact at 3 x Non-associated residences <b>Low to Medium</b> visual impact rating at 3 x Non-associated residences	<b>'Black line' residences (total=1)</b> Visual impact rating reduced <b>Low</b> at 1 x Non-associated residence <b>'Blue line' residences (total=6)</b> <b>Medium</b> visual impact rating at 2 x Non-associated residences <b>Negligible to Low or Low</b> visual impact rating at 2 x Non-associated residences <b>Low to Medium</b> visual impact rating at 2 x Non-associated residences	Reduction in visual impact ratings at 2 x Non-associated residences. No change in visual impact ratings for all other previously assessed Non-associated residences.
<b>Visual Impact Rating (Dwelling Zone 3)</b> Approved Project: 9 Non-associated residences Modified Project: 9 Non-associated residences	<b>Medium</b> visual impact at 9 x Non-associated residences	<b>'Black line' residences (total=2)</b> <b>Medium</b> visual impact at 2 x Non-associated residences[1] <b>'Blue line' residences (total=7)</b> <b>Medium</b> visual impact at 7 x Non-associated residences	<b>'Black line' residences (total=1)</b> <b>Medium</b> visual impact at 1x Non-associated residences <b>'Blue line' residences (total=3)</b> <b>Medium</b> visual impact rating at 3 x Non-associated residences	No change in visual impact rating. Mitigation measures recommended.
<b>Visual Impact Rating (Dwelling Zone 4)</b> Approved Project: 18 Non-associated residences Modified Project: 18 Non-associated residences	<b>Medium</b> visual impact at 18 x Non-associated residences	<b>'Black line' residences (total=2)</b> Visual impact rating reduced to <b>Negligible to Low</b> at 1 x Non-associated residence <b>Medium</b> visual impact at 1 x Non-associated residence <b>'Blue line' residences (total=16)</b> <b>Medium</b> visual impact at 17 x Non-associated residences	<b>'Black line' residences (total=0)</b> <b>'Blue line' residences (total=8)</b> <b>Medium</b> visual impact rating at 7 x Non-associated residences <b>Negligible to Low</b> visual impact rating at 1 x Non-associated residence	Reduction in visual impact ratings at 1 x Non-associated residence. No change in visual impact ratings for all other previously assessed Non-associated residences. Mitigation measures recommended
<b>Visual Impact Rating (Dwelling Zone 5)</b> Approved Project: 2 Non-associated residences Modified Project: 2 Non-associated residences	<b>Low to Medium</b> visual impact at 2 x Non-associated residences	<b>'Black line' residences (total=0)</b> <b>'Blue line' residences (total=2)</b> <b>Low to Medium</b> visual impact at 2 x Non-associated residences	<b>'Black line' residences (total=0)</b> <b>'Blue line' residences (total=2)</b> <b>Low to Medium</b> visual impact rating at 2 x Non-associated residences	No change in visual impact rating. Mitigation measures recommended.
<b>Visual Impact Rating (Dwelling Zone 6)</b> Approved Project: 7 Non-associated residences Modified Project: 10 Non-associated residences	<b>Low to Medium</b> visual impact at 7 x Non-associated residences	<b>'Black line' residences (total=0)</b> <b>'Blue line' residences (total=9)</b> <b>Low to Medium</b> visual impact at 7 x Non-associated residences (includes 1 newly identified Non-associated residence - Dwelling ID: 11). <b>Very Low</b> visual impact rating at 2 x newly identified Non-associated residences (Dwelling ID:12 and 13).	<b>'Black line' residences (total=0)</b> <b>'Blue line' residences (total=9)</b> <b>Low to Medium</b> visual impact at 7 x Non-associated residences (includes 1 newly identified Non-associated residence - Dwelling ID: 11). <b>Very Low</b> visual impact rating at 2 x newly identified Non-associated residences (Dwelling ID:12 and 13).	No change in visual impact ratings for previously assessed Non-associated residences. 3 x newly identified Non-associated residences assessed as Very Low or Low to Medium visual impact rating. Mitigation measures recommended.

# FIGURE 1: CUMULATIVE VISUAL IMPACT MAP



## Cumulative Zone of Visual Influence Liverpool Range Wind Farm & Valley of the Winds Wind Farm

### LEGEND

- Project Site Boundary
- Non-associated Dwelling within 4,250 m (of nearest WTG)
- Associated Dwelling within 4,250 m (of nearest WTG)
- Non-associated Dwelling outside 4,250 m (of nearest WTG)
- Additional non-associated Dwelling (identified post approval)
- Modified Project Turbine Location - Liverpool Range Wind Farm (LRWF)
- 8,000 m from LRWF turbine
- Turbine Location - Valley of the Winds Wind Farm (VoWWF- As per submission dated March 2022)
- 8,000 m from VoWWF turbine
- ↔ Travel route and direction of travel with potential visibility of both Projects
- Cumulative Wire Frame Diagram Location

### ZVI Legend:

- No turbines visible
- LRWF Visible
- VoWWF Visible
- LRWF & VoWWF Visible

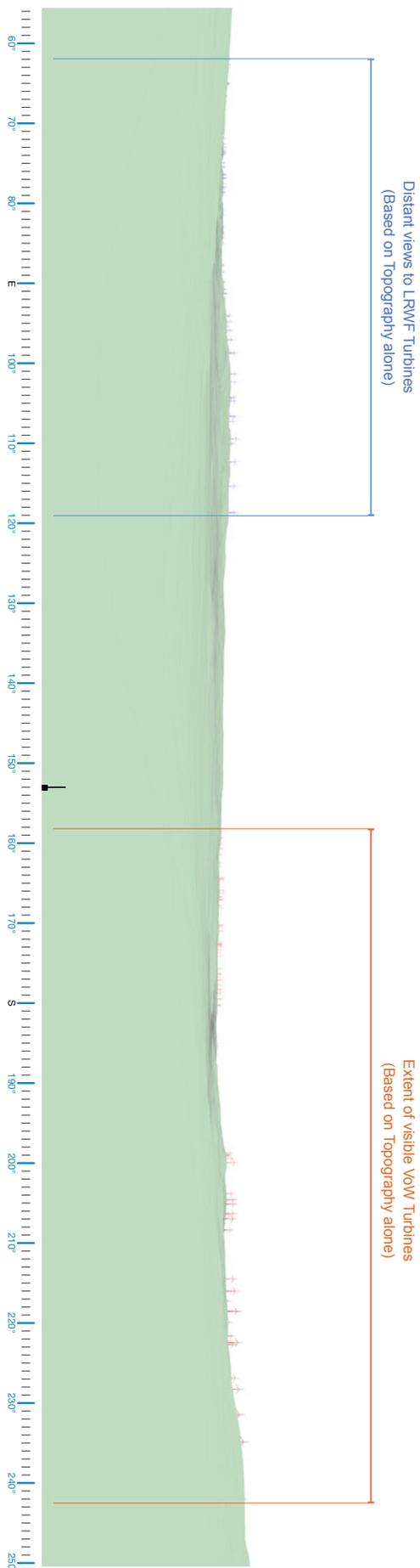
### Note:

The Zone of Visual Influence (ZVI) is a preliminary assessment tool that represents a bare ground scenario (ie. a landscape without screening, structures or vegetation). As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

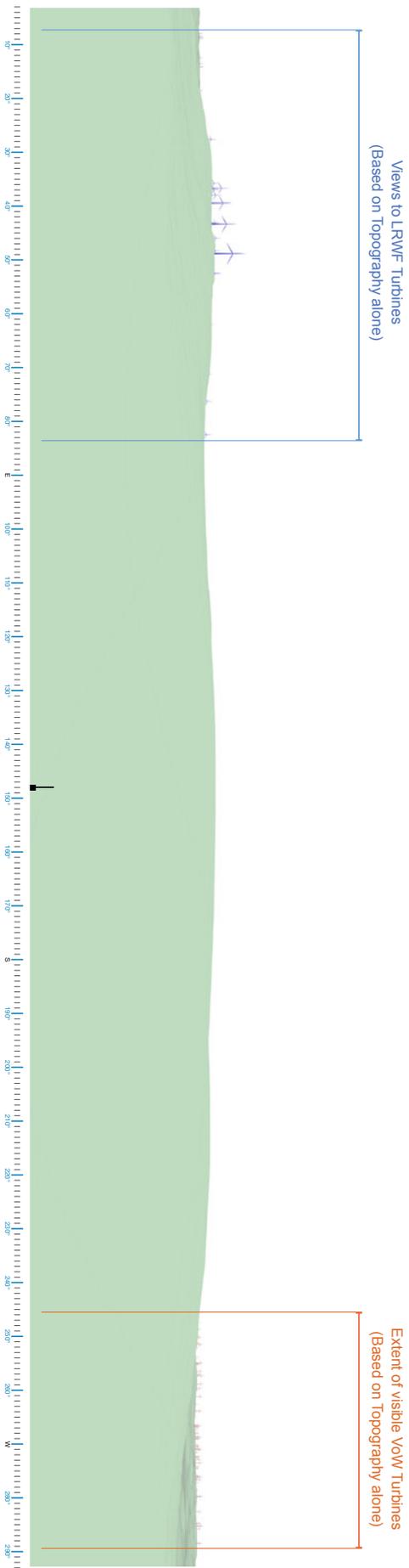


## FIGURE 2 AND 3: CUMULATIVE VISUAL IMPACT MAP

**Figure 2: CWD01 Cumulative Wireframe Diagram – Coolah**



**Figure 3: CWD02 Cumulative Wireframe Diagram – Vinegaroy Road Rest Area**



## Shadow flicker

Shadow flicker results from the fluctuating light levels caused by intermittent (moving or changing) shadows. It occurs when the sun passes behind the rotating blades of a wind turbine (see Figure 4). This casts an intermittent shadow on the area surrounding the wind turbine. Shadow flicker can cause annoyance when it affects a residence over an extended period of time. Due to a reduction in maximum blade tip height and removal of several turbines proposed by the RTS Project no Non-associated or Associated residences would be subject to shadow flicker.

## Managing visual impacts and shadow flicker

To manage the impacts associated with the RTS Project we will:

- Extend the offer of off-site landscape works to all Non-associated residences within 4,250 m of a turbine (an increase of 250 m required for the Approved Project)
- Apply a Non-reflective finish to the wind turbine blades to reduce potential blade glint

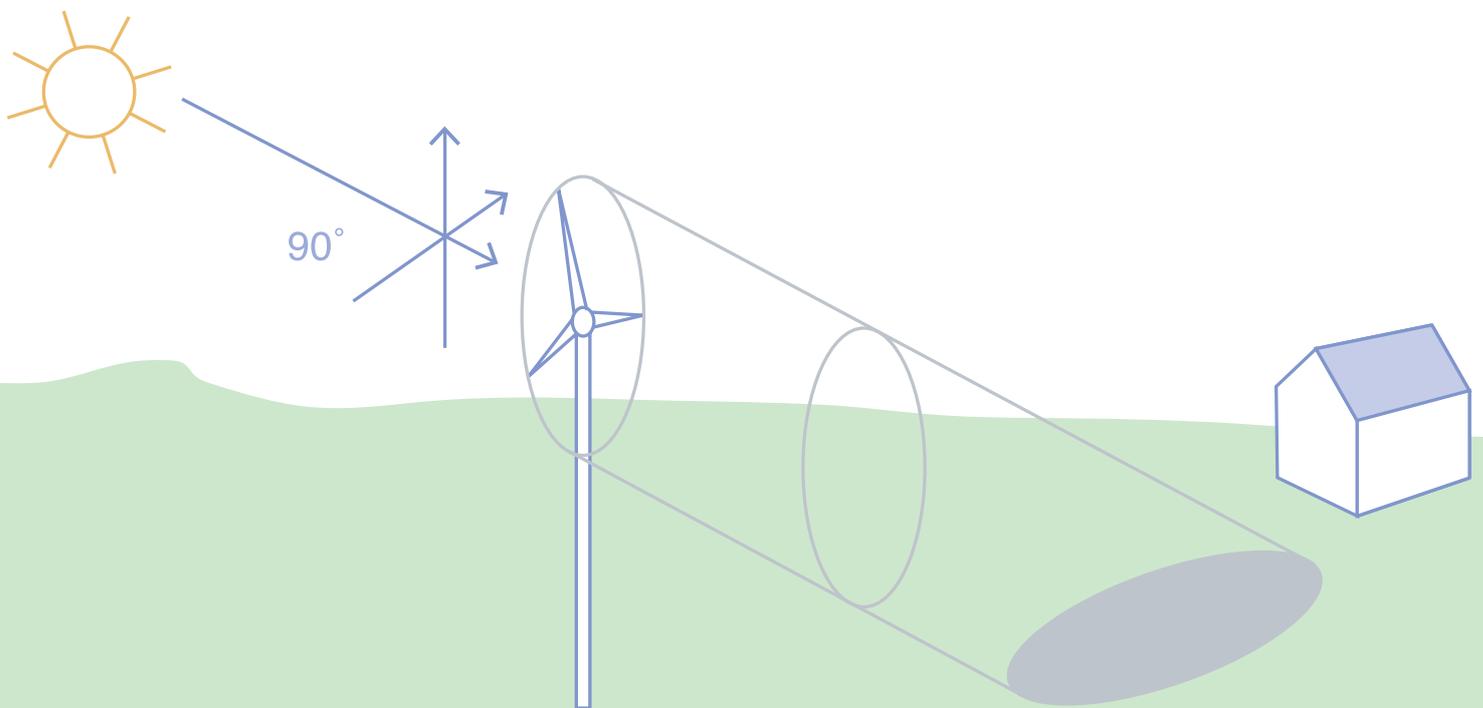


Figure 4: How shadow flicker can impact a residence

## Next steps:

We are aiming to lodge the Response to Submissions (RTS) report, Amendment Report, and all updated environmental impact assessments with DPE in June 2023. These reports will detail the consultation completed to-date, how submissions received during public exhibition have been addressed, and will clearly show the changes to the design and layout of the Project. DPE will review the documentation and make a determination on the Modification Application.

We are also seeking Commonwealth approval under a separate approvals process under the *Environment Protection and Biodiversity Conservation Act 1999*. The project will be assessed by way of Public Environment Report (PER) which will be subject to a public exhibition process managed by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). Further details on the timing of this will be provided via our website and newsletters.



### STAY UP TO DATE

To view the Project online and to subscribe to the newsletter, visit:  
[www.liverpoolrangewindfarm.com.au](http://www.liverpoolrangewindfarm.com.au)



## To stay up to date on progress of the Project visit:

Modification Application:

[www.planningportal.nsw.gov.au/major-projects/projects/mod-1-turbine-and-infrastructure-changes](http://www.planningportal.nsw.gov.au/major-projects/projects/mod-1-turbine-and-infrastructure-changes)

EPBC Approval:

[epbcpportal.awe.gov.au/all-referrals/project-referral-summary/?id=dc3fd301-9a6b-ed11-81ac-00224818aa21](http://epbcpportal.awe.gov.au/all-referrals/project-referral-summary/?id=dc3fd301-9a6b-ed11-81ac-00224818aa21)

For more information, please visit the website below

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